(5) Parking characteristic

The number of trips by parking form based on the OD survey is given in Table 3-6. In urban area of B.S.B. and other areas except B.S.B., on-street charged parking is quite different. In the areas except B.S.B., off-street non-charged parking is done.

Table 3-6 Number of Cars by District of Arrival and by Parking Form

Unit: Trip

	Mid-town of B.S.B. (11 zones)		Areas except B.S.B.		Total	
1. On-street charged	21,505	38.4%	17,561	12.0%	39,066	19.4%
2. On-street non-charged	14,271	25.5	26,348	18.0	40,619	20.1
3. Off-street charged	3,702	6.6	4,820	3.3	8,522	4.2
4. Off-street non-charged	15,896	28.4	93,025	63.8	108,421	54.0
No answer	569	1.0	4,120	2.8	4,683	2.4
Total	55,943	100.0	145,869	100.0	201,812	100.0

(6) Results of consciousness survey on bus utilization

Table 3-7 shows the results of consciousness survey about the bus services to car users carried out at the same with the road-side OD survey. One of the reasons why car users do not choose bus services is that the trip by bus takes too much time, and this answer is given most. As for what should be improved for bus services, "regular operation" is required. If the above problems are settled, 54% of the answers told that they would utilize buses more.

Table 3-7   Results of Bus Operation Improvement Consciousness Survey to Car Users

Question	Answer		
Why didn't you choose bus services for your trip?	1. Bus fare is expensive	442	5.6%
	2. Too much travel time	2,302	29.2
	3. Crowded	1,219	15.5
	4. Frequency is to dense	777	9.9
	5. Operating schedule is irregular	1,185	15.0
	No-answer	1,956	24.8
	Total	7,877	100.0
What kind of improvement of bus services do you want?	1. Low fare	1,079	13.7
	2. To increase bus frequency	1,263	16.0
	3. Comfortable bus services	1,366	17.3
	4. To keep a regular operating schedule	1,904	24.2
	5. To speed-up bus running	425	5.4
	No answer	1,840	23.4
	Total	7,877	100.0
If passengers are provided with improved bus services, will you prefer bus for your trip?	1. Yes	4,257	54.0
	2. No	2,023	25.7
	No answer	1,597	20.3
	Total	7,877	100.0

Table 3-8 shows the results of consciousness survey about the bus service to bus passengers. The most reason why bus passengers utilize buses is that they do not own their cars and 60% of answerers answered so. The next most is that they do not have drivers' licenses. About 80% of the answerers use buses by the above reasons. Judging from these results and others made by other surveys, in Brunei, school children, low income earners, the old and non-owners of cars utilize buses mainly. That is, bus services are said to be services for the transportation poor only. Improvement points in bus services are low fare, comfortability and regular operation, they say.

Table 3-8 Results of Bus Improvement Consciousness Survey to Bus Passengers

Question	Answer		
Why did you choose bus services for your trip?	1. Bus fare is cheeper than car	61	5.8%
	2. Bus services are better than car	172	16.3
	3. I have no car	624	59.4
	4. I have no driver license	183	17.4
	No answer	10	1.0
	Total	1,050	100.0
What kind of improvement of bus services do you want	1. Low fare	212	20.2
	2. To increase bus-frequency	120	11.4
	3. Comfortable bus services	362	34.5
	4. To keep a regular operating schedule	285	27.1
	5. To speed-up bus running	57	5.4
	No answer	14	1.3
	Total	1,050	100.0
If passengers are provided with improved bus services, will you take bus more often than present?	1. Yes	973	92.7
	2. No	62	5.9
	No answer	15	1.4
	Total	1,050	100.0

3-2-2 Other Traffic Surveys

(1) Survey of car travelling speed

The survey of car travelling speed was carried out to grasp relation between the road traffic volume and the travelling speed and to use it for establishing a model of traffic demand estimation. Fig. 3-10 is the chart of road congestion-seed curve produced by analyzing the above results.
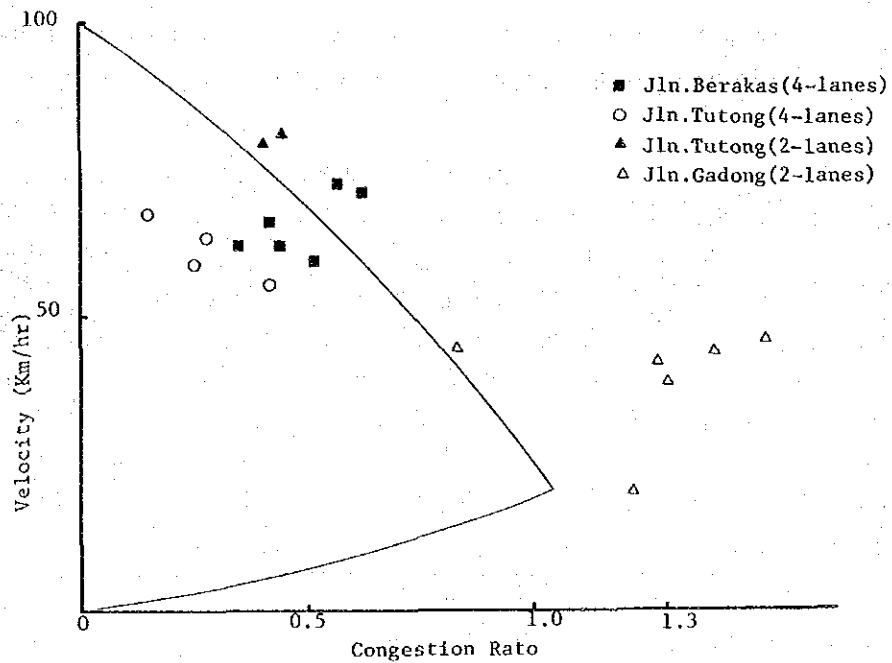

Fig. 3-10 K-V Curve Based on Survey Results

(2) Bus floating survey

Bus floating survey was carried out to obtain scheduled speed of public buses under operation. The results are given in Table 3-9. In Brunei, bus stops are not fixed and buses stop at any places to get passengers on or off by their request. In some cases, the bus carries passengers to Kampon where is out of the route. Such operation system gives services like those of demand bus, but gives lower travelling speed also.

The average travelling speed of buses becomes lower in the areas surrounding B.S.B., which is corresponding to the congestion state of the roads.

Table 3-9 Results of Bus Floating Survey

Destination	Number of Investigated Trips	Frequency of Average Stops	Distance to Destination	Average Time Required	Average Traveling Speed
			km	min	km/h
Seria	7	12.9	92.5	110.0	50.5
Muara	15	13.1	26.0	51.2	30.5
Jerudong	2	12.0	25.0	42.5	35.3
Berakas	4	15.0	14.5	39.8	21.9

3-3 Public Buses

3-3-1 Operation

In the object areas of the survey, 45 bus service companies operate public buses on 17 routes. 73 buses are registered as public buses, and the average number of buses owned by each company is 1.6.

The public bus routes in the object areas of survey are shown in Table 3-10 and Fig. 3-12. The highest service is made on the route between Seria and Kuala Belait, and 72 bus trips with average operation interval of 23 minutes are made a day.

The next highest is on the route between B.S.Begawan and Seria, 51 bus trips a day with 26 minutes interval, and next on the route between B.S. Begawan and Berakas, 32 trips a day with 37 minutes interval, the route between B.S. Begawan and Muara, 30 trips a day with 40 minutes interval and so on. These routes from a main bus route. The total average operation interval including main routes and branch routes in 48 minutes.

The features of operation are given as follows.

① Bus routes are not fixed and some routes are changed by the request of passengers. Buses stop anywhere users want. These services are made to meet the request of users but such irregular operation is inconvenient to those who take routine actions.

② Except some routes, no times table service is given even at the bus terminals.

③ Recently bus operation companies have talked over regular time operation at the bus terminals adjusted, but according to the present state investigation, regular operation is not still made.

Due to no checking of operating condition by the Government, they start buses when the number of passengers reaches to the capacity on the routes where some companies operate buses competitively, which is the reason of irregular operation.

④ However in B.S. Begawan, Seria and Kuala Belait, bus terminals have been adjusted and regular time operation has been tried. As the result, it is reported that the number of bus users is increasing.

⑤ In Brunei, bus routes are constructed radially among cities and bus users move along the routes between B.S.B. and other cities. That is, passengers who are along the bus

routes use buses when they go to the urban area of B.S.B. or to other cities only.

However when they go to other cities over B.S.B., they seldom use buses because of little information on bus routes, long interval of bus operations and inconvenient transfer, which makes car utilization increasing. (See Fig. 3-9 Desired Route of Buses)

⑥ The population of the object areas of surveys is 186,614 and that along the bus routes is about 99,000, then the coverage rate of population[1] is 53% in average, and average bus utilization rate per 1,000 persons is as low as 66 tripends.

$$1): \text{The coverge rate} = \frac{\text{Populaton within 500 m zone from the bus route}}{\text{Total population}} \times 100$$

Usability of buses seem to depend on the operation interval of buses and population rate along the bus routes.

Then the relation between bus using ratio and waiting time is given as follows in Fig. 3-11 in which number of bus passenger tripends per population by zone is on the vertical axis and average waiting time adjusted by the coverage rate of bus routes is on the horizontal axis. According to the chart, it is found that the number of passengers is increasing as bus services are improved.

AVERAGE WAITING TIME ADJUSTED BY THE COVERAGE RATE OF BUS ROUTES

$$= \frac{\text{AVERAGE DEPARTURE} \times 100}{2 \times \text{COVERAGE RATE}}$$
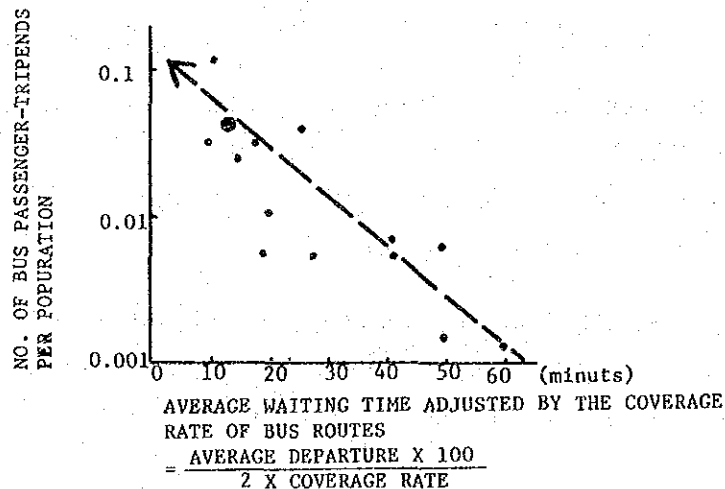
SOURCE; TRANSPORT SURVEY DATA BY THE TEAM

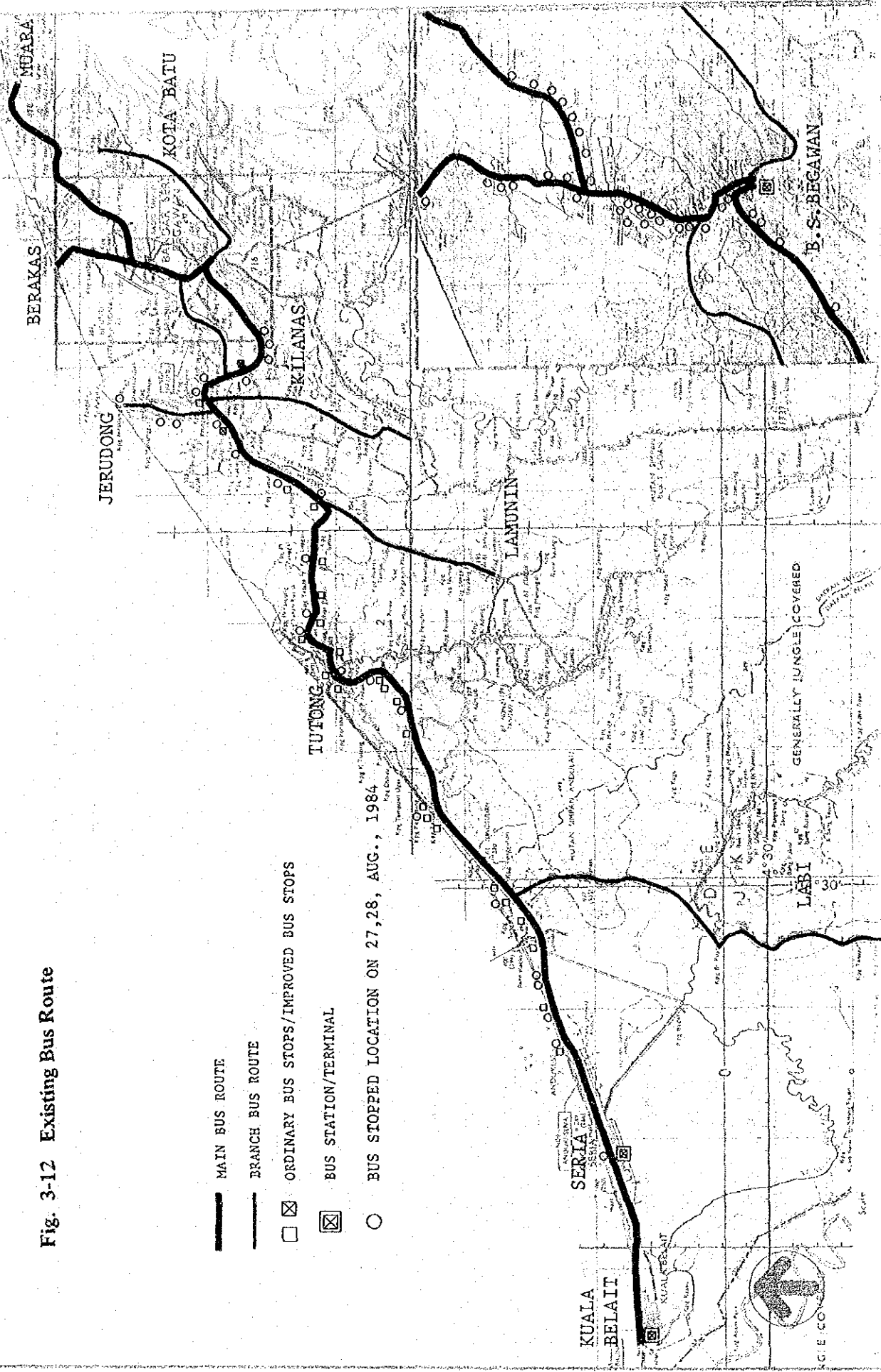**Fig. 3-11   Relation between Bus Utilization Ratio and Waiting Time**

Table 3-10 Existing Bus Route

No. of Route	Origin - Destination	No. of Companies	No. of Buses Registered	Operating Trips	Operating Hours	Average Departure (minutes)	Average Trip Time (minutes)	Distance (km)	Trip Speed (km/h)	Fare
1	B.S.B. - Gadong	1	1	12	8:26 - 16:27	85	-	6.4	30	$1/6.4 km
2	B.S.B. - Berakas	1	3	32	6:30 - 16:26	37	37	15	25	$1/15 km
3	B.S.B. - Muara	11	11	30	6:30 - 16:46	40	56	26	28	$2/26 km
4	B.S.B. - Kota Batu	1	1	24	7:36 - 18:00	50	17	10	35	$1/10 km
5	B.S.B. - Jerudong	1	1	10	7:40 - 17:50	142	42	25	36	-
6	B.S.B. - Limau Maris	1	2	8	7:44 - 16:48	136	45	32	43	$2/32 km
7	B.S.B. - Lamunin	4	4	2	6:47 - 9:27	-	57	45.4	48	$2/
8	B.S.B. - Tutong	1	1	-	-	-	-	-	-	-
9	B.S.B. - Seria	16	20	51	6:20 - 17:32	26	110	92.5	50	$4/92.5 km
10	B.S.B. - Hospital	-	-	16	6:33 - 17:50	80	4	2.0	30	$0.6/2 km
11	B.S.B. - Airport	1	2	30	6:25 - 17:05	52	20	9	28	$0.9/9 km
12	Sungai Kabum - Lumapas	1	1	-	-	-	-	-	-	-
13	Tutong - Tutong Camp	1	1	-	-	-	-	-	-	-
14	Seria - Kuala Belait	1	16	72	6:20 - 19:30	23	30	16	32	$1/16 km
15	Seria - Labi	3	3	20	-	60	46	40.3	53	-
16	Seria - Sungai Liang	2	2	-	-	-	20	20.3	60	-
17	Kuala Belait - Miri	1	4	12	7:30 - 15:00	90	-	-	-	-
	Total	47	73	319	-	48	-	339.9	-	-

Fig. 3-12 Existing Bus Route

MAIN BUS ROUTE

BRANCH BUS ROUTE

ORDINARY BUS STOPS/IMPROVED BUS STOPS

BUS STATION/TERMINAL

BUS STOPPED LOCATION ON 27,28, AUG., 1984

MUARA

KOTA BATU

BERAKAS

B.S. BEGAWAN

KILANAS

JERUDONG

LAMUNIN

TUTONG

LABI

GENERALLY JUNGLE COVERED

SERIA

KUALA BELAIT

3-3-2 Bus Terminal, Bus Stop

(1) Bus terminal

Bus terminals are at present distributed in three areas of B.S. Begawan, Seria and Kuala-Belait.

a) The bus terminal in B.S. Begawan is placed on the basement of the terminal building built in 1984, and provided with modern facilities adjusted for 20 berths and chairs for passengers (See Fig. 3-13). However as operation information such as time table and bus routes is not complete, these facilities may be inconvenient even if they are modern.

All the berths are used for buses going to their destinations. These berths are used for 215 trips, that is, 11 trips per 1 berth in average and utilization efficiency is worse. This is because most of bus routes have a few trips as the demand is small.

b) The bus terminal in Kuala Belait was constructed recently and is provided with modern facilities such as five berths, waiting room for passengers, the offices of bus companies, and with information of time tables. Total 84 trips are started from five berths, and 17 trips are made per one berth. (See Fig. 3-14)

c) The bus terminal of Seria provided with 12 berths and waiting facilities for passengers, and offices of bus companies is old. Time table of buses is provided, but it is necessary to adjust it for modern bus terminal. (See Fig. 3-15)

(2) Bus stop

Numerous simple bus stops are placed along bus routes at present. These bus stops have no bus bay, no sign as bus stop and no information such as time table.

To deal with such a condition, the Government is

carrying out two projects in the 1979 – 1984 Five-Year Plan.

a) Bus stop construction in Brunei District
b) Bus stop construction in Kuala Belait

a) This project is performed to improve main bus stops along Jln. Tutong in Brunei District, and each bus stop will be provided with bus bay and platform and shown in Fig. 3-16. Total 15 bus stops are now under construction. After completion, operation services for passengers will be improved and at the same time effect to the other traffic flow due to bus stopping at the bus stop will be decreased. These improved bus stops are expected to be used effectively.

b) In this project, bus stops of the bus route between Kuala Belait and Seria are improved. These bus stops were mobile and simple platform type stops without bus bay, then it is desired to provide effective bus stops which will be provided in the project a).

Fig. 3-12 shows the places where buses stop for passengers based on the bus floating survey. Some of bus routes are changed by the request of passengers, but most bus stops are used as scheduled. When the number of bus passengers is increased, improved bus stops will be required.

Fig. 3-13 B.S.B. Bus
Terminal

Fig. 3-14 Kuala Belait
Bus Terminal
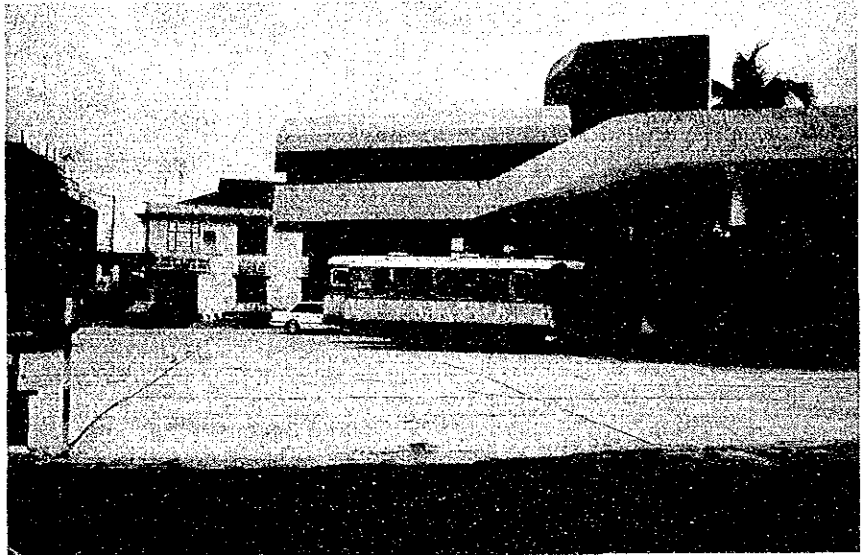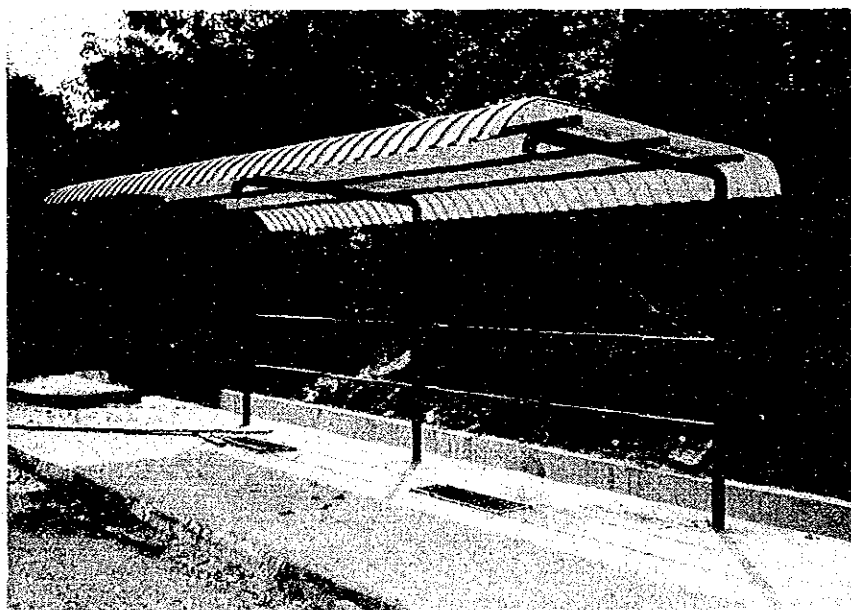

Fig. 3-15 Seria Bus
Terminal

Fig. 3-16 Bus Stop under Construction

3-3-3 Present State of Bus Service Companies

In the survey to bus service businesses, 13 (29%) out of 45 service companies asked answered to questions. (See Table 3-11). According to the table, one service company owns average 3.6 buses. Comparing this with total average figures of 1.6, the above 13 companies have bushiness scale twice or more as much as of the total average one. As a whole, when adding small businesses, management level will be lowered. Furthermore, most of bus service businesses operate multimanagement not only bus services, then it is difficult to separate pure management index. Therefore management cost may be summed up too small and earning rate is considered to be lower.

The results of the survey are as follows.

The number of staff of a company is 10.6 and out of them, 1.6 persons belongs to the head office and 3.6 persons are engaged in driving.

The average operation a day is 12.2 trips, total average travelling length is 284.2 miles and 312 persons are carried. That is, 1 trip takes 23.3 miles and carries 25.6 persons.

The average income is 14,441 B$/month and earning rate is 149%. The reason such a high income is obtained is thought that the minimum services will be made and expenditure will be small to cover the small demand.

Table 3-11 Features of Main Bus Service Businesses

		B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8
Organization	Number of Company's staff	15	10	2	2	43	25	17	5
	Number of staff at Head Office	3	1	-	-	6	3	5	-
	Number of Drivers	6	3	2	2	9	9	4	2
Working System	Working System	Two shift	No shift	1 hour shift	Two shift	Two shift	No shift	Two shift	No shift
	Working Hours	10 hrs shift	9 hrs	9 hrs	9 hrs	13 hrs	8 hrs	6 hrs	7 hrs
Facility Vehicle	Vehicle Holdings	6	3	2	2	12	9	4 + 2 mini	2
	Number of Actually Operating	6	1 sch. 2 public	2	2	12	9	4 + 2 mini	1 sch. 1 public
	Location of Terminals and Garages	2 1/2, Jln. Tutong / BSB, Seria	Butu 8 Jln. Tutong	Bus terminal (BSB) Seria	Bus terminal (BSB) Seria	Seria Bus Sta.	Seria Bus Sta.	K.B. Station	1 sch.1 public Seria Station
Operation	Bus route	BSB-Berakas / BSB - Seria	BSB - Gadong	BSB - Seria	BSB - Seria	K.B. - Seria	BSB - Seria	K.B. - Miri	BSB - Seria
	Number of Daily Trips	34 trips	8 trips	10 trips	10 trips	24 trips	16 trips	8 trips	8 trips
	Total Daily Running Distance	558 miles	40 miles	570 miles	570 miles	240 miles	418 miles	78 miles	264 miles
	Total Daily Passenger	1,100	180	400	180	684	470	204	270
Model Fare	Less than 5 km (miles)	($1)	1 mile : 30¢	$80	-do-	($0.5)	$80	1 1/2 miles=4.95$	($1.0)
	5 km to 10 km (miles)	$1 $1.5		$1.34		($1.0)	$1.34	14 miles=$10	($2.0)
	Over 10 km (miles)	($3 (BSB to Seria))		$4 (BSB to Seria)		($1.0)	$4.0	-	($4.0)
Vehicle	Capacity	53 pass.	45 pass.	18 pass.	18 pass.	30 - 40	45 - 51	45/6	36/44
Transportation Cost (per month)	Labour Cost	$1,700	$4,000	$1,449	$2,400	$25,000	$8,550	$2,500	$1,400
	Fuel Cost	$ 600	$ 200	$ 450	$ 600	$ 5,000	$ 350	$ 200	$1,000
	Repairing Cost	$1,000	$ 500	$ 100	$ 160	$ 3,300	$ 200	$ 290	$ 400
	Depreciation Cost	$7,000	$ -	$ 700	$ 140	$ 6,800	$1,600	$ 230	$ 300
	Premium, etc.	$1,350	$ 90	$ 666	$ 830	$ 1,580	$ 200	$ 180	$ 250
	Total	$11,650	$4,790	$3,365	$4,130	$41,680	$10,900	$3,400	$3,350
Administrative Cost (per month)	Administrative Cost	$5,000	$ 400	$ 350	0	$ 3,600	$1,500	$2,000	$1,000
Operating Revenue (per month)	Operating Revenue	$27,000	$7,600	$4,132	$4,400	$62,500	$30,000	$8,400	$5,500

Source: Interviews with Awong Damit Co., Abd. Rohman Dan Aruk 2, Hj Ya Akub Bin Zainal Pte, Co., Chua Chui Guan & Sons, Belait United Traction Co., Syarikat Konderaan Pelancongan Fajar, Syh. Berlima Sdn. Bhd and Syarikat Mata Hari

Continue

		B-9	B-10	B-11	B-12	B-13	Average
Organization	Number of Company's staff	6	3	1	3	1	10.3
	Number of staff at Head Office	2	-	-	1	-	1.6
	Number of Drivers	4	1	1	1	1	3.6
Working System	Working System	No shift	-ditto-	-ditto-	-ditto-	-ditto-	-
	Working Hours	12 hrs.	10 hrs.	-	-	8.5 hrs	9.3 hrs.
Facility Vehicle	Vehicle Holdings	2	1	1	1	1	3.6
	No. of Actually Operating	2	1	1	1	1	3.6
	Location of terminals	mile 6, J.Kota Batu	Kg Sungai Tuiong Batu	Seria	B.S.B.	K.B.	-
Operation	Bus route	B.S.B. - Kota Batu	B.S.B. - Muara B.S.B. - Seria	B.S.B. - Seria	B.S.B. - Seria	Loki - Seria	-
	No. of Daily Trips	24 trips	4 trips	4 trips	2 trips	6 trips	12.2 trips
	Total Daily Running Distance	288 miles	74 miles	228 miles	114 miles	252 miles	284.2 miles
	Total Daily Passengers	240	100	60	74	90	312
Model Fare	Less than 5 km (miles)	0 - 60¢	50¢	-	-	($1)	($1.0)
	5 km to 10 km (miles)	70¢ - 1$	1$	-	-	($1.5)	($1.5)
	Over 10 km (miles)	1$ (12 mile)	$2 (17 mile)	-	-	($4)	($4.0)
Vehicle	Capacity	52 pass.	42	44	-	17	-
Transportation Cost (per month)	Labour Cost	2,188	1,458	1,050	2,860	700	$ 4,250
	Fuel Cost	546	375	918	464	380	853
	Repairing Cost	2,174	1,417	383	83	250	789
	Depreciation Cost	4,905	-	1,796	392	1,327	2,099
	Premium, etc.	538	58	287	108	114	481
	Total	10,351	3,308	4,433	3,907	2,771	8,472
Administrative Cost (per month)	Administrative Cost	1,800	500	-	-	-	1,235
Operating Revenue (per month)	Operating Revenue	14,432	6,000	7,000	8,000	2,760	14,441

Source: Interview with Sharitat Kota, Sharitat Haji Hassan, PG Hj Besar Bin PG, Kuladan, Sharikat Liun Tong and Hj Arshad Bin Abu Bakar.

3-4 School Bus

The Educational Transport Department of Brunei operates school bus for attending school of public school students (From Malay school to Junior/Senior college).

The number of contract school buses by district in the object areas is 64 in Brunei Muara district, 6 in Kuala Belait district and 32 in Tutong district, total 102.

The number of buses owned by the Government is 20, 19.6% of the total number, and these 20 buses are operated in Brunei Muara district. 19 out of 20 are mini-bus which have 25 seats or less.

82 school buses are owned by private bus companies and operated under lease contract. 22 out of them are mini buses having 25 seats or less. (See Table 3-12)

Table 3-12 Number of School Buses by District

(year: 1983)

Name of District	No. of Government Buses	No. of Private Buses	Total
Brunei Muara	20 (19)	44 (12)	64 (31)
Kuala Belait	−	6 (-)	6 (6)
Tutong	−	32 (10)	32 (10)
Total	20 (19) 1)	82 (22)	102 (41)

Source: School Bus Operation Table in 1983, Educational Transport Department

1): Number of registered mini buses are shown in ( ).

102 school buses are in service for students living in the areas 3 miles far or more from schools for 28 schools in three districts in the morning and partially in the afternoon in two return trips. The total number of 28 schools is 17,174 and 32.6%, 5,595 out of them use school buses.

To these students, 102 buses make 370 trips a day, and the total bus capacity is 13,038. While students make 11,190 trips, then

average occupancy is 85.8% and average number of passenger per one bus is 30. However when considering the ratio of students using school buses including students of private schools, it is 9.3% and considerable number of students use passenger cars. (See Table 3-13)

OD table and Desire Line of school bus users are given respectively in Table 3-14.

The contract fee of school buses is determined according to the operation distance, transportation personnel and condition of bus body.

The average contract fee of three districts is as follows.

Average Contract Fee of School Bus in 1984

(B$ per one month)

District	Brunei/Muara	Tutong	Kuala Belait	Total
Average fee in one month	4,331.7	4,187.4	4,743.7	4,384.0

Table 3-13 School Bus Operation (in 1983)

Name of District	(A) Bus Trips (Trips)	(B) Total Bus Capacity (passengers)	(C) Total Passengers (passengers)	(C/A) Passengers per One Bus	(C/B) Occupancy (%)	(D) No. of Students in 28 School 1)	B/2×D (%)	(E) Total No. of Students	(C)/2×(E) (%)
Brunei Muara	246	8,204	7,186	29	87.6	12,129	29.6	38,367	9.4
Tutong	104	3,892	3,370	32	86.6	3,239	52.0	7,184	27.1
Kuala Belait	20	942	642	22	68.2	1,806	17.8	14,293	2.2
Total	370	13,038	11,190	30	85.8	17,174	32.6	59,844	9.3

Prepared by : Research, Evaluation and Statistics Unit, Department of Education, and Department of Educational Transportation

Table 3-14 Existing Daily School Bus OD (in year 1983)
— Brunei Muara District —

( ) : No. of bus through
Upper : No. of bus trips
Under : No. of student trips

School \ Kampong	11	15	17	21	22	24	25	26	27	28	29	30	31	Total
13			4/128	24(8)/768	2/104	6/218	2/22	20(4)/372	24(6)/600	12/538	10(6)/276		6/132	110(24)/3,158
14				14(2)/252			14(10)/168	14(10)/168	12(2)/135	12(2)/270	6/80			58(16)/900
15				2/4										2/4
17											2/52	10/132		12/184
22	6/226			2/44		10(4)/358		2/24	4/106	6/70			24/868	54(4)/1,696
23						6/116			2/42				2/60	10/218
24														
25								6/132		2/80				8/212
27	2/62										2/52	2/18		6/132
28										8/244			4/152	12/396
29											2/52			2/52
30											4/38	8/100		12/138
31													4/96	4/96
Total	8/288	–	4/128	42(10)/1,068	2/104	22(4)/692	16(10)/190	42(14)/696	42(8)/883	42(2)/1,254	26(6)/516	18/232	40/1,308	290(44)/7,186

— Tutong District —

School \ Kampong	51	52	Total
51	52/1,646	44/1,266	96/2,912
52	2/96	8(2)/362	10(2)/458
Total	54/1,742	52(2)/1,628	106(2)/3,370

— Seria/Kuala Belait District —

School \ Kampong	41	42	43	Total
41	–	2/76	–	2/76
42	–	2/64	14/436	16/500
43	–	–	2/66	2/66
Total	–	4/140	16/502	20/642

3-5 Type of Bus

119 non-government buses such as public buses and school buses are classified according to the number of buses by type and model and capacity as in Table 3-15.

Buses are classified into 13 types from models before 1969 to those of 1983, and their capacity is changed from 4 to 52. Therefore many problems of parts supply and security of adjustment workers for periodical adjustment and against sudden repair should be settled from now.

Model distribution of buses is given below. 29.4% are buses constructed after 1980 and 42.0% are those of 1975 - 1979. But 28.5% are those made 10 years ago.

Table 3-15 Bus Model

Type of Model	No. of Buses	Percentage
1980 - '84	35	29.4
1975 - '79	50	42.0
1970 - '74	18	15.1
- '69	16	13.4
Total	119	100.0

The most used type is Isuzu Bus and its structure ratio is 21.8. Next Bedford Bus - 21.0, Tata Bus - 11.8, Mitsubishi Bus - 11.8 and Hino Bus - 7.6. These five types occupy 74% of the total.

When considering types with models, some changes are found as in Table 3-16. If the present buses will be used in the future, models after 1980 will be main in services. These models are Isuzu, Nissan and Hino buses, 25.2% of the total. In case of settling the present problems on bus adjustment, consolidation of types is required. Therefore, it is desirable to consolidate buses to the above three types.

Bus Type	Rate of Model after 1980 to the Total
Isuzu Bus	16.8%
Nissan Bus	5.0%
Hino Bus	3.4%
Bedford Bus	0.8%
Tata Bus	0.8%
Toyota Bus	0.8%
Total	27.6%

Table 3-16 Type of Bus

	Type	Model	Capacity	No. of Buses	Percentage
		Year	Passenger		%
1.	Isuzu Bus	1980 - '84	28 - 45	20	16.8
		1975 - '79	28 - 45	5	4.2
		1970 - '74	41	1	0.8
		Sub-Total		26	21.8
2.	Bedford Bus	1980 - '84	44	1	0.8
		1975 - '79	44	13	10.9
		1970 - '74	44	2	1.7
		- '69	27 - 41	9	7.6
		Sub-Total		25	21.0
3.	Tata Bus	1980 - '84	52	1	0.8
		1975 - '79	52	13	10.9
		Sub-Total		14	11.8
4.	Mitsubishi Bus	1975 - '79	20 - 47	13	10.9
		1970 - '74	38	1	0.8
		Sub-Total		14	11.8
5.	Hino Bus	1980 - '84	45	4	3.4
		1970 - '75	42	4	3.4
		'69	46	1	0.8
		Sub-Total		9	7.6
6.	Toyota Bus	1980 - '84	15	1	0.8
		1975 - '79	17 - 21	4	3.4
		1970 - '74	21	2	1.7
		- '69	37	1	0.8
		Sub-Total		8	6.7
7.	Nissan Bus	1980 - '84	43 - 52	6	5.0
8.	Layland Bus	1975 - '79	24	1	0.8
		1970 - '74	24	4	3.4
		Sub-Total		5	4.2
9.	Commer Bus	1970 - '74	11 - 30	3	2.5
		- '69	13	1	0.8
		Sub-Total		4	3.4
10.	Daihatsu Bus	1980 - '84	17 - 25	2	1.7
		1970 - '75	42	1	0.8
		Sub-Total		3	2.5
11.	Morris Bus	- '69	30	3	2.5
12.	Rover Bus	1975 - '79	4	1	0.8
13.	Ford Bus	- '69	14	1	0.8
			Total	119	100.0

3-6 Taxi

The number of registered taxis in Brunei has been increased or decreased since 1965, but from 1979 to 1983, average number is 117. However the number of taxis per 1000 persons has been lowered from 0.91 in 1966 to 0.58 in 1982. (See Table 3-17)

This is thought the demand for taxi is decreased as private cars are increased.

According to the results of the survey for taxi businesses, the taxi business is a private one and gets low income. (See Table 3-19)

Present taxis are not cruising only arranged in taxi pools of B.S.B., airport, main hotels and main towns only. Moreover, radio taxi service and taxi service by telephone are not provided. When taxi users get taxi, they must go to the taxi pool.

Thus, present condition of taxi services is poor and utilization of taxi by general people is very small. Taxi fare is generally higher, and foreign travelers use them.

Present taxi pools, that in B.S.B. bus terminal which can accommodate 10 taxis with parking space for 10 - 15 taxis on street, that in Seria accommodating 23 taxis, that in Kuala Belait accommodating 18 taxis and that in Tutong accommodating some are provided.

Fig. 3-17 Number of Registered Taxi in Brunei

Year	Number of Taxi	Taxi per 1000 Persons
1965	95	0.90
1966	99	0.91
1967	101	0.89
1968	104	0.87
1969	103	0.82
1970	106	0.82
1971	107	0.79
1972	104	0.74
1973	108	0.74
1974	102	0.68
1975	102	0.65
1976	102	0.63
1977	102	0.61
1978	104	0.60
1979	113	0.63
1980	117	0.63
1981	117	0.61
1982	117	0.58
1983	117	

Fig. 3-18 Number of Taxi by District

District	Number of Taxi	Taxi per 1000 Persons
Brunei Muara	62	0.59
Tutong	11	0.55
Belait	31	0.79
Temburong	5	0.88
Total	109	0.62

Prepared by Land Transport Department 1979

Table 3-19 Result of the Taxi Survey

		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	Average
Organization	No. of Company's staff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	No. of Drivers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Working System	Working Hours	16	15	12	15	16	16	12	12	16	11	15	15	16	9	15	-	-	9	-	9	10	-	13
Vehicles/Facility	No. of Vehicle Holdings	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Location of Taxi Terminal	BSB	BSB	BSB	BSB	Airpot	Airpot	BSB	Sheraton Hotel	BSB	Sheraton Hotel	BSB	BSB	Tutong	Seria	Seria	X.B.	X.B.	X.B.	BSB	Seria	Seria	BSB	-
Transportation Cost ($ per month)	Labour Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fuel Cost	380	480	100	200	270	150	60	50	300	300	200	250	180	50	50	200	300	200	250	300	300	-	208
	Repairing Cost	150	170	296	100	200	292	-	100	-	300	83	200	75	-	70	-	200	200	-	90	100	100	160
	Depreciation Cost	430	500	-	415	400	400	441	452	400	500	-	-	380	435	415	441	500	430	425	440	354	-	408
	Premium, etc.	104	83	333	94	83	63	104	83	104	63	-	94	50	42	58	42	54	52	135	125	104	-	89
	Total	1,064	1,233	729	809	953	905	605	685	804	1,163	1,200	554	685	527	593	653	1,054	882	810	955	858	110	865
Operating Revenue	($ per month)	1,800	-	1,229	1,200	1,500	-	1,200	-	-	1,300	1,200	-	1,100	950	1,000	1,100	1,600	1,000	-	1,500	1,800	1,000	1,121
Daily Operation	Revenue ($ per day)	50	50	40	40	50	30	40	40	30	30	40	-	83	30	35	40	50	35	-	50	60	40	41
	Running Distance (mile per day)	10	30	20	24	18	30	17	12	-	6	-	-	50	30	30	30	30	50	-	55	50	50	30
	How many trips per day	-	2	1	4	4	3	1	2	-	3	-	-	3	3	4	4	4	-	-	5	5	4	3
	Running Distance per trips	-	15	20	6	5	5	17	6	-	2	-	-	16	10	10	8	8	-	-	11	10	12	10
Fare System ($)	Less than 2 miles	5	5	6	5	5	5	5	5	5	5	5	5	3	4	4	5	5	-	-	3	3	-	4.6
	2 to 5 miles	7	7	8	7	8	8	8	8	7	7	7	7	10	4	4	8	8	-	-	7	7	-	7.2
	5 to 10 miles	15	10	8	15	8	8	8	8	15	15	15	10	12	10	10	8	10	-	-	10	10	-	10.8
	Over 10 miles	20	15	12	20	15	15	15	10	20	20	20	15	15	12	12	10	15	-	-	19	19	-	15.7
	Fare for Area (one hour)	30	30	-	30	30	30	40	30	-	30	30	-	-	-	-	-	-	-	-	-	-	-	31.1
How to provide taxi services do you want?	Telephone	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	29%
	Causing	o	o	o	o	o	o	o	o	o						o			o	o				23
	Terminal	o	o	o	o	o	o	o	o	o	o	o					o		o	o	o	o	o	48

3-7 Parking Condition and Traffic Control in B.S.B. Central Area

3-7-1 Parking Condition

a) Location and capacity of parking block

Parking blocks are made up by those provided on road side, toll open space parking lots provided on the site of off street and toll multistory parking building. Each parking capacity and location are as follows.

Table 3-20 Parking Capacity in Central Area on B.S.B.

On Street and Off Street	Hourly	1,307 lots
	Season	165 lots
	Reserved	290 lots
Multi-storey Parking	Hourly	380 lots
	Season	106 lots
	Total	2,248 lots
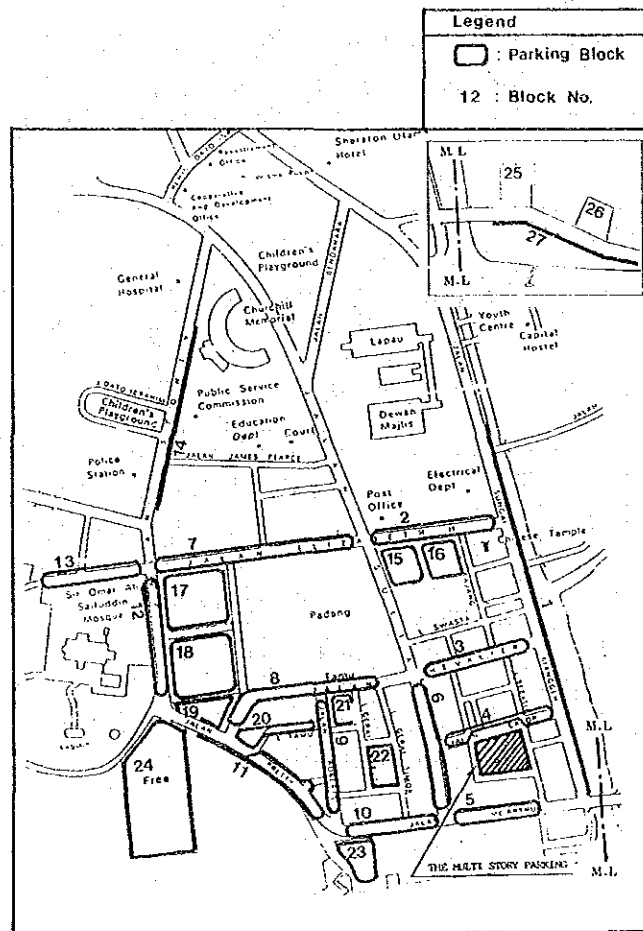
Fig. 3-17 Location of Public Parking Space – Central Area

b) Condition of occupants in parking area

There are 70 to 80% occupation rate for two maximum time, 9:00 a.m. to 11:00 a.m. and 2:00 p.m. to 4:00 p.m. There is the low occupation rate especially between the lunch time 12:00 p.m. to 1:00 p.m.
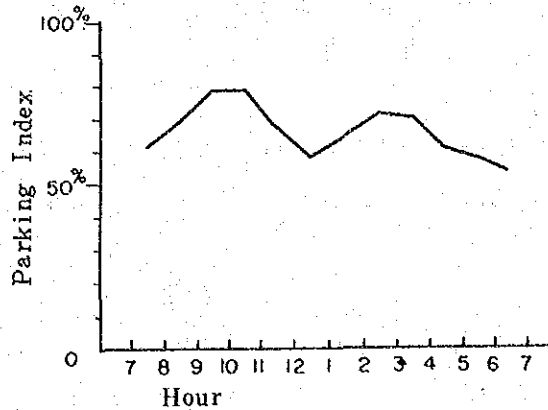
Fig. 3-18 Occupancy of Parking Sapces in C.B.D.

The same result can be seen at the multi-storey parking in C.B.D. by the every fifteen minute survey.
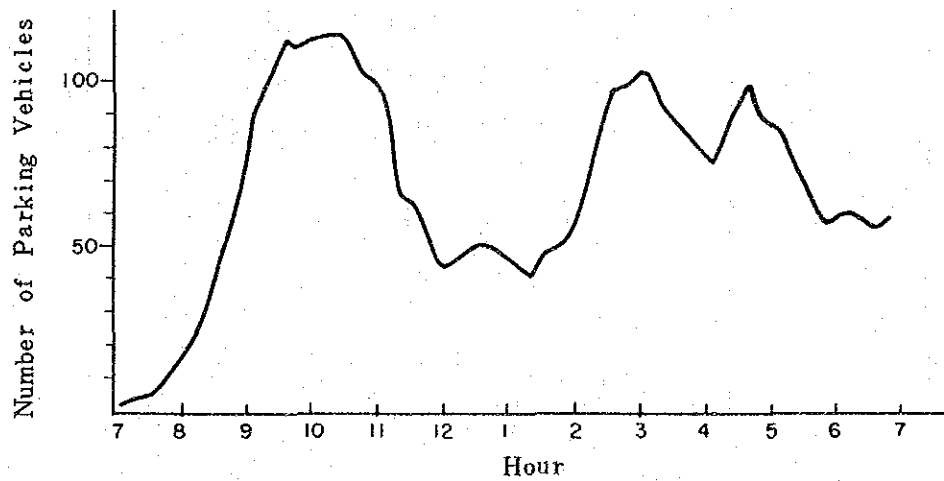
Fig. 3-19 Number of Vehicles Parked at the Multi-Storey Parking (hourly)

c) Parking purpose

The sampling results by interviewing are, 40% or just less - business purpose 30% or just more for shopping and the others of 30%. Considering the situation or condition of the parking area, the usage purpose should be more clear and accurate.

Area										
	10	20	30	40	50	60	70	80	90	100%

Business Area: 55.1 %, 8.7, 11.6, 24.6

Shopping Area: 9.6, 13.6, 44.0, 32.8

Intermediary Area: 36.6, 36.6, 26.8

Total: Go to The office-21.3, Busi-ness 16.2, Shopping 33.2, Others 29.3
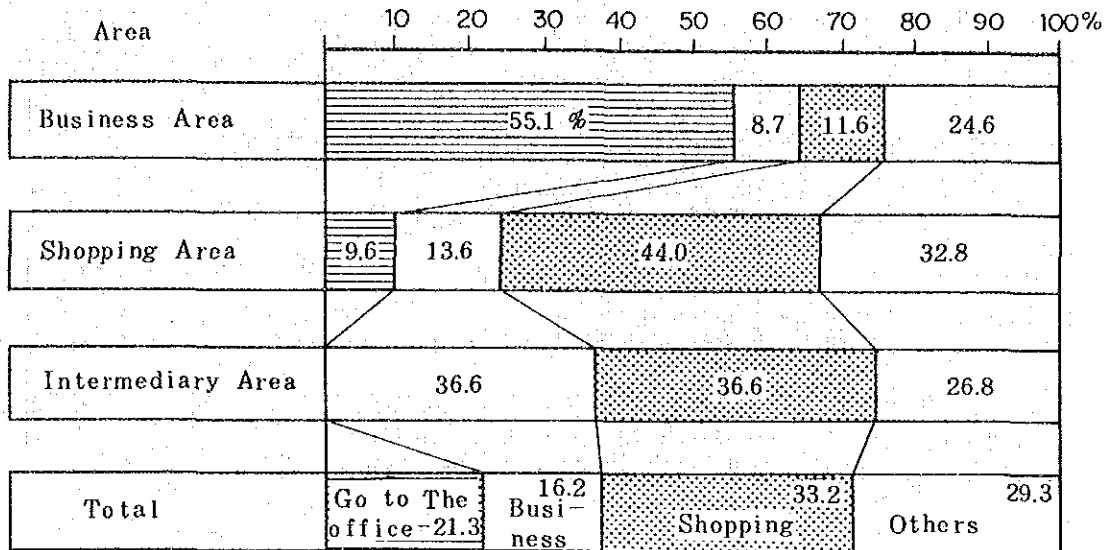
Fig. 3-20 Distribution of Parking Purpose Sampled by Interviewing

Area	Corresponded Block No.
Business Area	2,7,12,13 14,15,16,17
Shopping Area	3,4,5,6,8, 9,10,11,19, 20,21,22,23
Intermediary Area	1,18,24,25, 26,27

d) Ambulation distance to destination

Almost 55% of drivers reach his or her destinations within five minutes on foot, and around 80% of them reach in

ten minutes'. But there are few drivers who walk more than thirty minutes, which is only around 1%.

The result shows that the shorter ambulation distance is noticeable in the business areas than the shopping areas.
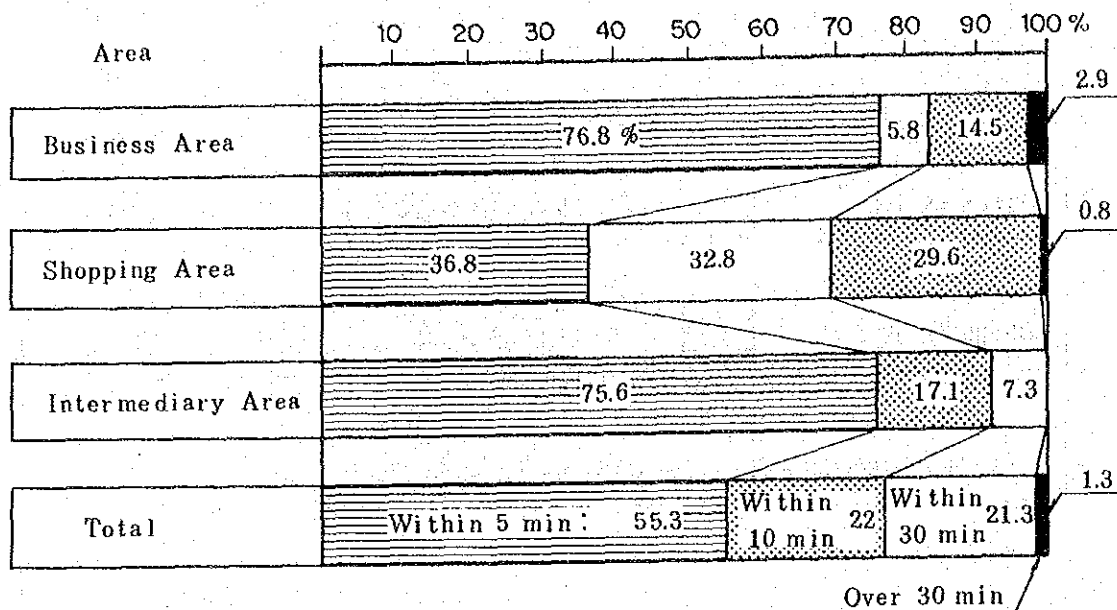
Fig. 3-21   Distance from Parking to Destination Sampled
by Interviewing

e)   Points of parking condition

The occupancy of parking spaces in the central area on B.S.B. is 80% in peak hour and in the central business area, it is 90% all day long. Then, double parking on streets due to the full parking of parking lots is seen, especially in Jln. Sultan (Block No. 6), Jln. McAuthur (Block No. 5, 10) and Jln. Chevalier (Block No. 3), which disturbs road traffic. On the northern aspect road in Jln. Kianggeh, many vehicles are parking inspite of no parking space. The location of parkings blocks are shown in Fig. 3-17.

f)   Improvement plans being carried out

The Brunei Government and B.S.B. Municipality are

carrying out improvement plans of parking facilities for the future.

① Multistory parking building in front of existing one

Construction of new parking building with almost the same scale is planned adjacent to the north side of the existing multistory parking building.

② Open space parking lots on the river side of Jln. Pretty

The river on the east side of the No. 24 Parking Lot of the river side in Jln. Pretty is scheduled to be filled in to construct open parking lot with parking capacity of about 200 cars.

After improvement and new construction of parking lots, the parking capacity of public parking lots in central area is estimated to be increased to about 700 in the near future.

3-7-2 Traffic Control

As the main traffic control means in the central areas, linked linear system of traffic signals will be provided from 1985. One-way system in Jln. Lintang and Jln. Simpang and no right turn system from Jln. Stoney at the crossing in front of Hotel Ang's are taken as other traffic control means.

The outline of the linked linear system of traffic signals to be established is given below.

17 intersections with traffic signals provided on the central areas are divided into 4 sub-areas, and signals are operated at the interval of 90 - 120 seconds according to the day of the week and time zone systematically to prevent lowerness of traffic capacity by continuous intersections.

The 4 sub-areas are as follows.
Sub-area 01　Intersection No. 1 - No. 5

Sub-area 02   Intersection No. 11 – No. 15
Sub-area 03   Intersection No. 6 – No. 8
                            No. 16 – No. 17
Sub-area 04   Intersection No. 9 – No. 10
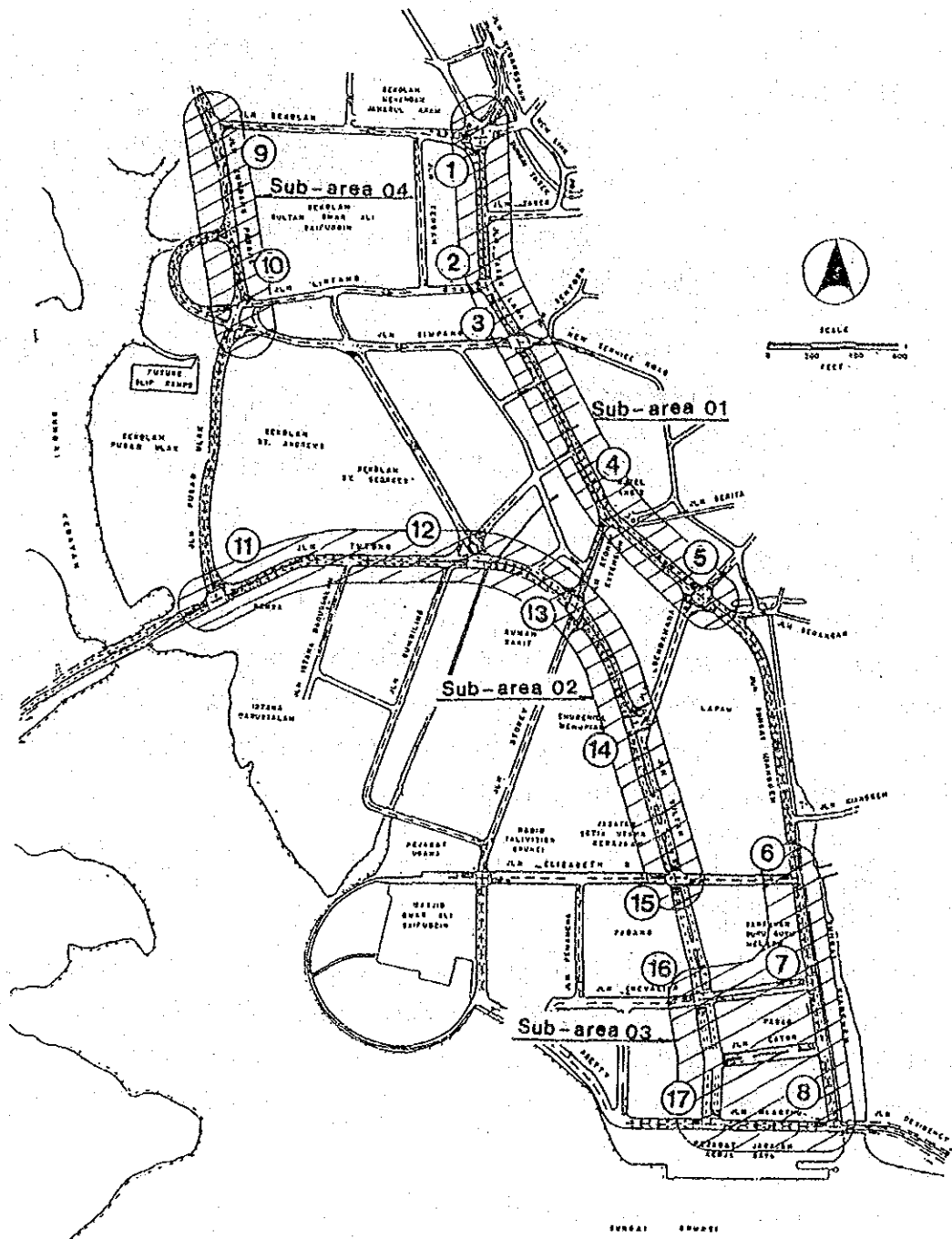
Each sub-area is given in Fig. 3-22

Fig. 3-22 Linked Linear System of Traffic Signal in B.S.B.

3-8 Evaluation of Present Traffic Network

3-8-1 Problems of Present Road Network

Two main problems are found in the present road network. One of the problems is the traffic jam at the entrances of urban area of B.S.B. in peak hours of morning, noon and evening, especially in the morning peak hour. The other is the road which is not corresponding to the expansion of urban cities, that is non-adjusted pedestrian roads along the arterial road and non-adjusted pedestrial crossing at the intersections.

a) Traffic jam at the entrance of urban area of B.S.B.

The present traffic flow to the center of urban is through the five radial roads of Jln. Gadong, Jln. Tutong, Jln. Berakas (this road is jointed to Jln. Gadong to become Jln. Kumbang Pasang) and Jln. Residency. In peak hours, these roads are all crowded with cars and long traffic jam line of vehicles to the suburbs appear. Excessive concentration of cars to the urban and radial road system are the causes of the traffic jam. As improvement measures, dispersion of urban function in the suburbs and construction of ring roads connecting radial roads mutually are considered. As for these measures, the Brunei Government is promoting at present. The followings are the road construction projects including construction of ring roads with the completion schedule by 1990.

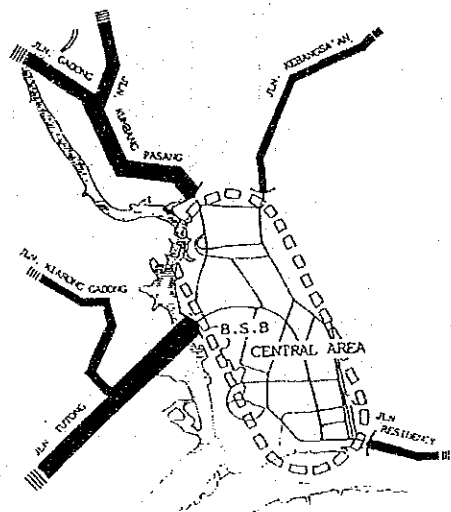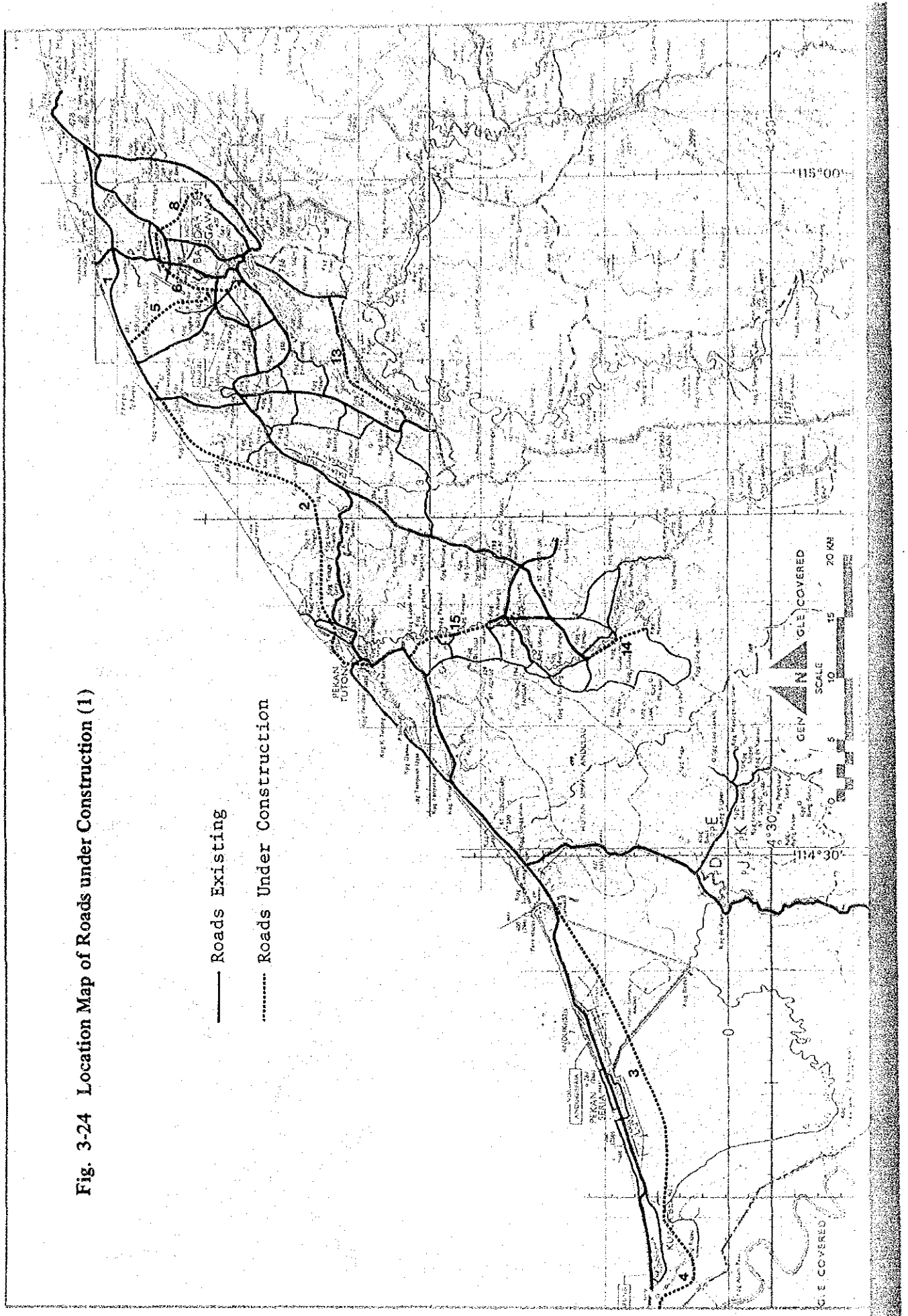Fig. 3-23 Traffic Jam at the Entrance of Urban in Peak Hour

Fig. 3-24 Location Map of Roads under Construction (1)

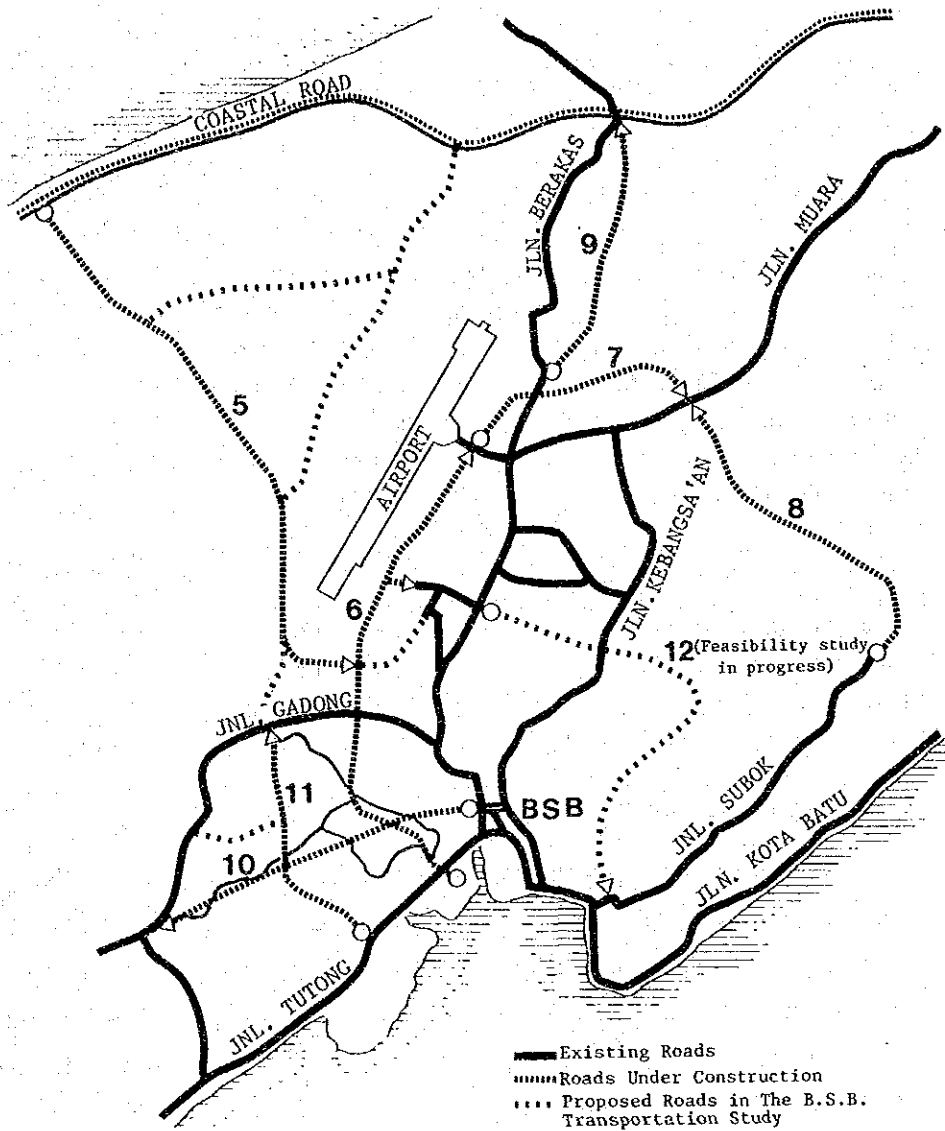—— Roads Existing

········ Roads Under Construction

Existing Roads
Roads Under Construction
Proposed Roads in The B.S.B. Transportation Study

Fig. 3-25 Location Map of Roads under Construction (2)

Table 3-21   Roads Under Construction

	DESCRIPTION	LENGTH (IN MILES)	SCHEDULE COMPLETED	REMARKS
1	MUARA/JERUDONG COASTAL ROAD	19.5	COMPLETED	Single Carriageway with provision for Future Double Carriageway.
2	JERUDONG/TUTONG COASTAL ROAD	18.0	Sep. 1985	- do -
3	SERIA BYPASS	17.0	End of 1986	
4	SUNGAI TUJOH ROAD	7.0	End of 1986	
5	TUNGKU LINK ROAD	6.0	End of 1985	
6	MAJOR ARTERIAL ROAD PHASE I	5.2	Early 1986	Dual Carriageway
7	MAJOR ARTERIAL ROAD PHASE II	2.3	End of 1988	Dual Carriageway
8	SUBOK/MANGGIS LINK	4.5	End of 1985	
9	BERAKAS LINK	2.4	End of 1986	
10	SG. KEDAYAN RADIAL ROAD	3.1	End of 1987	
11	KIARONG LINK	2.3	End of 1987	
12	BERAKAS/KEBANGSAAN/SUBOK LINK	5.1	-	Feasibility study in Progress
13	LIMAU MANIS/LUMAPAS ROAD	9.0	End of 1985	
14	RAMUI/MERIMBUN ROAD	4.0	End of 1986	
15	TANJONG MAYA ROAD	5.0	End of 1985	

b)   Non-adjusted condition of pedestrian road

Though the movement of people along the roads with the expansion of land use plan as urban area, rural type roads are still remained.   That is, roadways have no pedestrian roads and have only green belt for landscape or road shoulders for road protection.   For instance, the road between Jln.   Sekolah intersection and intersection in front of Istana Edinburgh of Jln. Kumbang Pesang is an example.

When constructing sideways, it is desirable to construct pedestrian roads and to plant street trees to give shadows to pedestrians.

The intersection in front of the hospital of Jln. Totung and that of Jln. Gadong and Jln. Kumbang Pasang have no pedestrians' crossing, which prevents use of the crossings. These crossings are required to have signals or to reform traffic signal phase in due consideration of convenience of pedestrians.

3-8-2   Evaluation of the present public transport system

Public bus

The present ratio of the number of bus passengers to that of total passengers occupies only 3% due to such a low service level as shown below :

a) Only a radial bus network is provided in the Brunei-Muara district and B.S.B. bus which accompanied by a large population and a massive movement of passengers. This is not satisfactory for a various travel desire and transit passengers.

b) It is not desirable for regular passengers to travel by bus, because no fixed bus operation is provided.

c) Total average operation interval of bus departure is as long as 48 minutes which shows a long service level.

d) Such informations as operating time table, route map and bus fare, are not available not only even in B.S.B. bus terminal but also at bus stops.

e) Bus stops are not sufficiently improved.

f) The present situation that obsolete buses without air-conditioner are operating constitues a problem of unsatisfactory bus service for passengers.

g) The type, model and capacity of buses are different. So that is becoming extremely difficult to repair and maintain the buses.

h) These are a lot of small bus business companies so that is difficult to operate bus on schedule.

To cope with the above problems, the following improvement are deemed necessary.

a) Re-routing of the present bus network

b) Increasing of bus operating frequency

c) Improvement of bus terminals and bus stops

d) Improvement and standardization of bus type

e) Establishment of bus operating and management system as well as the maintenance facilities.

School bus

The following problems are acute in the present school bus operation.

a) Out of the total, only 10% of students are enjoying the school bus service. The majority of them obliged to use their family cars.

b) The school bus operation seemed to be uneconomy due to its limited operating hours.

c) Shortage of school bus parking space in the B.S.B. town center would accelerate the traffic congestion more.

To cope with the above problems, the following improvements are deemed necessary.

a) Conversion of school bus to public bus

b) Increasing of bus operating frequency

c) Improvement of bus stops

d) Introduction of season tickets for students

Taxi

The following problems are acute in the present taxi business.

a) It is inconvenient for passengers to walk up to a small number of taxi pools.

b) It is inconvenient for passengers to call a taxi because a telephone calling system is not available.

c) A fare meter is not equipped with a taxi so that the fare is not reliable.

d) Positive investment to improve the existing taxi service cannot be expected in taxi business now, because most of taxi business companies are small and thereby lending to low profitability.

To cope with the above problems, the following improvements are deemed necessary.

a) Improvement of taxi stations

b) Introduction of a telephone calling system and radio taxi services

c) Incentive for improvement, etc.

CHAPTER 4
FORECASTS OF SOCIO-ECONOMIC ACTIVITIES
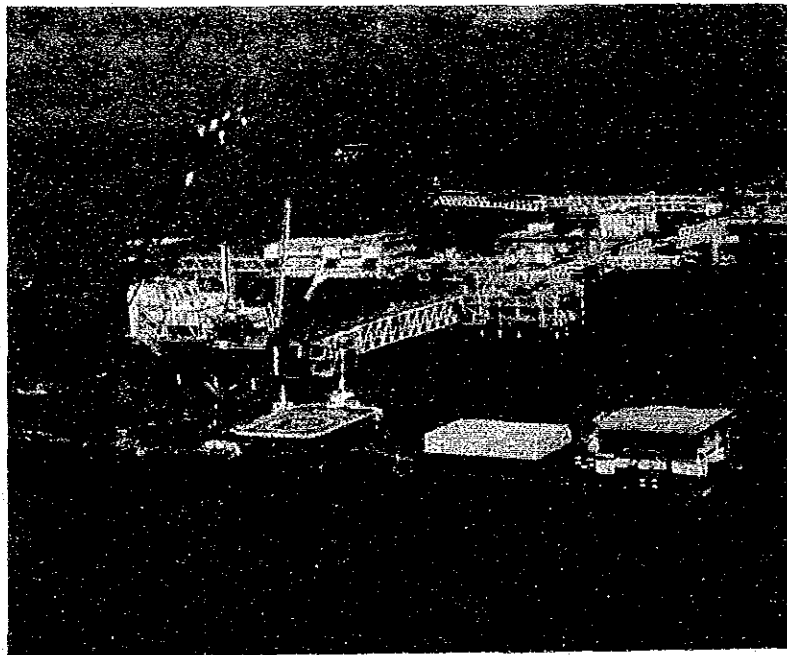
CHAPTER 4 FORECASTS OF SOCIO-ECONOMIC ACTIVITIES

4-1 Land Use in Major Populated Areas ·

5 major populated areas were focussed on in considering the land use. These comprises Bandar Seri Begawan (B.S.B.) and its environs, Muara, Tutong, Kuala Belait (KB) and Seria. The land use would have to be dealt with population increase and expansion of economic activities into the neighbouring areas. The Town and Country Planning Department has the town planning which only give physical patterns of the internal structures, not to serve as a basis for statutory interpretations. Few target years have been fixed for these, but some are already in implementation.

4-1-4 B.S.B. and its Environs

Large resettlement sites have been in preparation recently in the northern part of B.S.B., for removing residents from Kampong Ayer as well as for Suburban centers. Governmental departments and the related agencies are apt to disperse urban functions to the provinces 5 to 7 km far from the town center of B.S.B., going to be disposed to continual planning. (See Fig. 4-1)

The disperse resettlement schemes as mentioned above have been prepared not only for office spaces but for residential areas. It can be said that "home to office in a short distance" system would be attained by these. Such ideas have been applied already in and around B.S.B; New Office Zones for the Government at Old Berakas Airport and around the area of the Police Headquarters, and at Police Training Center in the eastern region.

Industrial areas are proposed at the west of International Airport and around Jalan Gadong 6 km (3.73 miles). However, these are not for the heavy industry but for light industries such as car-repair workshop and vehicle dealers, under the prohibition of heavy industries inside the radius of about 10 miles from the Airport.

4-1-2 Muara

The only port facilities for external trade exist in Muara where the town is located in narrow and long area along Jalan Muara and Jalan Serasa. As it is the base point for the imports, some industrial development have been proposed including a car assembling manufacturer. Two small-scale residential areas have been prepared for future population increase; one will be the linear pattern in west-east at the east end with South China Sea, another will be around a fire-station.

4-1-3 Tutong

The government and municipal offices are located at west-east side, and residential areas extend along Jalan Inche Awang near the Sungai Tutong. In this narrow and long township, the northern part is formed by hillocky area which contains a school and a mosque but mainly with fields and forests. The planned coastal road will pass through this hillocky area, which is now under construction. Both sides of this road would be utilized for large-scale residential areas, government use, educational institutions and open spaces.

4-1-4 Kuala Belait

The town center of KB is situated between South China Sea and the estuary of Belait river, shaped in delta line. Town areas have been developed next to the town center; west-east 1.5 km (0.9 miles) and north-south 1.5 km, approximately in the shape of quadrate. At both sides of Jalan Seria, the urban areas extend as far as Seria in the distance of 4 km (2.5 miles).

A large-scale resettlement scheme has been planned in the southern part. Between the boundary of KB and Seria, it will cover an area of 4 km west-east and 1 km north-south. In this area, no big construction work will be required since it is the flat land only surrounded by low woods. Close to the south end of the town boundary, government offices and an industrial site have been proposed to establish.
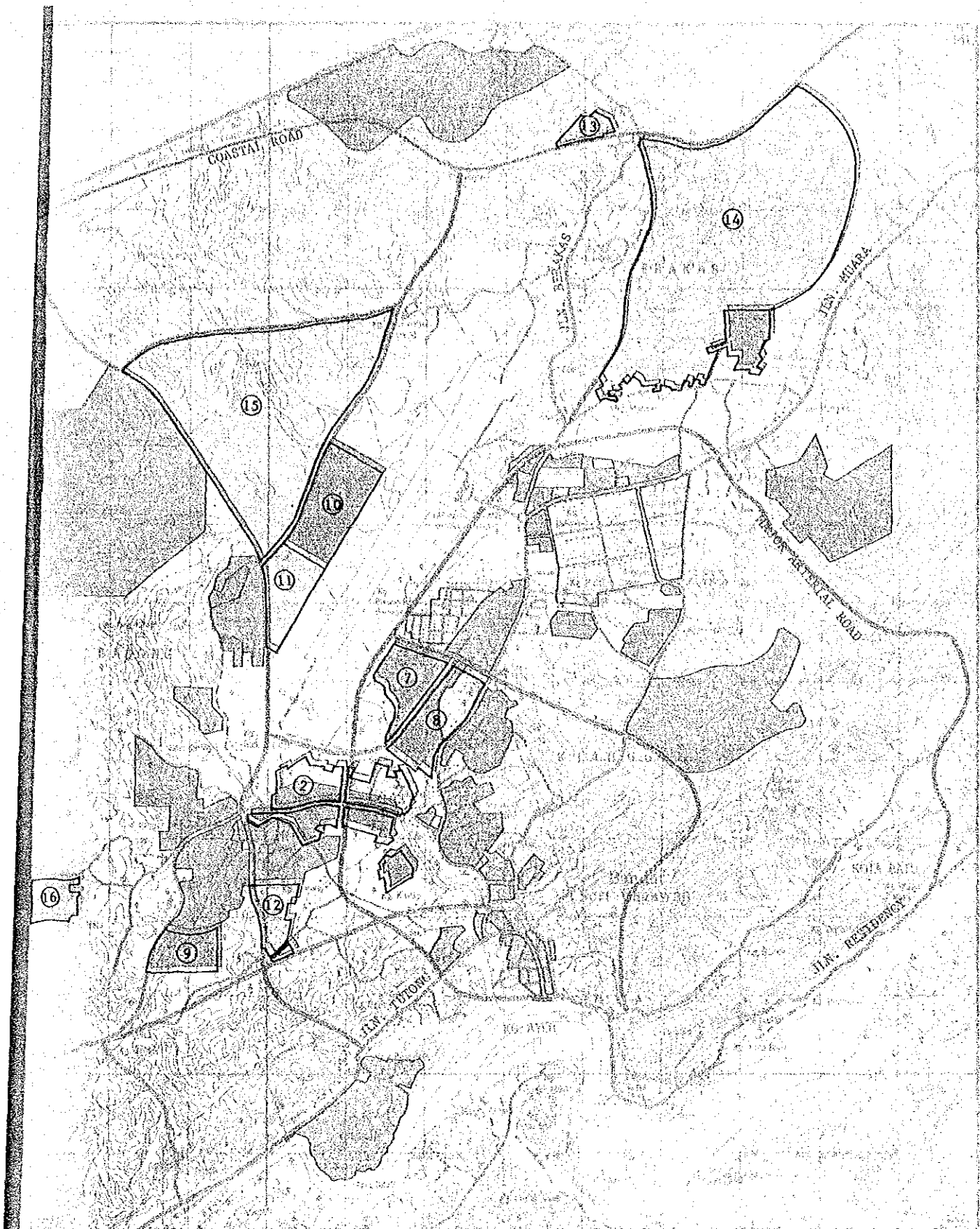
B.S.B. Structure Plan and Development

(1) ④ : No. of development projects/schemes corresponding to
that in Table 4-2 and Table 4-3

(2) *Entire area is the coverage of B.S.B. Structure Plan by the
Town and Country Planning Dept.*
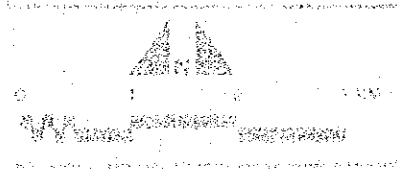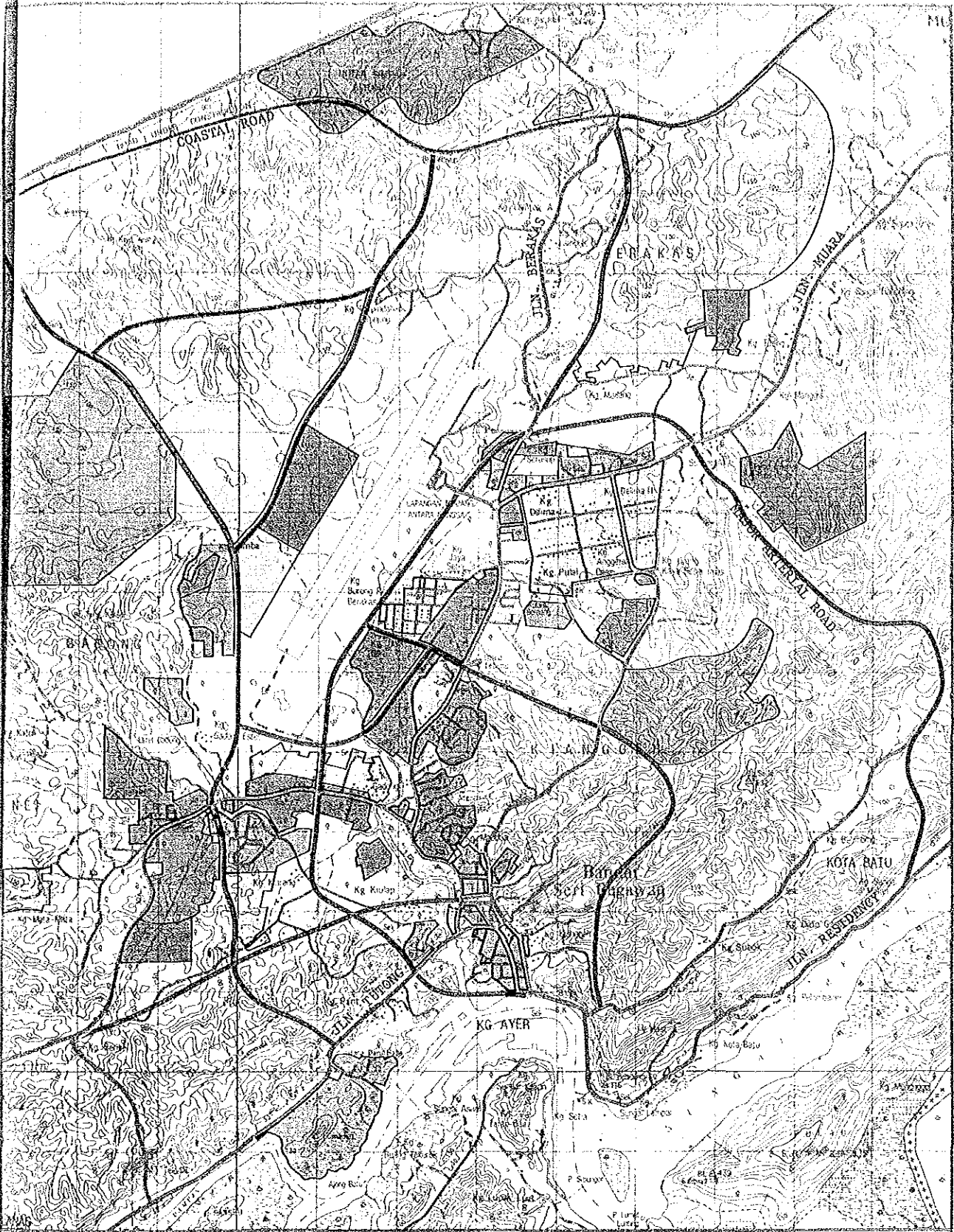
Fig. 4-1 B.S.B. -- Major Land Uses

C.B.D.	INDUSTRIAL
GOVERNMENT USE	OTHERS
RESIDENTIAL	PROPOSED ROAD

N

0   1   2   3 KM
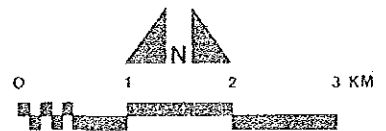
4-1-5 Seria

The town area has been formed along Jalan Seria, in narrow and long situation of west-east. The eastern part is the industrial area for Brunei Shell Petroleum (B.S.P.) and a town center and residential areas have been developed in the west. As it was already built-up around the town center, no scope of land use change is foreseeable for the moment. Outside the town area, a large-scale resettlement has been proposed.

4-2 Development Plans and Schemes

4-2-1 National Development Plan

The Government of Brunei has formulated the National Development Plan (NDP) usually for a period of 5 years; 1st NDP for 1953 - 1958, 2nd NDP for 1962 - 1966, 3rd NDP for 1975 - 1979 and 4th NDP for 1980 - 1984. Previous NDPs were the plans of government investment in 5 year period for providing infrastructure, public services and public facilities, and incentives to encourage private sector's participation. The new NDP (5th) is now in preparation, which is anticipated to be a comprehensive plan covering not only public investment but the planned development of the private sector.

The aims and objectives of 4th NDP include the followings:

(1) Real growth of GDP: at least 6% per annum

(2) Increase in per capita income: at least 4% per annum

(3) High level of employment

(4) Economic diversification by development of agriculture and industries other than oil/natural gas subsidiaries

(5) Acceptable level of inflation by fiscal and monetary policies

(6) Narrow disparity of income distribution

(7) Narrow disparity of regional development and growth

The allocation of development fund for the period from 1980 to 1984 is summarized in Table 4-2. Major fields of development investment are Roads, Public Buildings, Education, Government Housing and Medical/Health.

Table 4-1 Allocation of Development Funds for 4th NDP, 1980

Unit: $B\$10^6$

No.	Sector	Amount	No.	Sector	Amount
1.	Agriculture	28.2	12.	Radio/TV	1.4
2.	Forestry	1.5	13.	Postal Services	1.8
3.	Fisheries	7.4	14.	Government Housing	173.1
4.	Industrial Estate	4.0	15.	Medical/Health	171.4
5.	Commerce	23.1	16.	Sanitation	42.3
6.	Education	198.9	17.	Water Supplies	88.3
7.	Roads	213.5	18.	Public Facilities	47.6
8.	Civil Aviation	33.7	19.	Public Buildings	231.0
9.	Marines/Ports	51.5	20.	Town/Country Planning	50.0
10.	Electricity	98.2	21.	Religious Affairs	37.6
11.	Telecommunication	88.7	22.	Contingency Fund	106.8
				Total	1,700.0

Source: "National Development Plan, 1980 - 1984", EPU.

4-2-2 Significant Development Projects/Plans

A number of development projects have been proposed or implemented by various agencies in the country. Of these, enumerated as the specific projects/plans closely related to this Study are those undertaken by the Town and Country Planning Department (TCPD), Public Works Department (PWD), and the Housing Development Department (HDD). All of these 3 Departments belong to the Ministry of Development. Table 4-2 summarizes these projects/plans and their characteristics.

Table 4-2 Development Projects/Plans

Project/Plan/Scheme	Responsible/ Implementing Agency	Brief Contents	Target Year	Present Status
1. Bandar Seri Begawan Structure Plan	TCPD	Land use plan in and around B.S.B., as a configuration of the various project/schemes	–	Utilized as basic tool in land use control.
2. Gadong Development Planning Scheme	TCPD	Development control plan around Jalan Gadong – proposed ring road junction (residential + industrial + government use)	–	Utilized in development control by TCPD.
3. Muara Town Planning Scheme	TCPD	Land use plan inside Muara Town (residential + industrial area on reclaimed land + harbour extension).	–	Proposal
4. Tutong Town Planning Scheme	TCPD	Land use plan inside Pekan Tutong (residential + industrial + catchment reserve + green belt)	–	Utilized as basic tool in land use control.
5. Seria Urban Area Planning Scheme	TCPD	Land use and strategic planning for Seria Urban Area except for B.S.P. (residential + industrial)	–	Utilized as basic tool in land use control.
6. Greater Kuala Belait Planning Scheme	TCPD	Land use plan for Kuala Belait Urban Area and the vicinity (residential + industrial + resettlement + government housing)	–	Proposal
7. New Government Offices at Old Berakas Airport	PWD	Construction of office building for government agencies	1984	Completed: PSC Bldg. Education Bldg. PWD Bldg. Under construction: Others.
8. Government Housing for New Offices	PWD	Provision of housing for government workers (including expansion in future)	1984 and after	Partly completed and people is residing already.
9. Gadong Industrial Area	PWD	Site preparation for 80 commercial enterprise units	1988	Ongoing for detail design
10. Industrial Area between Airport and Rimba Resettlement Area	PWD	Site preparation for light industry/ commercial enterprise	–	Planning stage
11. Labour Line Site	PWD	Provision of housing facilities for temporary (immigrant) workers	–	Planning stage
12. Kiarong Government Housing	PWD	Provision of 350 housing units.	1987– 1988	One place to be started in 1985.
13. Lambak Kiri Resettlement Scheme	PWD	Provision of 130 housing units.	1986	Ongoing Site preparation

Remarks: PWD: Public Works Department

TCPD: Town and Country Planning Department

Table 4-2 Development Projects/Plans

Project/Plan/Scheme	Responsible/ Implementing Agency	Brief Contents	Target Year	Present Status
14. Lambak Kanan Resettlement Scheme	HDD/PWD	Population: 14,000 Housing : 2,000 units	1989	Stage I 90% Stage II 70%
15. Rimba Resettlement Scheme	HDD	Population: 9,000 Housing : 1,500 units	1989 + 2 or 3 years	Planning stage
16. Kg. Mata-Mata Resettlement Scheme	PWD	Total area: 112 acres + 46 acres for future Housing : 172 units + 156 units for future	1984 + 2 or 3 years	Phase I: Completed Extension: Site preparation
17. Bukit Beruang Resettlement Scheme, Tutong	HDD	Population: 4,000 - 9,000 Housing : 500 - 1,500 units	1989	Tender
18. Kg. Pandan Resettlement Scheme, KB	HDD	Population: 9,000 Housing : 1,500 units	1989 + 2 or 3 years	Planning stage
19. Sungai Liang Resettlement Scheme, Belait	HDD	Population: 9,000 Housing : 1,500 units	1989 + 2 or 3 years	Planning stage
20. Lorong Tengah Resettlement Scheme, Seria	HDD	Population: 6,000 Housing : 1,200 units	1989	Tender
21. Kg. Serasa Resettlement Scheme, Muara	PWD	Total area: 72 acres Housing : 70 units	1984	Completed except for a mosque and shophouses
22. Kg. Rataie Resettlement Scheme, Temburang	HDD	Population: 1,200 - 2,400 Housing : 200 - 400 units	1989 + 2 or 3 years	Planning stage

Remarks: PWD: Public Works Department
HDD: Housing Development Department (formerly Resettlement Dept.)

Most of the planning schemes by the TCPD have been utilized as basic tools in land use control in urban areas. Formulated planning schemes are those for B.S.B., Muara, Tutong, KB and Seria; in the form of maps upon which the respective land use purposes are indicated in colour. Target years are usually not fixed. B.S.B. Structure plan has the comprehensive features, consolidating all the ongoing development in and around B.S.B. (Refer to Fig. 4-2). Gadong Development Planning Scheme has been utilized in actuality for the development control by the TCPD.

Besides road construction, civil works such as public buildings and public facilities are entrusted to the PWD from detail design to engineering. The other government departments request structure provision and pass them the necessary funds to the PWD. New Government Offices at Old Berakas Airport, and government housing inside and outside B.S.B. Have been completed along this procedure. The PWD also provides civil works for industrial and resettlement sites.

The HDD has carried out the planning and implementation of large-scale housing development all over the country. Several resettlement schemes have been established with 1989 as the general target year of completion. The pilot site is Lambak Kanan, located at about 10 km (6 miles) north from the town center of B.S.B. According to the project plan, over 14,000 persons will reside in 2,000 housing units. Actual civil works have been undertaken by the PWD with the HDD's funds. Another big-scale housing development will be undertaken in Rimba which is located also 10 km far from B.S.B. town center; however this scheme is still at detail design stage. Other resettlement schemes are found around Tutong, KB and Seria and in Temburong.

4-3 Demography

4-3-1 Past Trend of Population Growth

Total population in Brunei grew from 83.9×10^3 in 1960 to 136.3 $\times 10^3$ in 1971, and to 192.8×10^3 in 1981. Whilst mid-year population estimates are available in time series, these Census figures in 1960, 1971 and 1981 are the most reliable. Recent population increase is characterized by 2 different average annual growth rates; namely, 4.5% in the period 1960 - 1971 and 3.5% in 1971 - 1981. Although the continuous inflow of immigrant workers has existed, the pace of population growth in Brunei somewhat dropped down recently. These figures might be found in Table 4-3.

Table 4-3 Population in Brunei, 1960, 1971 and 1981

Census Year	Population	Amount of Growth	Annual Average Growth Rate (%)
1960	83,877	52,379	4.5
1971	136,256	56,576	3.5
1981	192,832		

Source: "Population Census, 1971 and 1981", EPU.

4-3-2 Distribution of Population

Tables 4-4 to 4-6 show the basic data for population distribution in the whole country. In view of population concentration, 2 major centers have been formed in Brunei; ore is B.S.B. and its environs and another is the area covering both KB and Seria. Between these 2 population centers, one sub-center is located at Tutong. Population growth rates of Mukims during 1971 to 1981 suggest that the surrounding areas of B.S.B. had remarkable increase. The Mukims such as Berakas, Gadong, Senkurong and Mentiri/Serasa recorded high increase rates of 6 - 8% per annum, while B.S.B. had only 3.0% during that period. Brunei-Muara District and B.S.B. had the population of 114.3×10^3, corresponding to 59.3% of total population in 1981. Population density was the highest in B.S.B. in the same year, which was 3,868 persons/km^2.

Table 4-4 Population by District, 1960, 1971 and 1981

Unit: 10^3 Persons

District	1960	1971	1981
1. Bandar Seri Begawan	9.7	37.0	49.9
2. Brunei-Muara	27.8	35.8	64.3
3. Belait	31.7	42.4	50.8
4. Tutong	10.7	15.9	21.6
5. Temburong	3.9	5.2	6.2
Total	83.9	136.3	192.8

Table 4-5 Population by Mukim, 1971 and 1981

District/Mukim	1971	1981	District/Mukim	1971	1981
Bandar Seri Begawan			Tutong		
Bandar Seri Begawan	17,410	22,777	Pekan Tutong	4,373	8,525
Kg. Ayer (A and B)	19,577	27,125	Keriam	2,612	3,348
Brunei - Muara			Telisai	1,134	1,469
Berakas	12,321	22,757	Tanjong Maya	1,443	1,480
Gadong	4,480	9,926	Kindang	2,204	2,678
Kota Batu	4,587	6,554	Lamunin	1,632	2,195
Lumapas	1,800	2,284	Ukong	1,214	964
Kilanas	3,623	5,344	Rambai	1,246	956
Sengkurong	3,596	6,365	Temburong		
Pengkalan Batu	1,683	2,932	Labu	582	492
Menteri	3,714	2,908	Bangar	2,458	2,593
Serasa		5,259	Amo	583	876
Belait			Batu Apoi	706	1,006
Kuala Belait	14,239	19,335	Bokok	895	1,251
Seria	20,824	23,415			
Sg. Liang	3,965	3,771			
Kuala Barai	206	62			
Labi	1,558	1,556			
Bukit Sawat	847	655			
Sukang	574	639			
Melilas	170	125			
Off-shore	--	1,210			

Table 4-6 Population Density, 1981

District	Area (Sq. miles)	Area (km²)	Population Density (person/km²)
1. Bandar Seri Begawan	5	12.9	3,868.4
2. Brunei-Muara	215	556.8	115.5
3. Belait	1,052	2,724.6	18.6
4. Tutong	450	1,165.4	18.5
5. Temburong	503	1,302.7	4.8
Total	2,226	5,765.0	33.4

Remarks: Total sum sometimes does not coincide with the sum of each, due to rounding.

Source: "Population Census, 1971 and 1981", EPU.

4-3-3 Population Projection

For the purpose of projecting population in 1995, the following formula was made use of:

$$P_n = P_0 \cdot (1 + r)^n$$

, where

P_n : Population after n years from the base year

P_0 : Population in the base year

r : Average annual increase rate for n years

The base year was fixed at 1981 in which the latest Census was conducted.

To determine the value of r, considered were the following:

(1) Past trend of population growth

The description is found in the former sub-section 4-3-1.

(2) Population projection in 4th NDP, 1980 - 1984

Utilizing 1981 Census figures, 4th NDP gives the national target of 3.5% per annum including the increase due to the immigration.

(3) Population projection by the EPU

Under the condition that immigrants are excluded, 5-year
interval population up to 1996 was provided as follows:

Year	Projected Population	Average Rate for 5 years	Average Rate from 1981
1981*	192.8×10^3	-	-
1986	232.9	3.86%	3.85%
1991	278.7	3.66	3.75
1996	318.4	2.70	3.40

*) Actual figure

(4) Consideration of Government policy towards the immigration

At the moment, huge amount of immigrant workers exists in
Brunei (around 25% of total population in 1981). It is
anticipated to increase in the difficulty of obtaining cheap
labourer from the neighbouring countries. Furthermore,
more strict control on the immigration might be taken,
depending upon the international environment.

Considering all the factors having influence on population
growth, the average annual growth rate was assumed to be 3.5% for
1981 - 1990 and 3.0% for 1990 - 1995, including inflow of immigrant
workers. The total population in 1995 was thus calculated to be 304.7
x 10^3. Average annual growth rate from 1981 to 1995 has resulted in
3.3%. Table 4-7 shows population projection figures.

Table 4-7 Population in 1981, 1990 and 1995

Year	1981	1990	1995
Population	192,832	262,810	304,668

Remarks: 1981: Actual figure by 1981 Census
          1990 and 1995: Projected values

4-3-4 Assignment of the Projected Population to Traffic Zones

Assignment of the projected population in 1995 to each Traffic Zone was carried out utilizing land use planning by the TCPD and resettlement schemes by the HDD. The total amount to be assigned is 111.8×10^3 which come from the difference between the projected population in 1995 and actual figure by 1981 Census.

Major features in the assignment are as follows:

(1) Basically by the increase rate in each Traffic Zone

In each traffic zone assumed was the annual increase rate of 1.3% to 1.5% per annum as a basis which is lower than the natural increase rate of total population (1.65%) from 1971 to 1981. Natural increase in total population from 1971 to 1981 has been calculated in the simplified method as shown below.

Year	Total Population	Immigrant Inflow	Factor to be Multiplied	New Birth in Immigrants
1971	136,256	1,170/2 (585)	1.0	585
1972		962	0.9	866
1973		899	0.8	719
1974		1,154	0.7	808
1975		2,030	0.6	1,218
1976		2,370	0.5	1,185
1977		2,379	0.4	952
1978		3,465	0.3	1,040
1979		4,508	0.2	902
1980		7,247	0.1	725
1981	192,832	10,247/2 (5,123)	0.0	–
Increase, 1971 – 1981	56,576	30,723		9,000

- Population increase due to the immigration: 30,723 (mid-year estimation)

- Increased population excluding immigrants: 56,576 – 30,723 = 25,853

- Natural increase rate during 1971 to 1981:   (136,256 + 25,853 + 9,000)/ (136,256 + 9,000) = 1.178

(Average annual rate of natural increase: 1.65% per annum)

(2) Consideration of large-scale resettlement schemes by the
     HDD

     Out of the planned population (55,560) to be inspired in the
     7 major sites, 90% would be attained. It is about 50×10^3
     of population.

(3) Laying emphasis on the resettlement schemes in
     Brunei-Muara District

     Due consideration was taken in resettlement schemes
     including Lambak-Kanan and Rimba. 17,150 to 23,620 would
     be the newly-settled population.

(4) Estimation of population in Kampong Ayer

     According to the "Kampong Ayer Master Plan Study, 1982",
     53.5% of residents in Area-A and 35.8% in Area-B would like
     to move on land area. Assuming that all the applicants be
     able to move in 20 years since 1985, the population increase
     of both Areas in 1995 would be:

     Area-A: $15,958 \times 1,013^{14} \times (1 - 0.535/2) = 14,010$

     Area-B: $11,167 \times 1.013^{14} \times (1 - 0.358/2) = 10,990$

     , in which
          Basic figure of population: from 1981 Census
          Natural increase rate assumed: 1.3% per annum

     Actual assignment was carried out in the order of Districts;
B.S.B. $\rightarrow$ Belait $\rightarrow$ Tutong $\rightarrow$ Temburong $\rightarrow$ Brunei-Muara. The
results are shown in Table 4-8.

Table 4-8 Population by Traffic Zone, 1971, 1981 and 1995

Traffic Zone	Actual Population		Average Growth Rate, 1971-1981 (%)	Population in 1995	Average Growth Rate, 1981-1995 (%)
	1971	1981			
10	36,987	49,902	3.0	63,490	1.7
11		2,969		3,560	1.3
12		3,831		4,590	1.3
13		4,482		6,160	2.3
14		6,287		14,790	6.3
15		5,208		9,390	4.3
16		11,167		10,990	--
17		15,958		14,010	-0.9
20	35,804	64,329	6.0	117,950	4.4
21		6,554		9,900	3.0
22		10,786		16,960	3.3
23		4,563		6,230	2.2
24		7,400		21,710	8.0
25		3,933		6,700	3.9
26		5,993		18,280	8.3
27		5,344		7,100	2.1
28		6,365		9,280	2.7
29		2,932		4,050	2.3
30		2,284		2,950	1.8
31		8,167		14,790	4.3
40	42,383	50,768	1.8	82,410	3.5
41		20,545		32,720	3.4
42		23,415		33,430	2.6
43		6,808		16,260	6.4
50	15,858	21,615	3.1	31,750	2.8
51		14,822		23,610	3.4
52		6,793		8,140	1.3
60	5,224	6,218	1.8	9,070	2.7
61	5,224	6,218		9,070	2.7
Total (Average)	136,256	192,832	3.5	304,670	3.3

4-4 Economic Activities by Industrial Sector

4-4-1 Agriculture, Forestry and Fishery

Table 4-9 shows a stagnant feature of this sector since 1974. Total percentage contribution to GDP was less than 1.0% recently and only Forestry recorded high rates of growth. The Government has the plans to encourage this sector, especially Agriculture. Taking this development policy into consideration, it is assumed that contribution to GDP for the next 13 years would be 1.0%.

Table 4-9 Economic Activity Level by Sector (1/4)

(1) Contribution to GDP

Unit: %

Sector	1974	1975	1976	1977	1978	1979	1980	1981	1982
1. Agriculture and Hunting	1.0	1.0	0.8	0.7	0.8	0.7	0.5	0.5	0.6
2. Forestry and Logging	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
3. Fishing	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Total	1.3	1.4	1.2	1.1	1.0	0.9	0.7	0.7	0.9

Remarks: Calculation using GDP at current prices

(2) Growth

Unit: %

Sector	1975	1976	1977	1978	1979	1980	1981	1982	Average
1. Agriculture and Hunting	-5.1	-6.9	-3.7	11.6	9.3	15.9	-3.4	5.3	2.6
2. Forestry and Logging	38.7	23.3	7.5	-15.8	14.6	-9.1	58.0	15.2	14.4
3. Fishing	6.3	-27.5	35.1	2.0	5.9	-22.2	16.7	0.0	0.2
Average Annual Growth Rate for 9 Years, 1974 - 1982									3.8

Remarks: Calculation using GDP at constant prices. 1974 value is not available.

4-4-2 Mining, Quarrying and Manufacturing

In the recent decade, twice of radial changes of oil prices took place in 1974 and around 1978, which directly gave this sector favourable effects. After 1980, it has been affected reversely leading to the decrease of the whole GDP of Brunei. (See Table 4-10) Although the activity level of this sector is unpredictable due to the limitation of natural resources and international influence, the percentage contribution to GDP would remain at 80.0% towards 1995.

Table 4-10 Economic Activity Level by Sector (2/4)

(1) Contribution to GDP

Unit: %

Sector	1974	1975	1976	1977	1978	1979	1980	1981	1982
4. Mining/ Quarrying and Manufacturing	88.9	87.3	88.2	82.5	78.3	82.4	82.7	81.8	79.4
5. Electricity, Gas and Water	0.2	0.2	0.2	0.1	0.04	-0.03	-0.04	-0.03	-0.01
6. Construction	1.3	2.0	2.1	2.1	2.2	1.8	1.6	1.5	1.8

Remarks: Using GDP at current prices

(2) Growth

Unit: %

Sector	1975	1976	1977	1978	1979	1980	1981	1982	Average
4. Mining/ Quarrying and Manufacturing	-1.5	21.8	4.6	3.5	27.5	-12.7	-2.5	6.6	1.8
5. Electricity, Gas and Water	5.1	20.1	-38.7	-69.6	-200.0	-350.0	74.6	-343.8	-220.3
6. Construction	45.9	15.0	15.1	13.9	13.0	48.9	-24.6	9.3	11.0

Remarks: Using GDP at constant prices. 1974 value is not available.

4-4-3 Construction

Historically speaking, Construction sector has maintained the percentage contribution at 1.0% - 2.0% to total GDP but increase rate in real terms severely altered year by year. (See Table 4-10) For the future perspective, it is important to reconsider the effects of the Independence in the beginning of 1984. The implementation of development projects will be accelerated under the Government policy and take a favourable influence to this sector. Thus, 1.8% of contribution to GDP is to be maintained by this sector until 1995.

4-4-4 Commerce

Table 4-11 summerizes the role and growth trend of this sector from 1974 to 1982. This sector is composed of 2 sub-sectors; Wholesale Trade and Retail Trade. The former showed a remarkable increase in percentage contribution to GDP after the year 1977. The growth trend also suggests that 1977 and 1978 was the turning point. Since 1979, gradual growth tendencies are observed in the both sub-sectors, except for the decline in 1981. By the year 1995, the percentage contribution of Commerce sector would reach 10.0% in total GDP.

Table 4-11 Economic Activity Level by Sector (3/4)

(1) Contribution to GDP

Unit: %

Sector	1974	1975	1976	1977	1978	1979	1980	1981	1982
7. Wholesale Trade	0.4	0.4	0.3	4.2	7.4	6.2	7.9	7.9	8.3
8. Retail Trade	1.6	1.7	1.5	1.9	2.0	1.5	1.0	1.2	1.4
Sub-total	2.0	2.1	1.8	6.1	9.4	7.7	8.9	9.1	9.7
10. Transport Storage and Communication	0.5	0.8	0.8	0.9	1.1	0.9	0.5	0.7	0.9

Remarks: Using GDP at current prices

(2) Growth

Unit: %

Sector	1975	1976	1977	1978	1979	1980	1981	1982	Average
7. Wholesale Trade	7.4	-13.9	133.9	84.9	5.4	1.9	-29.0	1.7	42.7
8. Retail Trade	11.7	10.3	41.8	5.0	-6.6	15.1	-2.3	1.8	8.9
Average Annual Growth Rate of Commerce for 9 years, 1974 - 1982									22.7
10. Transport Storage and Communication	51.1	20.2	19.5	2.7	-2.6	-1.8	14.5	2.6	15.2

Remarks: Using GDP at constant prices. 1974 value is not available.

4-4-5 Transport, Storage and Communication

The production in this sector has had an almost constant proportion to total GDP; however, annual increase rates in real terms fluctuated heavily from 1974 to 1982. (See Table 4-11) Since the same factor as in Construction sector might be expected, the contribution of this sector in the national economy would go upward to some extent. It is assumed to rise up to 1.0% towards total GDP.

4-4-6 Other Services

This sector includes 6 sub-sectors; namely, Restaurant and Hotels, Banking and Finance, Insurance, Real Estate and Business Services, Ownership of Dwellings, and Community, Social and Personal Services. The past trend of production in this sector is shown in Table 4-12. Any drastic change of percentage contribution to GDP did not take place in the individual sub-sectors, but growth

in real terms varied yearly and by sub-sector. In order to reduce the sectoral/annual variation, it is necessary to consider the total sum of contribution of this sector. To GDP, 7.0% of percentage contribution might be assumed for this sector towards 1995.

Table 4-12 Economic Activity Level by Sector (4/4)

(1) Contribution in GDP

Unit: %

Sector	1974	1975	1976	1977	1978	1979	1980	1981	1982
9. Restaurant and Hotels	0.2	0.4	0.3	0.3	0.4	0.3	0.2	0.2	0.3
11. Banking and Finance	0.5	0.8	0.7	0.9	1.0	1.2	0.7	1.0	1.3
12. Insurance	0.03	0.03	0.02	0.05	0.06	0.04	0.04	0.03	0.04
13. Real Estate and Business Services	0.4	0.7	0.7	0.9	1.2	0.7	0.5	0.6	0.7
14. Ownership of Dwellings	0.5	0.5	0.4	0.4	0.5	0.4	0.2	0.4	0.4
15. Community Social and Personal Services	4.4	4.6	4.3	5.2	5.6	4.5	4.0	4.5	5.5
Total	6.0	7.0	6.4	6.9	8.8	7.1	5.6	6.7	8.2

(2) Growth

Unit: %

Sector	1975	1976	1977	1978	1979	1980	1981	1982	Average
9. Restaurant and Hotels	50.1	7.1	2.9	13.0	-0.8	12.4	0.0	2.9	10.1
11. Banking and Finance	68.0	2.3	45.9	6.9	57.4	27.8	-12.0	18.3	24.1
12. Insurance	-22.2	-14.3	200.0	5.6	0.0	105.3	-46.2	14.3	13.0
13. Real Estate and Business	40.7	26.6	46.6	24.6	-17.8	76.9	-36.4	5.7	15.6
14. Ownership of Dwellings	8.3	9.2	7.0	5.9	5.6	-12.9	29.1	6.3	6.8
15. Community, Social and Personal Services	5.9	11.6	30.9	8.8	0.8	41.4	-3.3	9.7	12.4
Average Annual Growth Rate for 9 Years, 1974 - 1982									13.5

Remarks: (1): Using GDP at current prices.
(2): Using GDP at constant prices. 1974 value is not available.

4-5 Econmic Growth and Employment

4-5-1 Forecasts of Econimic Growth and Income Level

The same type of formula as in the population projection was applied to real term GDP, that is:

$$G_n = G_o \cdot (1 + r)^n$$

, where

G_n : Constant GDP after n years from the base year

G_o : Constant GDP in the base year

r : Average annual growth rate of constant GDP for n years

The base year was set at 1982 which gives the latest GDP figure in real terms.

r towards the year 1995 was determined through the following calculation:

$$r = \Sigma \ (r_i \cdot C_i) / C_i$$

, where

r_i : Average annual growth rate towards 1995 in i industrial sector

C_i : Percentage contribution to GDP towards 1995 of i industrial sector (as a weight)

In the previous Section 4-4, almost all C_i were already fixed. The remained fields are only 2; one is Electricity, Gas and Water sector and the other is Bank Charge. As shown in Table 4-10, the percentage contribution of Electricity, Gas and Water sector to GDP has decreased into minus since 1979; consequently, the percentage contribution of this sector might be assumed to be 0.0 for the future. In case of Bank Charge, there appeared always less accounts in GDP aggregation (Refer to Tables 2-3 and 2-4); the percentage contribution was assumed to be -0.8%. Enumerated below are the industrial sector represented by i and the fixed value of corresponding C_i.

Suffix (i)	Industrial Sector/Item	Percentage Contribution to GDP (C_i)
1	Agriculture, Forestry and Fishery	1.0
2	Mining/Quarrying and Manufacturing	80.0
3	Construction	1.8
4	Commerce (Wholesale and Retail Trade)	10.0
5	Transport, Storage and Communication	1.0
6	Other Services (Including 6 sub-sectors)	7.0
7	Electricity, Gas and Water	0.0
8	Bank Charge	-0.8

The fixation of values of r_i was carried out in 3 cases; High, Medium and Low. Basic principles to divide into these 3 cases were considerations of oil price change and its influence to the other sectors. This division may be justified by the fact that oil sector (corresponding i=2 above) has maintained a dominant position in Brunei economy. It was assumed that production amount of oil and natural gas would be constant.

High case

The oil prices would be at the same level as at present. Fixed r_i was:

Industrial Sector	1	2	3	4	5	6	7	8
r_i	4.0	2.0	15.0	20.0	15.0	14.0	0.0	0.0

Medium case

The oil prices were assumed to be less 10% to the present level in the next 10 years. The average annual growth rate of oil sector (Sector 2 below) is to be 0.9% towards 1995. Respective r_i were fixed as follows:

Industrial Sector	1	2	3	4	5	6	7	8
r_i	4.0	0.9	10.0	15.0	10.0	10.0	0.0	0.0

Low case

The oil prices were assumed to be less 20% to the present level in the next 10 years. Oil sector would grow at -0.3% per annum towards 1995. In this consequence, r_i was assumed:

Industrial Sector	1	2	3	4	5	6	7	8
r_i	4.0	-0.3	5.0	10.0	5.0	5.0	0.0	0.0

GDP in the year 1982 was B\$3,501 x 10^6 at constant 1974 prices. Applied r and the results of GDP projection are as shown in Table

4-13, simultaneously indicating per capita GDP calculated with the projected population.

Table 4-13 Results of Projection of GDP and Per Capita GDP

Case	Growth Rate Applied (r) (%)	Projected GDP in 1995 (B$10⁶)	Per Capita GDP in 1995 (B$)	Income Growth Rate, 1982-95 (%)
1. High	5.0	6,602	21,667	1.7
2. Medium	3.2	5,273	17,306	-0.1
3. Low	1.3	4,141	13,590	-1.9

Remarks: GDP and per Capita GDP are at constant prices of 1974.

4-5-2 Employment Projection

From the analysis in each industrial sector, it was revealed to be impossible to correlate the amount of employment with either production level or the precentage contribution to GDP. Based on this fact, only the total figure of employment in the country was calculated in the simplified steps as shown below.

(1) Projection of population aged 15 years and over

The ratio 0.66 (from population projection by the EPU) was multiplied to the projected population in 1995.

(2) Projection of labour force

The ratio 0.60 (determined from the past trend of economically active population, 1971 - 1981) was multiplied to the projected population aged 15 years and over in 1995.

(3) Projection of employment

The ratio 0.95 (determined from the past trend of unemployment rate in economically active population, 1971 - 1981) was multiplied to the projected labour force in 1995.

The results of the employment projection for the year 1995 and the actual figures in 1971 and 1981 are shown in Table 4-14. Towards 1995, population increase would be 3.3% per annum, while the population aged 15 and over and labour force would grow at average annual growth rates of 3.8% and 3.9%, respectively. The employment growth would be 3.8% per annum from 1981 to 1995. The total employment amount in 1995 was projected to be 114.6 x 10³. These figures should be regarded as those including immigrant workers.

Table 4-14 Employment, 1971, 1981 and 1995

Item	1971*	1981**	1995***
Total Population	136,256	192,832	304,668
Population of 15 years in age and over	77,120	118,525	201,080
Economically active population	41,099	70,695	120,648
Working Population	40,012	68,128	114,615

Remarks: (1):   *: Actual figures in 1971 Census
          (2):   **: Actual figures in 1981 Census
          (3): ***: Projected value

4-5-3 Assignment of the Projected Employment to Traffic Zones

In Brunei, no reliable figure of the employment volume at working place base is available either in Population Census or from other statistical data. For the preparation of the basic employment figures in 1981, aggregation of the individual obtained data were conducted. Major data sources, obtained information and utilization are as follows:

(1) Data from the Establishment Department

The number of workers and addresses of 51 government departments and the related employees were provided. The original excluded those of the army force, police, prison and school teachers.

- Out of 51 departments, 20 had only national figures which could hardly be divided for the head office and branches. To these departments, the location of headquarters and all branch offices was confirmed, and the figures were distributed according to the resident population in each Traffic Zone.

- In the employment figure of the PWD, there were only 780 employees with the full apprehension of working places out of 2,658 persons (in 1981). The remainder of 1,878 was distributed to construction industries in the private sector.

- To the Electrical Department workers and its related employees, apprehension of working places was made for 1,010 persons out of 1,774 in 1981 figure. 760 were distributed to the private sector.

- With regard to Royal Brunei Army, 3,691 persons in 1982 were allocated to the areas below, based on the resident population.

Berakas kem	(Berakas)
Pusat Latihan	(Old Airport)
Tentaralaut	(Muara)
Tutong kem	(Tutong)
Bangar kem	(Temburong) ( ) : Traffic Zone

- Fire services, police officers and the rest (4,750 persons in total) were also distributed.

(2) Data from the Education Department

The present 1984 figures of the number of school teachers and students were provided, prepared by each Traffic Zone.

(3) Data from the Labour Department

The data of employees in private establishments were provided in the form of computerized list which was arranged according to the places in each District.

School enrolment and number of school teachers were estimated utilizing the Census data in 1971 and 1981 as well as population projection for the year 1995. Tables 4-15 and 4-16 summarize the final results of this estimation.

Table 4-15 Estimation of School Enrolement

Year	Primary School	Secondary School	Others	Total
1971	30,893 (22.7)	11,362 (8.3)	554 (0.4)	42,809 (31.4)
1981	38,556 (20.0)	16,805 (8.7)	1,284 (0.7)	56,645 (29.4)
1995	54,800 (18.0)	30,500 (10.0)	4,600 (1.5)	89,900 (29.5)

Remarks: (1): Teacher training and vocational students are included in "Others".

(2): ( ): Percentage distribution in total population

Table 4-16 Estimation of Number of School Teachers

Year	Primary School	Secondary School	Others	Total
1971	1,444 (21.4)	629 (18.1)	46 (12.0)	2,119 (20.2)
1981	2,152 (17.9)	1,326 (12.7)	212 (6.1)	3,690 (15.4)
1995	3,400 (16.0)	2,500 (12.0)	500 (9.2)	6,400 (14.0)

Remarks: ( ): Number of student per one school teacher.

The number of students was determined based on the proportion to total population. In 1971, total number of students was 31.4% of total population and in 1981, 29.4%. This tendency might continue and the percentage might lower if considering the future population by age-group projected by the EPU. However, in the future, a university will be set up and the number of school attendant will increase as well as the school enrolment rate to the higher grade. One teacher had an average of 20.2 students in 1971 and 15.4 in 1981. The number of school teachers would increase to the number of students as well as to the total population.

The projected number of employment in 1995 was 114.6 x 10^3 as mentioned in the previous Sub-section 4-5-2. This figure would have to be divided into 3; namely, government officers, school teachers and those in the private sector. Based on the past trend of employment in the government departments and in private companies, the employment in 1995 was forecasted as shown in Table 4-17, divided into 3 categories.

Table 4-17 Employment by Category, 1971, 1981 and 1995

Year	Total Population	Employment	Government Officers	School Teachers	Private Sector Employees
1971	136,256 (100.0)	40,012 (29.4)	13,460 (9.9)	2,119 (1.56)	24,433 (17.9)
1981	192,832 (100.0)	68,128 (35.3)	28,036 (14.5)	3,690 (1.90)	36,402 (18.9)
1995	304,670 (100.0)	114,600 (37.6)	48,800 (16.0)	6,400 (2.10)	59,400 (19.5)

Remarks: ( ): Percentage distribution in total population.

In the above, the increase rate of the government employees was assumed to be higher than in the private sector.

At the final stage, assignment of employment figures in 1981 and 1995 to Traffic Zones was carried out, based on the principles as shown below

(1) The present proportion to total employment in government departments was applied, as it is, in the distribution of government officers to Traffic Zones.

(2) The number of school teachers was assigned, to meet the student increase, according to the population increase rate in each Traffic Zone.

(3) With regard to private sector employment, roughly District level data were provided (for 7 areas; B.S.B., Brunei-Muara, Tutong, KB, Seria, Ulu Belait and Temburong). Basically, these figures and the proportion were not changed.

(4) For the assignment to small Traffic Zones inside B.S.B. and Brunei-Muara District, the projected future population was adopted (For Kampong Ayer-Traffic Zone 11, 90% of the projected population was used as mentioned earlier).

Table 4-18 shows the assignment results for the year 1981. The assignment of the projected employment for the year 1995 is indicated in Table 4-19. Out of the increased employment between 1981 and 1995, which is 14.6×10^3, 10.0×10^3 was assigned to Brunei-Muara District and 4.5×10^3 to B.S.B. The preliminarily assigned figures were then revised as to governmental officers. The present proportion was made use of in Traffic Zones 11, 16 and 17, but some number was added to the firstly assigned volume in Zones 14 and 15. Additionally, as too much concentration had taken place in Zones 22 and 23, reassignment was made to Zones 25 and 26.

Table 4-18 Employment by Traffic Zone, 1981

District (Code No.)	Traffic Zone	Employment			
		Government Departments	School Teachers	Private Sector	Total
BSL (10)	11	6,260	180	7,150	13,590
	12	100	120	1,670	890
	13	110	360	2,220	2,690
	14	160	90	2,940	3,190
	15	130	90	2,620	2,840
	16	270	120	400	790
	17	390	270	480	1,140
Sub-total (BSL)		7,420	1,230	17,480	26,130
Brunei-Muara (20 and 30)	21	430	70	410	910
	22	6,220	260	590	7,070
	23	110	190	140	440
	24	1,970	80	520	2,570
	25	410	210	1,210	1,830
	26	300	30	790	1,120
	27	210	40	170	420
	28	820	110	240	1,170
	29	80	50	100	230
	30	100	50	70	220
	31	780	100	930	1,810
Sub-total (Brunei-Muara)		11,430	1,190	5,170	17,790
Belait (40)	41	3,420	360	6,760	10,540
	42	910	400	5,160	6,470
	43	170	110	680	960
Sub-total (Belait)		4,500	870	12,600	17,970
Tutong (50)	51	3,900	360	730	4,990
	52	170	180	240	590
Sub-total (Tutong)		4,070	540	970	5,580
Temburong (60)	61	610	180	180	970
Total (Brunei)		28,030	4,010	36,400	68,400

Remarks: No. of teachers is that in 1984.

Table 4-19 Employment by Traffic Zone, 1995

District (Code No.)	Traffic Zone	Employment			
		Government Departments	School Teachers	Private Sector	Total
BSB (10)	11	7,900	200	9,000	17,100
	12	400	100	2,100	2,600
	13	500	400	2,800	3,700
	14	2,200	300	3,700	6,200
	15	1,200	200	3,300	4,700
	16	300	100	500	900
	17	400	200	600	1,200
Sub-total (BSB)		12,900	1,500	22,000	36,400
Brunei-Muara (20 and 30)	21	800	100	1,200	2,100
	22	7,800	400	1,700	9,900
	23	200	200	400	800
	24	2,400	400	1,500	4,300
	25	2,700	300	3,500	6,500
	26	2,500	300	2,300	5,100
	27	400	100	500	1,000
	28	1,400	200	700	2,300
	29	100	100	300	500
	30	200	100	200	500
	31	1,400	200	2,700	4,300
Sub-total (Brunei-Muara)		19,900	2,400	15,000	37,300
Belait (40)	41	5,900	600	11,000	17,500
	42	1,600	600	8,400	10,600
	43	300	300	1,100	1,700
Sub-total (Belait)		7,800	1,500	20,500	29,800
Tutong (50)	51	6,800	600	1,200	8,600
	52	300	200	400	900
Sub-total (Tutong)		7,100	800	1,600	9,500
Temburong (60)	61	1,100	200	300	1,600
Total (Brunei)		48,800	6,400	59,400	114,600

4-6 Vehicle Ownership

The correlation between economic activity level and number of registered vehicles has been analyzed. Considering heavy fluctuation of production figures in oil sector affected by price variation, that in non-oil sector was employed as a basic economic indicator. The registered vehicles was divided into 3; passenger cars (private cars plus taxies), goods vehicles and others. After settling down the relationship, the production figures in non-oil sector derived from the GDP projection were applied in the forecasting.

4-6-1 Basic Data

The data prepared for the projection of vehicle ownership are summarized in Tables 4-20, 4-21 and 4-22. All were applied from the "Brunei Statistical Yearbook".

Table 4-20 Population, 1974 – 1982

Unit: 10^3

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982
Population	150.9	156.2	161.6	167.2	173.0	179.0	185.2	192.8	200.4

Table 4-21 Vehicle Ownership, 1974 – 1982

Year	Number of Registered Vehicles*				Passenger Cars per 10^3 Persons
	Passenger Cars	Goods Vehicles	Others**	Total	
1974	19,744	3,504	2,119	25,367	130.8
1975	22,610	4,426	2,398	29,434	144.8
1976	25,016	4,847	2,814	32,677	154.8
1977	29,893	5,523	3,182	38,598	178.8
1978	34,439	5,815	3,590	43,844	199.1
1979	37,516	6,149	3,742	47,407	209.6
1980	43,599	6,728	4,180	54,507	235.4
1981	49,193	8,420	4,434	62,047	255.2
1982	54,558	8,652	4,594	67,804	272.2

Remarks: (1): *: Includes both non-government and government vehicles.

(2): **: Buses, mini-buses, motor cycles, scooters, mopeds and other vehicles.

(3): Average annual increase rates, 1974 - 1982:

Number of passenger cars : 13.5%
Number of goods vehicles : 12.0%
Passenger cars per 10^3 persons: 9.6%

Table 4-22 Economic Indicators, 1974 - 1982

Year	Gross Domestic Product (B10^6)			GDP per Capita (B$)	
	Oil Sector	Non-oil Sector	Total	Non-oil	All Sectors
1974	2,327.3	288.9	2,616.2	1,915	17,337
1975	2,292.0	333.6	2,625.6	2,136	16,809
1976	2,790.6	364.2	3,154.8	2,254	19,522
1977	2,918.2	580.9	3,499.1	3,474	20,928
1978	3,020.2	716.1	3,736.3	4,139	21,597
1979	3,850.7	728.6	4,579.3	4,070	25,583
1980	3,361.5	897.4	4,258.9	4,846	22,996
1981	2,517.7	774.9	3,292.6	4,019	17,078
1982	2,684.2	816.7	3,500.9	4,075	17,470

Remarks: (1): At constant prices of 1974

(2): Average annual growth rates, 1974 - 1982

Non-oil sector GDP : 13.9%
Non-oil sector GDP per capita: 9.9%

4-6-2 Formulization

With the limitation of applicable data, analysis has been conducted for the period from 1974 onward. It was revealed that the number of passenger cars per 10^3 persons has a close relationship with per capita GDP in non-oil sector, while the number of goods vehicles is connected with non-oil sector GDP. In the both, 1981 and 1982 figures were excluded in correlation due to the dissociation from the principal tendencies.

In case of passenger cars, firstly assumed was the following formula:

$$NTP = a.PPNO + b$$
, where

NTP : Number of passenger cars per 10^3 persons
PPNO: Per capita production in non-oil sector
(Unit: B$ at constant 1974 prices)

a and b were determined through the regression, which were

a = 0.0321   b = 74.2
(correlation coefficient: 0.9850)

For goods vehicles, the formula finally settled was:

$$NGV = c.PNO + d$$
, where

NGV : Number of goods vehicles registered
PNO : Production in non-oil sector
(Unit: B$$10^6$ at constant 1974 prices)

c and d were then determined as follows:

c = 4.493   d = 2775.15
(correlation coefficient: 0.9576)

4-6-3 Forecasts of Vehicles Ownership

Projection of GDP and population for the year 1995 has already been carried out in the earlier Sub-section 4-3-3 and 4-5-1. Among 3 cases of the GDP projection, only Medium case was used for forecasting vehicle ownership. The projected 1995 value of population is 304.7 x 10^3 and real term GDP 5,273 x 10^6 B$ at constant 1974 prices.

In Medium case in GDP projection, the annual average real growth rate of production in oil sector is assumed at 0.9% towards 1995. The value of oil sector production in 1995 might be calculated to be B$3,016 x 10^6. The remainder would be derived from non-oil sector. The 1995 production value in non-oil sector was thus obtained to be B$2,257 x 10^6 at constant prices of 1974. Per capita production value was calculated by the division with the projected population in the same year. Table 4-23 tabulates these basic figures.

Table 4-23 Economic Figures for the Forecasting

Particulars	GDP, Non-oil Sector (B$10^6)	Per Capita GDP, Non-oil Sector (B$)
Actual Value in 1982	816.7	4,075
Projected Value in 1995	2,257	7,407
Annual Average Growth Rate, 1982 - 1995	8.1%	4.7%

By applying above figures, the number of passenger cars per 10^3 person was calculated to be 312.25 in 1995 and number of goods vehicles 12.9×10^3. Table 4-24 summarizes these results, giving the number of passenger cars transformed by multiplying with the projected population.

Table 4-24 Number of Vehicles Owned, 1982 and 1995

Year	Passenger Cars	Goods Vehicles	Sub-total
1982 (Actual)	54,558	8,652	63,210
1995 (Projected)	95,100	12,900	100,400
Average Annual Increase Rate	4.4%	3.1%	3.6%

CHAPTER 5   THE ALTERNATIVES

CHAPTER 5 THE ALTERNATIVES

5-1 Basic Policy for Transport System

The transport strategy described here indicates how to cope with increase of the traffic demand expected in the future.

It is becoming hard in many large cities to cope increase of traffic demands by simply expanding roads. Two directions are available in general. One is to increase the capacity of the road network, and another is to decrease the traffic demand of passenger cars.

In the study areas, the policy to reduce the traffic demand of passenger cars will also be required besides increase of the capacity of the road network according to a rough forecast of traffic demand in the future. The major strategies to accomplish these objectives and their effects are as shown below. Of these strategies, improvement of road network, intersections and of system of traffic flow and improvement of public transform system are selected as elements of decision of alternatives, and the strategies to restrict owing and using of cars are excluded.

Major Strategies	To improve Capacity	To reduce demand	Implementation cost1/
Improvement of road network	*		H
Improvement of intersections	*		M
Improvement of system of traffic flow	*		M
Improvement of public transport system	*	*	M
Intensity parking control		*	L
Increasing the cost of owing cars		*	L

1/   H : assume high cost

M : assume medium cost

L : assume low cost

Effects of Improvement of Public Transport System

According to the result of a questionnaire survey conducted with car users, about 50% of these car users answered that they will make use of buses if bus services are improved.

According to the modal split line of person trip for buses, however, the split ratio of buses is around 30% even if improvement is made to such an extent that travelling time with buses is equal to that with cars.

The travelling time with buses is longer than that with cars in usual because stop time at bus stops, waiting time and access time to bus stop are included.

In order to shorten the total travelling time to a level that is equal to that with cars, therefore, suitable layout of bus stops, increase of bus operation frequency and increase of bus speeds are required.

Immigrants whose share in the total population is about 28% at the present time, will constitute the people who frequently use bus services because they will be low income levels in general. It is said, however, that there is a trend that the ratio of immigrants to the population will decrease in the future according to the conception of the Government, and the bus split ratio of as much as 50% obtained as a result of a questionnaire survey is not realistic.

Based on what were described above, it is judged that the maximum bus split ratio in Brunei will be around 25%.

The relation between bus split ratio and bus supply is shown below.

$$X_1 = \frac{a \cdot Y}{b} \times C$$

X_1 : Travel demand of buses (Vehicle.Km)

Y : Total demand of person trips (Person Trip)

a : Bus split ratio

b : Average bus occupancy (Person/vehicle)

c : Average bus trip length (km/vehicle)

$$X_2 = \frac{60 \cdot T}{e} \times 2 \cdot D$$

X_2 : Total number of bus operating distance (Vehicle.Km)

T : Average operating hours (hr.)

e : Average operating interval (minutes)

D : Total extension of bus routes (Km)

If $X_1 = X_2$, the average bus operating interval is expressed as follows.

$$e = \frac{60 \cdot T \cdot 2 \cdot D}{\frac{a \cdot Y}{b} \cdot C}$$

When the average operating interval in the case where a bus split ratio of maximum 25% is assumed is computed 11 minutes, and it becomes necessary to shorten the bus operating interval to 1/4 of the present level. If the bus split ratio is assumed as 15 to 20%, it is necessary that the average operating interval is improved to around 19 to 14 minutes, and when the bus split ratio is assumed as 10%, it is necessary to improve the average operating interval to around 28 minutes. (See Table 5-1)

Table 5-1 Trial Computation of Bus Split Ratio and Operating Interval

	Present		Future	
Total demand of person trips (Y)$\underline{4/}$	186,954 person trip		358,000 person trip	
Bus split ratio (a)	3.2%	25%	15 ∿ 20%	10%
Average bus occupancy (b)	20 person/ vehicle	25 person/ vehicle $\underline{2/}$	→	→
Average bus trip length (c)	29 km/ vehicle	15 km/ $\underline{1/}$ vehicle	→	→
Travel demand of buses (X₁)	8,700 vehicle·Km	53,700 vehicle·Km	32,200∿43,000 vehicle·Km	21,500 vehicle·Km
Total extension of bus routes (D)	339.5 km	500 km $\underline{3/}$	→	→
Average operating hours (T)	10 hr.	10 hr	→	→
Average operating interval (e)	47 minutes (100)	11 minutes (23)	19∿40 minutes (40 ∿ 30)	28 minutes (6)