REPUBLIC OF INDONESIA

FEASIBILITY STUDY
OF
JAKARTA RING ROAD PROJECT

MAIN REPORT

March, 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a feasibility study on the Jakarta Ring Road Project and Japan International Cooperation Agency (JICA) carried out the study.

Noting that the Jakarta Ring Road Project has a vital bearing on the future urban transportation system in the metropolitan Jakarta area, the Agency dispatched a preliminary survey team to Indonesia in December 1976 for planning and preparation of the feasibility study, and further sent, from March 1977 to May 1977, a supervisory group headed by Mr. Shoji Miyazaki, Deputy Director-General for Engineering Affairs, Planning Burear, Ministry of Construction and a study team headed by Mr. Hideo Chiba.

While in Indonesia, the study was carried out smoothly with the close and unlimited cooperation of the competent Indonesian authorities. After its return to Japan, the team engaged in related studies, of which the results are compiled into this report.

In preparing the report, we have conducted not only economic and technical feasibility study but also the feasibility study, in compliance with the request of the Indonesian Government, of the Project in the case of its being implemented as a toll road.

I sincerely hope that the report would contribute to the socio-economic development in the metropolitan Jakarta area and at the same time serve for enhancement of the friendly relations between the two countries.

I would like to take this oppourunity to express my heartfelt appreciation to all the members who have participated in this study and to all the authorities concerned in the Republic of Indonesia.

March 1978

Shinsaku Hogen
President
Japan International Cooperation Agency

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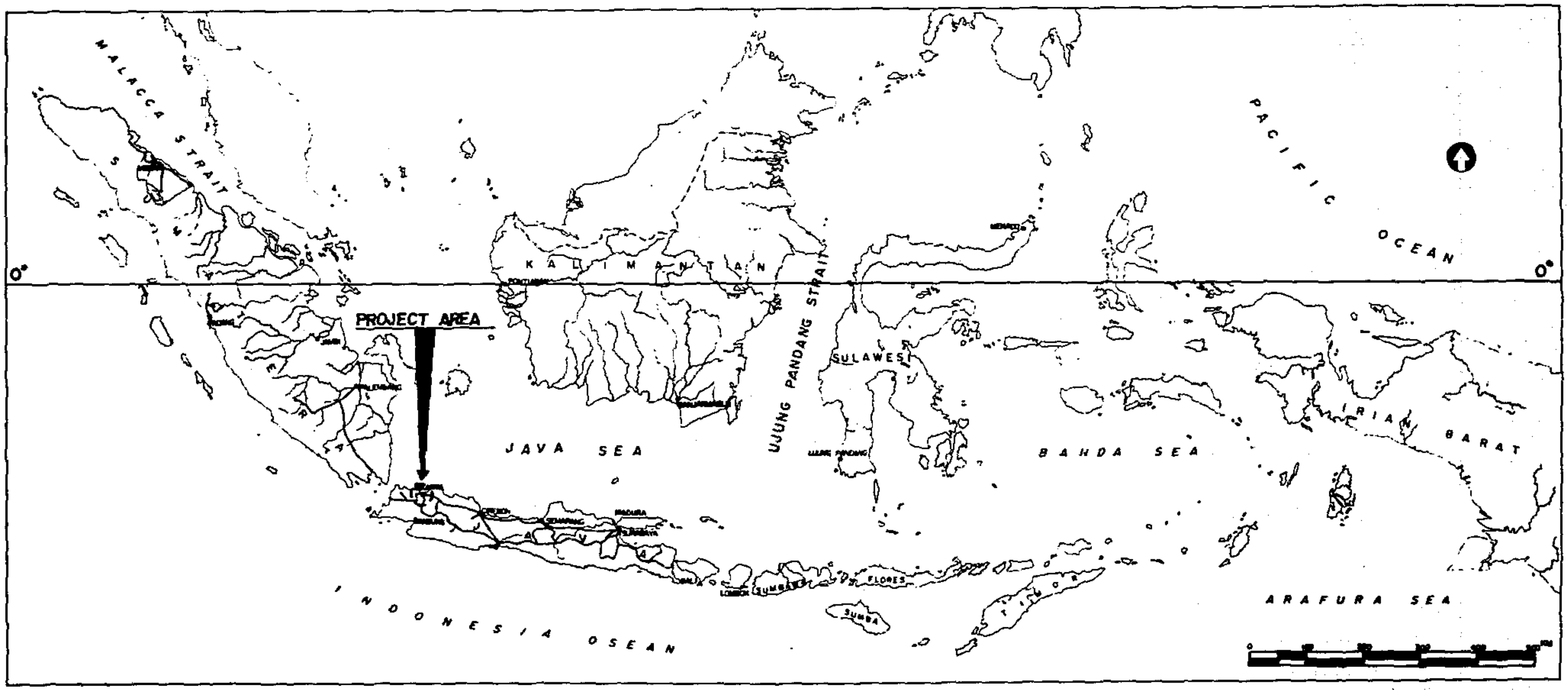
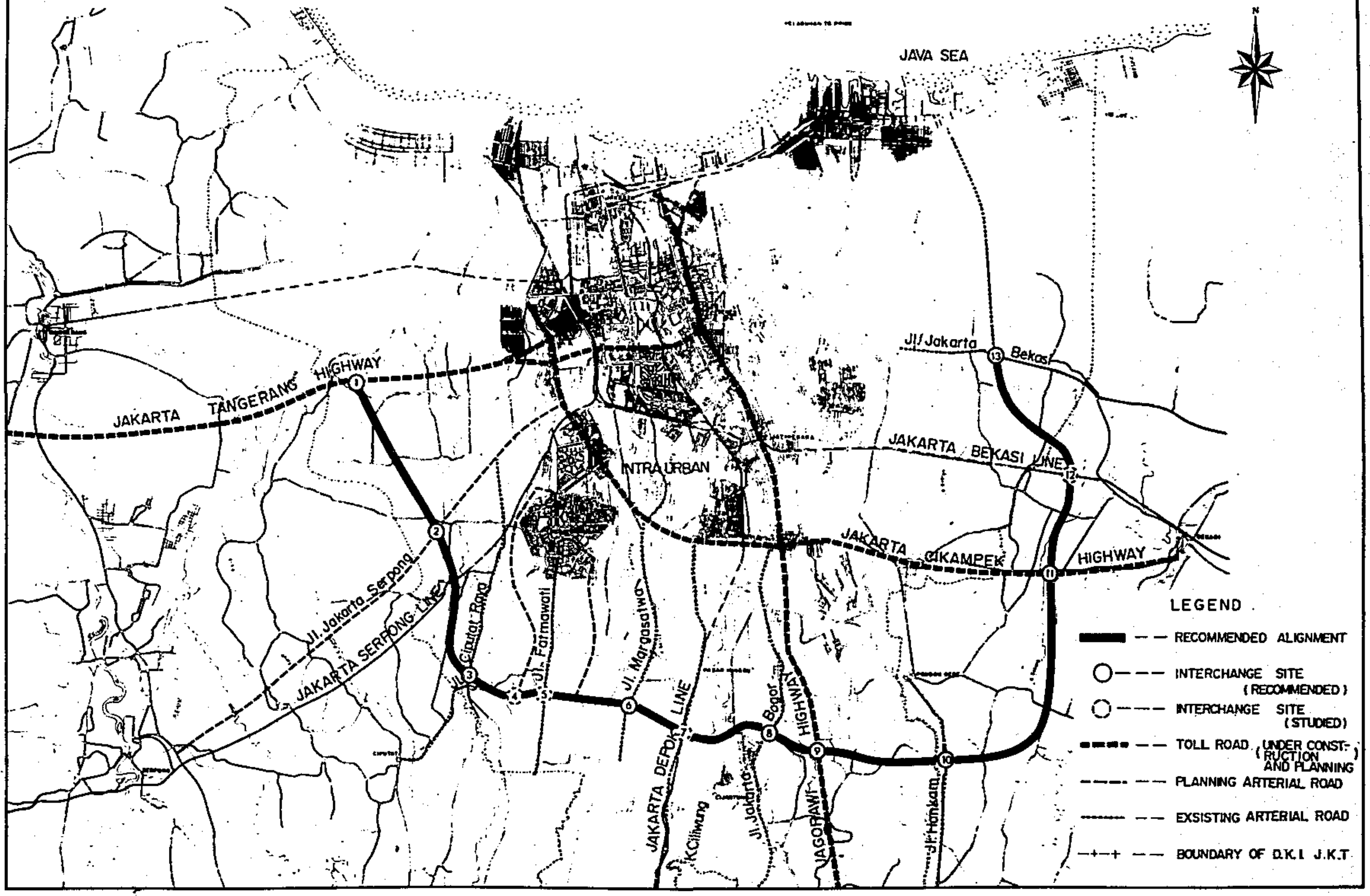
KEY MAP


MALACCA STRAIT
PACIFIC OCEAN
KALIMANTAN
UJUNG PANDANG STRAIT
SULAWESI
PROJECT AREA
JAVA SEA
BAHDA SEA
IRIAN BARAT
ARAFURA SEA
INDONESIA OSEAN
FLORES
SUMBA
TIMOR
MADURA
SEMARANG
SUMBAWA
LOMBOK
0°

MAP OF PROJECT AREA



CONCLUSION AND RECOMMENDATION

Conclusion and Recommendation

In and around the metropolitan Jakarta, there are now three inter-urban expressways planned as tollways to serve as trunk transportation roads for the metropolitan, and some sections are scheduled to be put into operation by this year.

The Jakarta Ring Road, which is the road under study, will, together with other intr-urban toll roads, serve as distributor roads for these trunk radial expressways and will also serve as a bypass of the metropolitan.

The Ring Road is basically a 4-lane-access-controlled road of expressway standard with a total length of about 48 km, which runs along the periphery of the metropolitan Jakarta, forming an outer circular road to divert the traffic into the urban center, and, in conjunction with the change of trend in the urban traffic direction, it is anticipated that the road will have ample impact on the development of the periphery of the city.

The results of this study show that the implementation of the Ring Road project is practical and that the construction and operation of the road as a toll road is viable.

The conclusion of the study are summarized below:

1. The proposed road is planned as a 4-lane road with a design speed of 120 kph and sufficient allowance is provided for future expansion into six lanes.

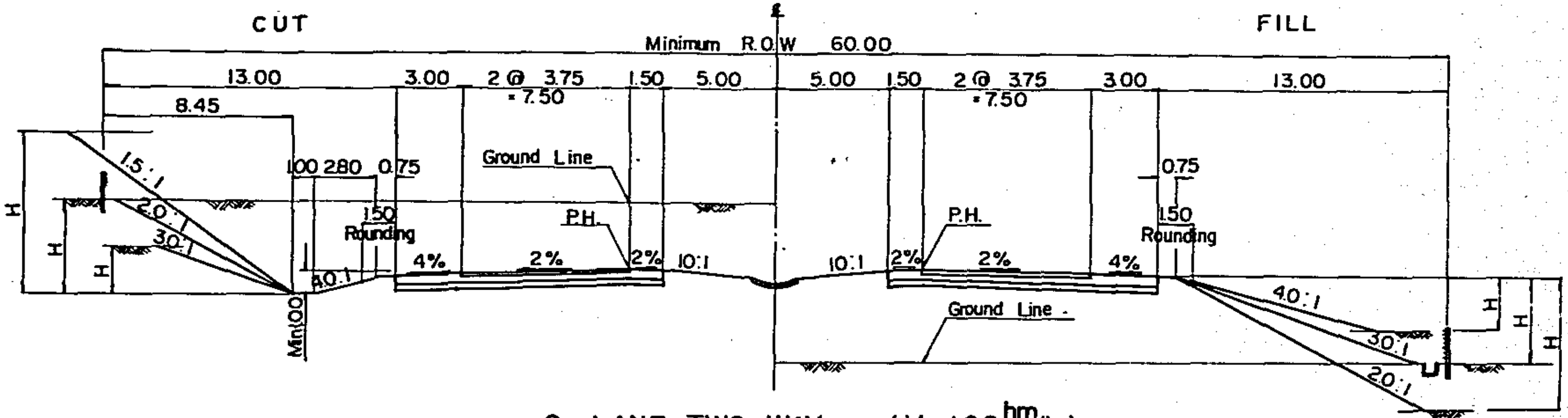
2. The typical cross-section of the road is as follows.

3. In the case that the whole route is implemented in the package, the volume of earthworks is about six million M^3.

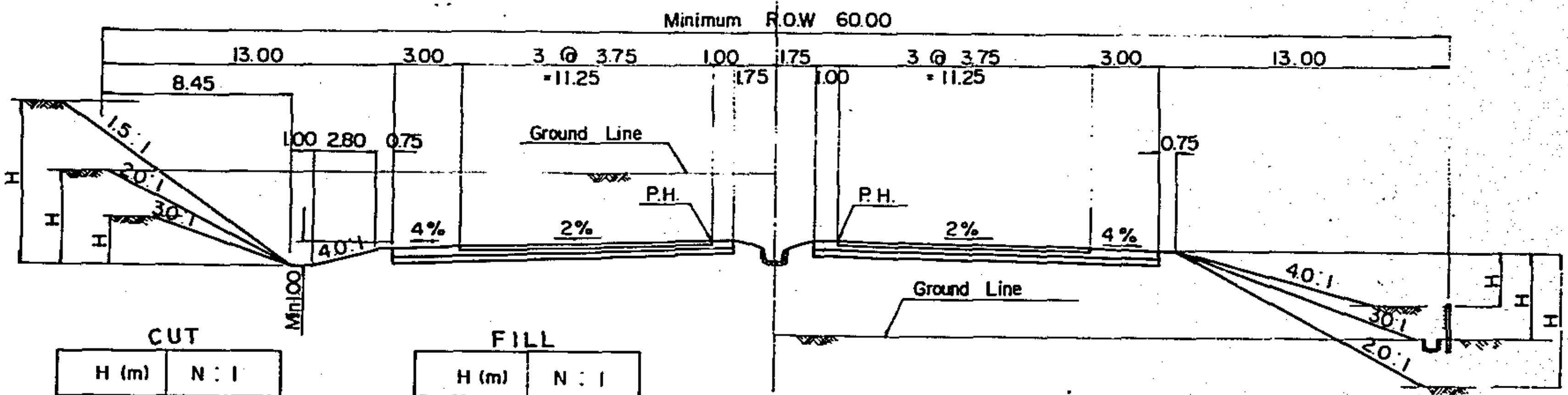
4. As for the initial investment, taking into consideration an escalation factor of 7%, the total amount will be 290 - 320 million US$ in the case of implementation at one stage, or about 89 - 200 million US$ in the case of stage construction which includes also partial operation of completed sections at the early stage.

TYPICAL CROSS SECTION SCALE 1 : 200

4 - LANE TWO WAY (V=120 km/h, 100 km/h)



6 - LANE TWO WAY (V= 100 hm/h)



CUT

H (m)	N : 1
0 ≦ H < 2.5	3 : 1
2.5 ≦ H < 4.0	2 : 1
4.0 ≦ H	1.5 : 1

FILL

H (m)	N : 1
0 ≦ H < 2.5	4 : 1
2.5 ≦ H < 4	3 : 1
4 ≦ H	2 : 1

5. The results of economic analyses as shown below, indicate that the project is economically feasible.

		B/C Ratio Discount Rate at 12%	B/C Ratio Discount Rate at 15%	I.R.R.
(i)	Whole route construction	2.24	1.61	17.5%
(ii)	Stage construction	1.67	1.20	16.1%

6. Since the amount of investment is enormous, it is recommended that from the point of regional distribution of national capital investment, the road should be implemented as a toll road instead of an ordinary national highway.

7. A trial calculation of the internal rate of return of the project in the case of its being implemented as a toll road shows that a high rate of 18.2% is obtained. The results also show that the project will be repayable within a period of 20 - 30 years, but experience shows that the actual period of repayment of toll roads is usually shorter than the period calculation during the study. It is recommendable that the possibility of pooling the financial account of all intra-urban toll road should be studied in the case that an earlier repayment period is desired.

In the stage of final engineering and further studies, it is recommended that additional studies be made, taking into consideration the following points.

1. Although the coastal road and the extension from the interchange with the Jakarta - Tangerang Highway are some of the road sections excluded from the road network taken up in this study, these sections should be considered as an integral part of the Ring Road system, and should be included in future additional studies.

2. The timing and sequence of implementation of the road sections should be decided after overall ascessment of the role of the urban transport network in the metropolitan of Jakarta.

3. The toll system to be adopted should form part and parcel of the overall toll system for the whole metropolitan, and sufficient consideration should be made keeping in view the actual situation of operation of the Jagorawi Highway and the study results for the Intra-urban Tollway Study, before the final toll system and toll collection system is decided for the Ring Road.

4. Furthermore, in the establishment of the basic transportation plan of the metropolitan Jakarta, a component of which is the Ring Road, special attention have to be paid to the following points regarding the landuse plan.

   (1) The "urban center dispersal pattern" is the basic concept adopted with regards to the landuse plan in this study and should be promoted. The partial opening of the Ring Road shall be taken into consideration as the impact to developments of urban nucleus in the periphery of the metropolitan Jakarta, with perticipation of the government.

   (2) It is possible to locate several sub-CBD at the outer side of the Ring Road. However, it is necessary to guide the implementation of the plan through identifying the role of tertiary services for the Kampung inhabitants in the important roles of Kampung, with proper policy and attention.

   (3) It is of great importance that an effective policy to realize the landuse basic concept considered in this study be established, and the landuse plan shall be put into effect at an early data, and the development policy shall be formulated, controlled and guided.

The Arterial Road Network in Jakarta and Its Surrounding Area

In DKI Jakarta and its surrounding area, three regional highways have been proposed from DKI Jakarta to Bogor, Tangerang and Cikampek as tollways, and the first one is under construction at present to be opened for public use partially in this year, whereas the second and the third are under detailed design service.

Respecting those conditions, the Intra Urban Tollway System and the Ring Road have been planned to avoid the anticipated serious traffic distribution problems in DKI Jakarta caused by the incoming traffic flow induced by these regional highways.

These highways form the arterial road network in the DKI Jakarta region, and some priority of construction have been recommended as the better solutions for the area as shown in the following map. This study has been carried out to further the recommendation mentioned above, stressing that the supplementary collector/distributor network must be largely improved together with the intra urban tollway construction, in order to channel traffic flows into their final destinations.

The Role of Ring Road for Jakarta

DKI Jakarta as the Capital of Indonesia has been growing rapidly and a continuous urbanization has taken place since 1945. Its population was recorded at about 600,000 in 1945 and increased to about 5,000,000 in 1975. Being the capital of a developing nation, coping mainly with the increasing demand, Jakarta is growing into a metropolis with expanding activities and a rapid increased provision of public facilities and public services is needed.

But Jakarta does not function as it is supposed, and its main reasons are:

a) Lack of road network within and surrounding DKI Jakarta resulting in a high transportation cost which confines people to have all their activities within the city in order to reduce the transportation cost.

b) The disorganized transportation pattern makes it impossible for Jakarta to exercise an efficient and effective function as a terminal of distribution services.

c) The improper location of activity centers and inadequate land use.

d) The unfavourable condition of transportation facilities within its economic region.

To solve transportation problems, a proper comprehensive plan for the DKI Jakarta road network system is needed. The fast growth would always be followed by an increase in public and private facilities, which from the view of expanding road networks, becomes an obstacle resulting in high cost of construction components, such as land acquisition, demolition, special structure, etc. For the further development of the city, if a proper plan has not been formulated, the development of road networks would not be economically justified, or might not possibly be realized at all, and it means that transportation network can no more support the fast increase in the amount of activities in this growing city.

The existing infrastructure does not meet the need, as only 1.39% of the surface of Jakarta consists of passable roads, against that of 10% in Singapore. New roads being built to release the stress on particular roads are not always based on a sound concept, and failure to take future demands into considerations, often result in shifting of traffic jams from one place to another.

The JABOTABEK urban area development plan formulated to legalize the control, directives and structural system for Greater Jakarta can, in some sense, be a mean to deconcentrate crowded areas by providing a greater urban area. On the same line of the concept, intensive studies on the desired pattern of transport demands will ensure a sound base for a transportation network system. This kind of general plan has to be set up before any implementation takes place, in order to syncronize the system and steps toward a more balanced development pattern over the wider area. At the same time, the existing network should be improved to cope with incidental needs and future demands. This system of roads may consist of ring and radial arterials supported by sufficient collectors and local roads.

The major system is intended to distribute traffic entering the heart of the city or any other part of the city where most of the activities and facilities are concentrated.

The total system will also promote a proper and balanced growth of the city network through the planned diversion of traffic. The capacity of the whole system may rise to its optimal level and give substantial contribution to serving transport demands.

The limited access characteristics of the major road system will minimize a ribbon development and saturation by local traffic. The collector and feeder roads serve to open and connect new areas within the nucleus, forming a part of the system to create favorable condition of the area for the further development.

The major system should be a part of the rural highway arterial system to accommodate the incoming traffic from neighbouring cities such as Tangerang, Bogor and Bekasi as well as Cikampek and Cirebon. The increasing traffic to Jakarta has caused rural transportation problems in recent years and steps are being taken to solve the problems.

Some new roads have been implemented (Jagorawi 4-lane-full-controlled-access freeway, Bekasi - Jakarta 4-lane-highway, Tangerang-Jakarta 4-lane-highway) and others are still in the phase of study. With the development of the rural arterial highways around DKI Jakarta, the inner DKI Jakarta has to be prepared to accommodate such increase of the incoming traffic.

When the whole system of the infrastructure is realized, the inter-nucleus system (in JABOTABEK urban development area) will be fully supported and might be developed intensively and balanced as planned.

CHAPTER 1 PRESENT SITUATION OF STUDY AREA

The analysis on the present situation of the study area, which includes the city of Jakarta and its surrounding region, is made on the geophysical, economic transport and landuse aspects.

1.1 Conditions of the Study Area

(1) Physical features

The study area is situated on the northwest region of Java Island, and its northern side facing the Java Sea is a flat plain. While towards the south it rises to form the Prancak Plateau, so that it is a gradually sloping formation from the plateau down to the sea. On the slope, many rivers flow towards the sea at the north, forming a alluvial plain which makes very wide rice field.

Jakarta City is situated near the Equator, being 6° south in latitude, and is located partly on the alluvial plain at the mouth of Chiliwong River and partly on the slope. The project road runs in a semi-circle from the flat plain on the east to the west end of the city, running through the gradual slope to the south.

(2) Climate

The average temperature of the study area ranges from 26.5 C to 27.5 C throughout the year and the average humidity is in the range of 75% to 85%, so that the study area is tropical in climate with high temperature and high humidity. The months of May to October are the dry season when the rainful is comparatively less but the months of November to April are the rainy season with heavy precipitation. Due to the effect of the monsoon, the prevailing wind direction is north and northeast in the dry season and west and northwest in the rainy season.

Table 1-1 Climate of Jakarta (1975)

Month	Average Temperature (°C)	Normal Humidity (%)	Normal Rainfall (mm)	Wind Direction	Wind Velocity (m/sec)
1	26.7	82	326	West	1.1
2	26.4	82	235	West	1.1
3	26.6	82	198	West	1.0
4	27.6	79	133	Northeast	0.9
5	27.2	79	112	Northeast	0.9
6	27.4	78	90	Northeast	0.8
7	027.0	76	67	Northeast	0.8
8	27.5	73	50	Northeast	0.9
9	27.1	73	77	North	1.1
10	26.7	74	89	North	0.9
11	27.0	78	149	North	0.8
12	27.8	75	180	West	1.0
Average	27.0	78	1,696	West	1.0

Source: Statistical Year Book of Jakarta 1976.

1.2 Administrative Division and Zoning

The Jakarta Ring Road is situated in the periphery of Jakarta. In a short term, it will serve as a bypass and distributor and collector road for the city center of Jakarta, and in the long term, this will form the main trunk road of Jakarta.

The zoning for the purpose of the study is made of the city of Jakarta and its sphere of influence taking into consideration those functions of the ring road. Full consideration is also made to the present administrative division, the future development plan, the present and future road networks, the past studies such as JMATS, SST etc.

The zoning results are as follows:

Total number of zones	66 zones
Jakarta city	41 zones
Tangerang Province	7 zones
Bogor Province	8 zones
Bekasi Province	6 zones
Others	4 zones

The list of zone code and the zoning map are respectively shown in Table 1-2 and Fig. 1-2.

Fig.1-1
ZONNING OF D.K.I.
JAKARTA

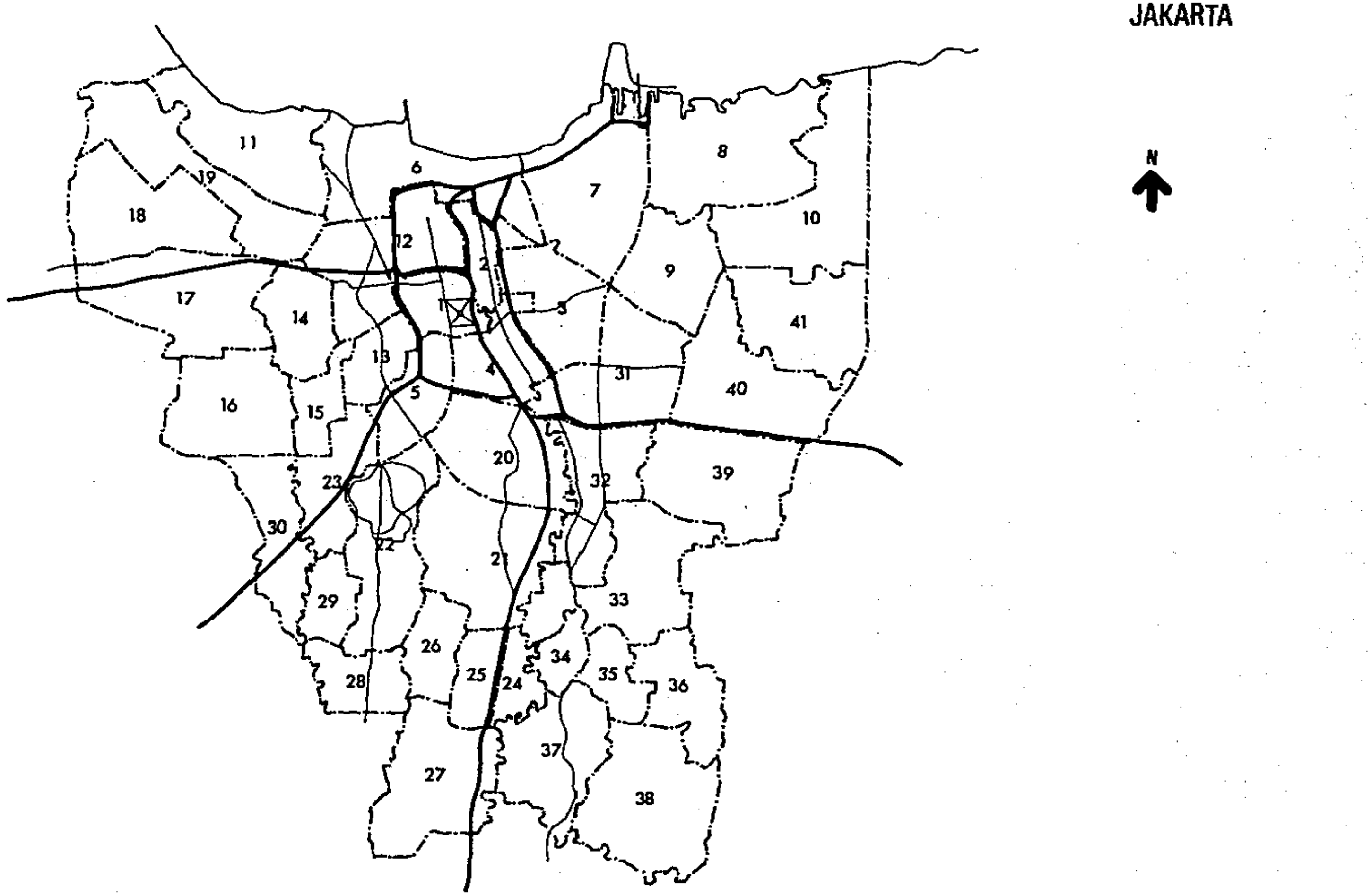


Fig. 1-2
ZONNING OF
JABOTABEK AREA

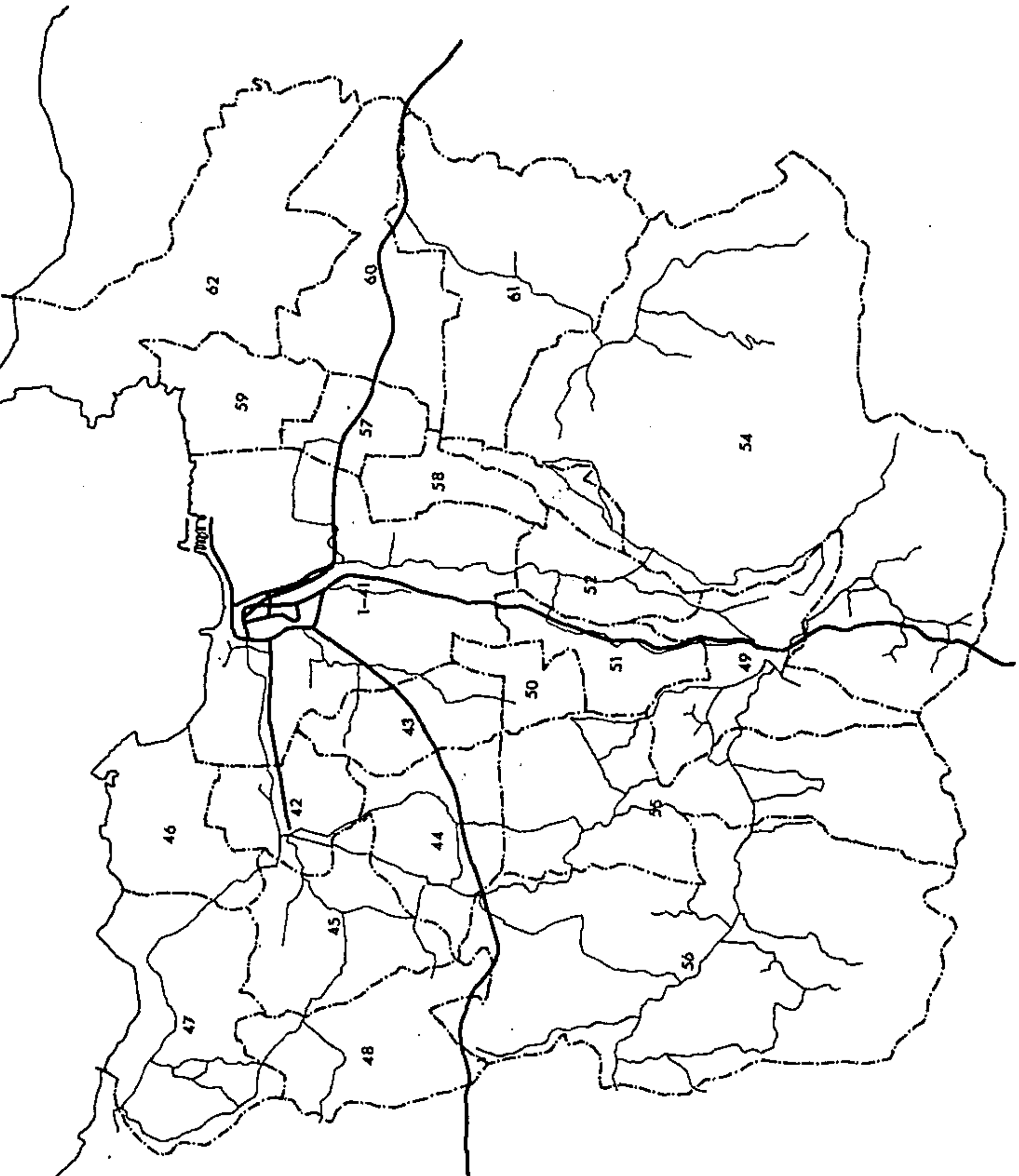


Table 1-2 ZONE CODE TABLE

one No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
1 (101)	1.JAKARTA PUSAT	1.Gambir (1-6)	1.Cideng 2.Duri Pulau 3.Petojo Utara 4.Petojo Sela- tan. 5.Kebon Kelapa 6.Gambir
2 (102)	1.JAKARTA PUSAT	2.Sawah Besar (1-5)	1.Mangga Dua Selatan. 2.Karang Anyar 3.Kartini 4.Pasar Baru 5.Gn.Sahari U.
3 (103)	1.JAKARTA	3.Kemayor an (1-5)	1.Gn.Saharai Selatan. 2.Kemayoran 3.Kebon Kosong 4.Serdang 5.Harapan Mulya
		5.Cempaka Putih. (1-7)	1.Tanah Tinggi 2.Johar Baru 3.Galur 4.Kampung Bawah 5.Rawa Sari 6.Cempaka Putih Barat. 7.Cempaka Putih Timur.
4 (104)	1.JAKARTA PUSAT	4.Senen (1-6)	1.Senen 2.Kwitang 3.Kenari 4.Keramat 5.Paseban 6.Bungur
		6.Menteng (1-5)	1.Kebon Sirih 2.Gondang Dia 3.Cikini 4.Menteng 5.Pegangsaan

Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
5 (105)	1.JAKARTA	7.Tn. Abang (1-7)	1.Kampung Bali 2.Kebon Kacang 3.Kebon Melati 4.Petamburan 5.Karet Tengsin 6.Bendungan Hilir. 7.Gelora
6 (201)	2.JAKARTA UTARA	2.Penja- ringan. (1-8)	3.Pejagalan 4.Penjaringan 5.Marga Dua U. 6.Pademangan U. 7.Pademangan T.
7 (202)	2.JAKARTA	3.Tanjung Priok.	1.Sunter 2.Pepanggo 3.Sungai Bambu 4.Kebon Bawang 5.Tj. Priok.
8 (203)	2.JAKARTA UTARA	4.Kota (1-7)	1.Kota Utara 2.Lagoa 3.Kota Selatan 4.Tugu 5.Rawabadak
		5.Cilinc- ing (1-5)	1.Kali Baru 2.Cilincing 3.Semper
9 (204)	2.JAKARTA UTARA	4.Kota	6.Kelapa Gading 7.PegangssanII
10 (205)	2.JAKARTA	5.Cilinc- ing	4.Marunda 5.Sukapura
11 (206)	2.JAKARTA UTARA	2.Penja- ringan	1.Kanal Muara 2.Kapuk Muara 8.Muara Angke

Zone	Kotamadya /Kabupaten	Kecamatan	Kelurahan
12 (301)	3.JAKARTA BARAT	2.Grogol Petamburan. (1-8)	1.Grogol 2.Jelambar 3.Tanjung Duren 4.Tomang
		3.Taman Sari. (1-8)	1.Pinangsia 2.Mangga Besar 3.Tangki 4.Glodok 5.Kagungan 6.Krukut 7.Taman Sari 8.Maphar
		4.Tambora (1-10)	1.Pekojan 2.Malaka 3.Tambora 4.Jembatan Lima 5.Angke 6.Jembatan Besi 7.Kerndang 8.Tanah Sareal 9.Duri 10 Kali Baru
13 (302)	3.JAKARTA BARAT	2.Grogol Petamburan	5.Jati Pulau 6.Kota Bambu 7.Slipi 8.Pal Merah
14 (303)	3.JAKARTA BARAT	5.Kebon Jeruk (1-11)	2.Kedoja 3.Duri
15 (304)	3.JAKARTA BARAT	5.Kebon Jeruk	8.Kebon Jeruk 9.Suka Bumi Ilir 10 Kelapa Dua 11 Suka Bumi Udik.
16 (305)	3.JAKARTA BARAT	5.Kebon Jeruk	4.Meruja Ilir 5.Meruja Udik 6.Joglo 7.Serengseng
17 (306)	3.JAKARTA BARAT	1.Cengkareng. (1-10)	1.Semanan 9.Duri Kosambi 10 Rawa Buaya
		5.Kb.Jeruk	1.Kembangan

Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
18 (307)	3.JAKARTA BARAT	1.Cengkareng.	4.Pegadungan 5.Kali Deres 6.Cengkareng
19 (308)	3.KAKARTA BARAT	1.Cengkareng	2.Kamal 3.Tegal Alur 7.Kapurkedaung 8.Kali Angke
20 (401)	4.JAKARTA SELATAN	1.Tebet (1-7)	1.Menteng Dalam 2.Tebet Barat 3.Tebet Timur 4.Kebon Baru 5.Bukit Duri 6.Manggarai Selatan. 7.Manggarai
		2.Setyabudi (1-8)	1.Setyabudi 2.Guntur 3.Karet 4.Karet Semanggi. 5.Karet Kuningan 6.Kuningan Timur. 7.Ps.Manggis 8.Menteng Atas
21 (402)	4.JAKARTA SELATAN	3.Mampang Prapatan	1.Kuningan Barat. 2.Mampang Prapatan. 3.Pela Mampang 4.Tegal Parang 5.Bangka 6.Pancoran 7.Duren Tiga 8.Kali Bata 9.Cikoko 10.Pangadegan 11.Rawajati
		4.Pasar Minggu (1-10)	1.Pejaten 2.Pasar Minggu

Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
22 (403)	4.JAKARTA	5.Kebayora Baru -	1.Senayan 2.Rawa Barat 3.Selong 4.Gunung 5.Kramat Pela 6.Melawai 7.Petogogan 8.Pulo 9.Gandaria Uta Utara. 10.Cipete Utara
		7.Cilandak (1-5)	1.Gandaria Selatan. 2.Cipete Selatan. 3.Cilandak
23 (404)	4.JAKARTA SELATAN	6.Kebayoran Lama. (1-10)	1.Grogol Utara 2.Grogol Selatan. 3.Cipulir 4.Kebayoran Lama.
24 (405)	4.JAKARTA SELATAN	4.Pasar Minggu.	3.Tanjung Barat
25 (406)	4.JAKARTA SELATAN	4.Pasar Minggu	4.Jati Padang
26 (407)	4.JAKARTA SELATAN	4.Pasar Minggu.	5.Ragunan.
27 (408)	4.JAKARTA SELATAN	4.Pasar Minggu	7.Jagakarsa 8.Lenteng Agung 9.Serengseng Sawah. 10.Cianjur
28 (409)	4.JAKARTA SELATAN	7.Cilandak (1-5)	4.Lebak Bulus 5.Pondok Labu
29 (410)	4.JAKARTA SELATAN	6.Kebayoran Lama.	5.Pondok Pinang
30 (411)	4.JAKARTA SELATAN	6.Kebayoran Lama.	6.Petukangan Utara. 7.Petukangan Selatan. 8.Ulujami 9.Pasanggrah-an 10.Bintaro.
31 (501)	5.JAKARTA TIMUR	1.Matraman (1-5)	1.K Manggis. 2.Pal Meriam. 3.Kayu Manis 4.Utan Kayu 5.Pisangan Barat.
		2.Pulau Gadung	1.Kayu Putih 2.Jati Rawa-mangun. 3.Pisangan Timur. 4.Cipinang 5.Pulau Gadung 6.Jatinegara Kaum.
32 (502)	5.JAKARTA TIMUR	3.Jati-negara (1-12)	1.Kampung Melayu. 2.Bali Mester 3.Bidara Cina 4.Cipinang Cempedak. 5.Rawa Bangke 6.Cipinang Muara. 7.Cipinang Besar.
		4.Kramat-jati. (1-11)	1.Cawang 3.Cililitan 4.Jati
33 (503)	5.JAKARTA TIMUR	4.Kramat-jati. (1-11)	2.Cipinang Melayu. 5.Kebon Pala 6.Halim Per-dana Kusuma 7.Batu Ampar

Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
			8.Bale Kambang 9.Makasar
34 (504)	5.JAKARTA TIMUR	4.Kramat- jati. 5.Ps.Rebo.	10.Tengah 2.Gedong
35 (505)	5.JAKARTA TIMUR	4.Kramat- jati. 5.Ps.Rebo (1-18)	11.Dukuh 3.Rambutan 4.Ceger
36 (507)	5.JAKARTA TIMUR	5.Ps.Rebo	8.Susukan 9.Ciracas 10.Cijantung 11.Baru 12.Kali Sari 13.Pekayon
37 (508)	5.JAKARTA TIMUR	5.Ps.Rebo	8.Susukan 9.Ciracas 10.Cijantung 11.Baru 12.Kali Sari 13.Pekayon
38 (508)	5.JAKARTA	5.Ps.Rebo	7.Cipayung 14.Kelapa II Wetan. 15.Munjul 16.Cilangkap 17.Cibubur 18.Pondok Rang- gon.
39 (509)	5.JAKARTA TIMUR	3.Jati- negara.	8.Pondok Bambu 9.Kelender 10.Duren Sawit 11.Malaka 12.Pondok Kelapa
40 (510)	5.JAKARTA TIMUR	6.Cakung (1-6)	1.Rawa Terate 2.Jatinegara 3.Penggilingan 6.P.Gebang.
41 (511)	5.JAKARTA TIMUR	6.Cakung (1-6)	4.Cakung 5.U. Menteng

Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
42	TANGERANG	Tangerang Batuceper	
43	TANGERANG	Cileduk Ciputat	
44	TANGERANG	Legok Serpon	
45	TANGERANG	Curug Cikura Ps. Kemis	
46	TANGERANG	Teliknaga Sepatan	
47	TANGERANG	Mauk Rajeg Kronjo Kresek	
48	TANGERANG	Balaraja Tigaraksa	
49	BOGOR	Bogor Ciomas Kedung - halang. Semplak	
50	BOGOR	Sawangan	
51	BOGOR	Depok	
52	BOGOR	Cibinong Cimanggis	
53	BOGOR	Gn. Putri	
54	BOGOR	Ciawi- Cisarua Cijeruk Citeureup Jonggol Cileungsi Cariu	

Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan	Zone No.	Kotamadya /Kabupaten	Kecamatan	Kelurahan
55	BOGOR	Ciamnea Cibungbu-lang. Rumpin Gunung-Sindar Parung					
56	BOGOR	Leuwiliang Jasinga Parung-Panjang Cigudeg					
57	BEKASI	Bekasi					
58	BEKASI	Pondok Ge-de.					
59	BEKASI	Bebelan Celingcing					
60	BEKASI	Tambun Cibitung Cikarang					
61	BEKASI	Setu Cibarusah Lemahabang					
62	BEKASI	Cabang - bungin. Sukatani Pebayuran					
63	JAWA BARAT						
64	JAWA SELATAN	Jogyakarta South of Jawa Pusat					
65	JAWA UTARA						
66	Out of Java.						

1.3 Population

1-3-1 Total Population

The total population of Indonesia was 132 million in 1975 and the growth rate over the previous year was 2.4% which showed an slight increase from 2.0% for the year 1950. This may be due to the fact that the decrease in death rate through medical, technological improvement has exceeded the reduction in birth rate throuh family planning.

The population of Java Island for the year 1975 was 83.5 million and the growth rate was about the same as the national average. That is, the growth over previous year has increased slightly from 2.0% in 1950 to 2.2% in 1975.

Table 1-3 Population Development in Jakarta Region, Java/Madura and Indonesia

	Indonesia		Java/Madura		Bo. Ta. Bek.		D.K.I. Jakarta	
	Population (x 1,000)	Growth Rates for each 5 Years, (%)						
1950	77,200		50,500		1,432			
		2.0		2.0		5.7		
1955	85,400		55,700		1,885			
		2.2		2.1		9.1		
1960	93,39		61,900		2,911			
		2.0		1.9		3.5		
1965	105,400		68,000		3,463			
		2.2		2.0		5.1		
1970	117,500		75,100		4,437		3,652	
		2.4		2.2		4.0		2.2
1975	132,100		83,500		5,404		4,074	

Source: Statistical Pocketbook of Indonesia
Statistical Year Book of Jakarta, Bappemka Bogor

The trend of increase in population of the city of Jakarta (DKI) is as shown in Fig. 1-3, showing that the population has reached 5.4 million in 1975. During the period of confusion after the Pacific War and also the year 1958, the trend showed a series of non-continuous rapid growth. However, in recent years, the growth rate showed a stable 4.3% of which the natural increase was estimated at 2.0% so that 2.3% was accounted by social increase, which is mainly due to the influx of population from the rural area of Java Island into the city.

The total population of the neighboring provinces of Bogor, Tangerang and Bekasi was 4 million, which showed an increase of 2.2% over the previous year, due mainly to natural increase.

The trend of changes of population of Jakarta by districts is as shown in Table 1-4, where it can be seen that the population increase has stagnated in Pusat District, but the Barat, Selatan and Timur Districts showed very rapid increase.

The trend of increase of the population of the Bogor, Tangerang and Bekasi Provinces are listed in Table 1-5, where the increase was phenomenal for all provinces.

1-3-2 Population by Stratum

The population of Jakarta may be largely classified by income level into the following strata.

A.	Extreme poverty stratum	20%
B.	Poverty stratum	40%
C.	Low income stratum	25%
	Middle income stratum	10%
	High income stratum	5%

The housing situation in Jakarta may be statistically classified into the 3 groups of Temporary, Semi-permanent and Permanent.

The temporary housing roughly corresponds to the extreme poverty stratum and also part of the poverty stratum of population. The semi-permanent housing corresponds to the major part of the poverty stratum. The permanent housing corresponds to the low,

Table 1-4

Population Development in Wilayah, (x 1,000)

	Pusant	Utara	Barat	Selatan	Timur
1970	1,268 (100)	582 (100)	782 (100)	1,036 (100)	770 (100)
'71	1,258 (99.2)	586 (100.7)	820 (104.5)	1,062 (102.5)	807 (104.8)
'72	1,260 (99.4)	593 (101.9)	840 (107.4)	1,079 (104.2)	808 (104.9)
'73	1,251 (98.7)	603 (103.7)	856 (109.5)	1,095 (105.7)	832 (108.1)
'74	1,241 (97.9)	616 (105.8)	870 (111.3)	1,120 (108.1)	862 (111.9)
'75	1,266 (39.8)	635 (109.1)	890 (113.8)	1,124 (108.5)	886 (115.1)
'76	1,265 (99.8)	664 (114.1)	949 (121.4)	1,205 (116.3)	972 (126.2)

Source: Statistik Wilayah, D.K.I. Jakarta, 1976

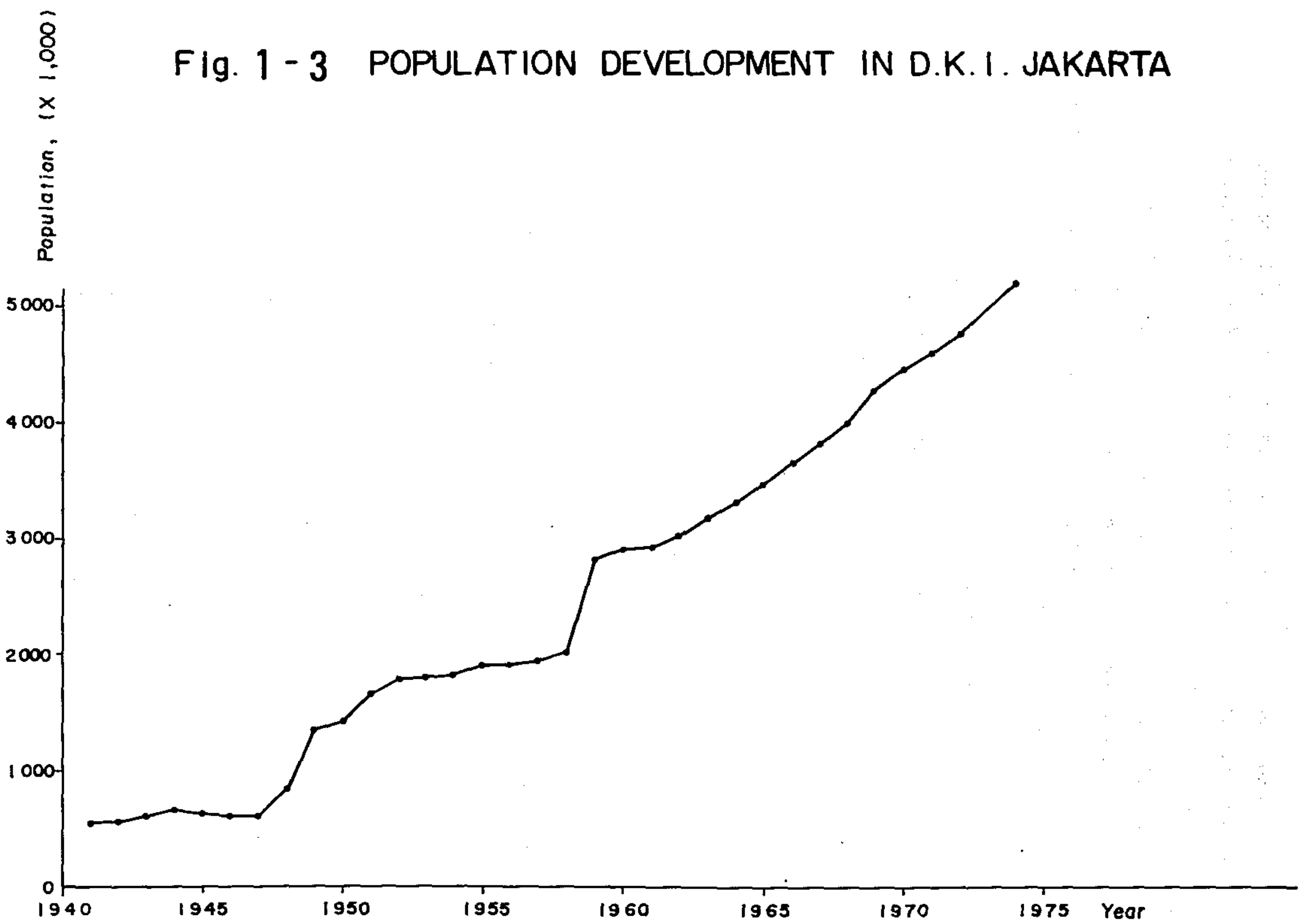
Table 1-5

Population Development in Bo. Ta. Bek. Area, (x 1,000)

	Bogor	Tangerang	Bekasi
1970	1,811 (100)	1,032 (100)	809 (100)
1971	1,859 (102.7)	1,067 (103.4)	831 (102.7)
1973	1,328 (106.5)	1,096 (106.2)	879 (108.7)
1975	2,022 (111.7)	1,155 (111.9)	897 (110.9)

Source: Bappemka Bogor
Kantos Seusus dan Statistik
Kabupatan Tangerang
Buppeuuka Kabpantan Bekas.

Fig. 1 - 3 POPULATION DEVELOPMENT IN D.K.I. JAKARTA



middle and high income strata.

The temporary housing has been greatly improved in recent years. By district, it is seen that the share of temporary housing is largest in Utara District.

The public transport system is mainly influenced by the residents of the temporary and semi-permanent housing while the private personal means of transport is considered to be mainly related to the occupants of Permanent housing.

Table 1-6 Housing Situation in Jakarta (%)

		Permanent	Semi-permanent	Temporary
	1971	22.8	25.0	52.3
	73	27.6	28.2	44.2
	75	31.9	30.6	37.5
	76	35.6	31.3	33.1
By District	Pusat	42.9	32.9	24.2
	Utara	21.0	28.3	50.7
	Barat	34.3	30.9	34.8
	Selatan	34.9	33.8	31.3
	Timur	39.0	28.7	32.3

Source: Statistic Wilayah DKI Jakarta 1971

1-3-3 Employed Population by Place of Residence

Of the population in Jakarta, the employment in tertiary industry occupied the largest share of about 80% of the total employed population, while the share of primary industry occupied only 3%. The details are as shown in Table 1-7.

In the provinces of Bogor, Tangerang and Bekasi, the primary and tertiary industries each occupied equal share of about 43%. The details are as shown in Table 1-8.

The employment situation in 1971 for the total population of 4,576 thousand in Jakarta may be summarized as follows:

Percentage of labour population in total population : 29.5%

Percentage of employed population: 25.8%

Unemployment rate : 3.7%

The same for the total population of 3,761 thousand in the provinces of Bogor, Tangerang and Bekasi are as follows:

Percentage of labour population in total population	:	26.2%
Percentage of employed population	:	20.3%
Percentage of employed population	:	5.9%

Table 1-7 Employed Population of Jakarta (1971)

(unit: 1,000 persons)

	Economically active population	Unemployed	Employed	%
Primary Industry	49.3	7.3	42.0	3.6
Secondary Industry	213.6	14.0	199.6	16.9
Tertiary Industry	1,088.4	150.9	937.5	79.5
Total	1,351.4	172.4	1,179.1	100

Table 1-8 Employed Population of Provinces of Bogor, Tangerang & Bekasi (1971)

		Economically Active Population	Unemployed	Employed	%
Primary Industry	Tangerang	73.7	23.3	50.4	
	(Kab) Bogor	194.0	11.7	182.3	
	(Kod) Bogor	1.9	0.2	1.7	
	Bekasi	124.0	32.0	92.0	
	Total	393.6	67.2	326.4	42.8
Secondary Industry	Tangerang	29.4	4.8	24.6	
	(Kab) Bogor	53.5	3.1	50.4	
	(Kod) Bogor	7.8	0.4	7.4	
	Bekasi	24.5	2.0	22.5	
	Total	115.2	10.3	104.9	13.8
Tertiary Industry	Tangerang	144.3	57.1	87.2	
	(Kab) Bogor	192.8	32.5	160.3	
	(Kab) Bogor	44.2	9.4	34.8	
	Bekasi	94.8	45.8	49.0	
	Total	476.1	144.8	331.3	43.4
	Total	984.9	222.3	762.6	100

Source: Census Penduduk 1971

1.4 Economic Activities

1-4-1 Economic Growth and Industrial Structure of Indonesia

Indonesia has greatly exceeded its target of economic growth, recording an average annual real growth rate of over 7% for the first Five Year Plan Period (First Repelita 1969-1973 which started from April, 1969.

However, the petroleum crisis from the fall of 1973 brought about stagnation in world economic activities, and consequently the economic growth of Indonesia also slowed down in pace.

In the second Five Year Plan (Second Repelita) which started from 1974, the target for the annual growth in gross domestic products was set at 7.5%, so that the GDP in the fiscal year 1973/1974 of 6,224.4 billion rupiah was estimated to be increased to 8,935.6 billion rupiah for 1978/1979.

However, international economic and monetary crisis also greatly affected the economy of Indonesia so that the 7.4% growth in GDP for 1974 dropped to 5.2% for 1975. This was due to the drop in export volume of crude oil, timber, etc., and the rise in the price of imported goods. Also, the price of commodities, which had hitherto been comparatively stable, also showed a rapid increase for the years 1973 and 1974 so that the rates of increase over the previous years were respectively recorded at 27.4% and 33.3%.

The depression continued in 1975, and could not recover throughout the year. Meanwhile, the production of crude oil, which is the largest foreign exchange earner, also had to be reduced due to stagnant overseas demand.

The foreign currency reserves of Indonesia fell drastically from 2,030 million dollars in October 1974 to 580 million dollars in the end of 1975, but had shown recovery since 1976. Following the world economic recovery of the world developed nations, the economy of Indonesia also recovered gradually from 1976. In foreign trade, active promotion measures were taken for stimulation of export and the effects had been favorable. Export of crude oil and timber particularly, recorded an increase of respectively 25.4% and 28.3% over the previous year. Restrictive measures against import also bore and the volume of import had decreased compared to the previous year so that considerable surplus in balance of trade could be expected. If the economy should continue to recovered, it will not be impossible to reach the target of the second Repelita.

The target annual growth rates for the various sectors in the second Repelita were 4.6$ for agriculture, 13% for industry, 9% for mining, 10% for transport and communication, 15% for public works, and 8% for other sectors, and the average growth of GDP was projected at 8%, as seen from Table 1-9.

Table 1-9 Projected Gross Domestic Product (Repelita II)

	1973/74 (as % of GDP)	1978/79 (as % of GDP)	Annual Growth Rate(%)
1. Agriculture, forestry & fishery	40.2	35.6	4.6
2. Mining & quarrying	9.2	9.9	9.0
3. Manufacturing	9.8	12.5	13.0
4. Construction	3.7	4.0	9.2
5. Transportation & Communication	4.1	4.7	10.0
6. Others	33.0	33.3	7.6
7. GDP	100.0	100.0	7.5
- At 1973 constant price(billion Rp.)	6,224.4	8,935.6	7.5
- At current price*	6,224.4	13,745.0	17.2

(Note) *Assuming inflation at 9.7% per year.

(Source) Second Five-Year Plan

Agriculture is a very important sector in the economy of Indonesia and top priority was given to this sector in the second Repelita. This is because agriculture occupied 60.3% of the employed people in Indonesia for 1973/74 who are the largest consumer group for domestic products, so that the growth in agriculture will also bring about the growth of the blooming industry sector.

The share of the industry sector in GDP has been as a constant increase from 8.8% in 1971 to 10.4% and 11.1% respectively in 1974 and 1975. In the second Repelita, the industry sector is envisaged to form the backbone of the future national economy. Thus in the first Repelita, emphasis in the industry sector was put on the construction of agriculture related industries, but in the second Repelita, the emphasis is shifted to the materials processing industry. To promote the development of industry, stress is put on the improvement of the infrastructure and the construction of industrial estates, for which in the second Repelita, plans are made for Jakarta, Cilacap, Surabaya, Medan and Batam.

Production of crude oil and natural gas, the major sources of foreign exchange of Indonesia has realized a growth of 200% from 1966 to 1973 and the targets were established at a 12% annual growth for the first Repelita and 8% for the second Repelita. Production of natural gas is also planned to be greatly increased after the completion of the LNG plant and in line with the rapid pace in the construction of large scale fertilizer factories.

1-4-2 Economic Growth and Industrial Structure in Jakarta

The annual economic growth rate of Jakarta for the period 1969 to 1974 came to nearly 10%. This is considerably higher than the average annual growth in national GDP of about 7%. Meanwhile, the annual population growth of Jakarta for the same period was 4.4% which was nearly double the national average growth rate of 2.4%. This phenomenon caused not only serious fiscal and economic problems but also very grave social problems. On the other hand, great effort was put on the increase of employment opportunity, the protection and fostering of small enterprises and substitute industries for imported products, the promotion of labour intensive industries, the planning of appropriate landuse and the improvement of infrastructure facilities.

From the point of industrial structure, it is seen that great changes have taken place in the economic activities of Jakarta. The share of agriculture and fishery industry in the gross regional domestic products (GRDP) has greatly reduced from 6.4% in 1969 to 2.4% in 1974, whereas the share of wholesale and retailing industry has from 49.4% to 55.0%.

From the point of economic growth of Jakarta by economic sector, taking the index of 1959 at 100, the index of the agriculture and forest industry fell to 64.5 in 1974. Of this, although agricultural products had decreased, the volume of husbandry and agricultural products had increased, indicating an improvement in the food requirement of the population following the development of the city and the increase of real personal income.

The sectors of most phenomenal growth in the GRDP of Jakarta were wholesale and retailing sector, financing and insurance sector and also the real estate sector, showing respectively an index of 191.8, 192.2 and nearly 200 taking the index in 1969 as 100. The sectors of electricity, gas and water supply, government administration and also services also showed a great increase to an index of 160 to 180, indicating that Jakarta has developed as a commercial, business and service center.

The manufacturing sector for the period 1969 to 1973 had enjoyed a similar growth to that for GRDP. However, for the year 1974, the index for manufacturing sector was 157.2 which was considerably lower than the 174.2 for GRDP. In the second Repelita, plans were provided for the construction of industrial estates in Jakarta, and, considering the masterplan of the city, it is anticipated that the manufacturing sector will continue to occupy an important share in the GRDP.

It is seen that the characteristics of the industrial structure of Jakarta was such that the share of agricultural products in GRDP had decreased and that of wholesale and retailing sector had increased, whereas the other sectors had remained more or less unchanged through the years except for minor fluctuations. The total production, however, has been constantly on the increase.

The share of GRDP of Jakarta in the GDP of Indonesia had increased yearly from 7.9% in 1969 to 9.6% in 1974, and, as described above, the average annual economic growth rate had reached nearly 10%, accompanied by a corresponding population increase at an average annual rate of about 4%. The constant economic investment in Jakarta over the years had brought about a great economic growth, and the increase in disparity in income between regions had contributed to the inflow of population into Jakarta which makes an estimated social increase in population of about 2%.

Taking such present situation into consideration, the JABOTABEK Study Report and the masterplan for Jakarta had planned the peripheral township of Tangerang, Bekasi, Serpong and Depok as "growth centers" to diversify the population and public and private investments in Jakarta. Also, to develop Jakarta as a national capital and an international city, the importance of maintaining an appropriate balance in economic development of the entire capital region including Tangerang, Bogor and Bekasi had been strongly stressed.

In the masterplan for Jakarta (1965 - 1985), the population of Jakarta in 1975 was estimated at 4.9 million, but in actual fact the forecast was greatly exceeded by the 5.4 million recorded for that year. It can be anticipated that the forecast 1985 population of 6.5 million may also be exceeded much earlier than the target year, and it seems that the limit of capacity of population accommodation of Jakarta will be near. Under such condition, and judging from the plans in the JABOTABEK Report and the masterplan for Jakarta, it may be difficult for the GRDP to maintain a high annual growth of about 10%. On the other hand, it is hoped that the investment and promotion of economic development of the BOTABEK region will serve about the surplus population from Jakarta and result in a more balanced regional development and diversification of economic function.

From the above considerations, the average annual economic growth rate up to 1980 is assumed to be 9%, that for the period 1980 to 1990 at 8% and from 1990 to 2000 at 7%.

1-4-3 Existing Situation of Car-ownership

As seen in the following tables, the number of vehicles in Jakarta has increased by 1.7 times in 5 years from 1971 to 1975, and the rate of car-ownership per 1,000 population has also increased by 1.5 times.

Table 1-10 Car-ownership in Jakarta

(x 1,000 vehicles)

	1971	1972	1973	1974	1975
Passenger vehicles	95.1	103.3	115.6	131.0	152.5
Buses	5.8	6.7	7.6	8.6	9.8
Trucks	21.9	24.9	29.4	37.8	44.7
Total	122.8	134.9	152.6	177.4	207.0
Vehicles/1,000 persons	26.8	28.4	30.7	34.2	38.3

(x 1,000 vehicles)

	1971	1972	1973	1974	1975
Passenger vehicles	259	277	307	338	383
Buses	23	26	30	31	35
Trucks	115	131	143	166	196
Total	297	434	480	535	614
Vehicles/1,000 persons	3.3	3.5	3.8	4.1	4.6

Comparing to Table 1-10 shows the ownership situation in the whole of Indonesia it is seen that 30% of the national total number of vehicles are concentrated in Jakarta and that the

Fig. 1 - 4 DEVELOPMENT OF VEHICLE OWNERSHIP D.K.I. JAKARTA

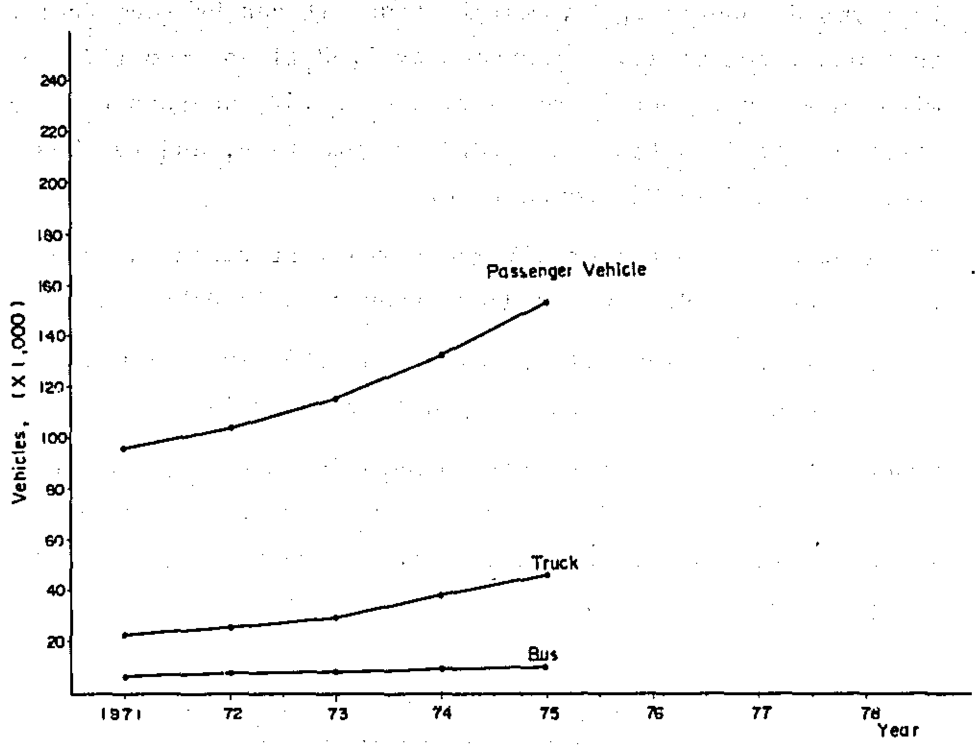
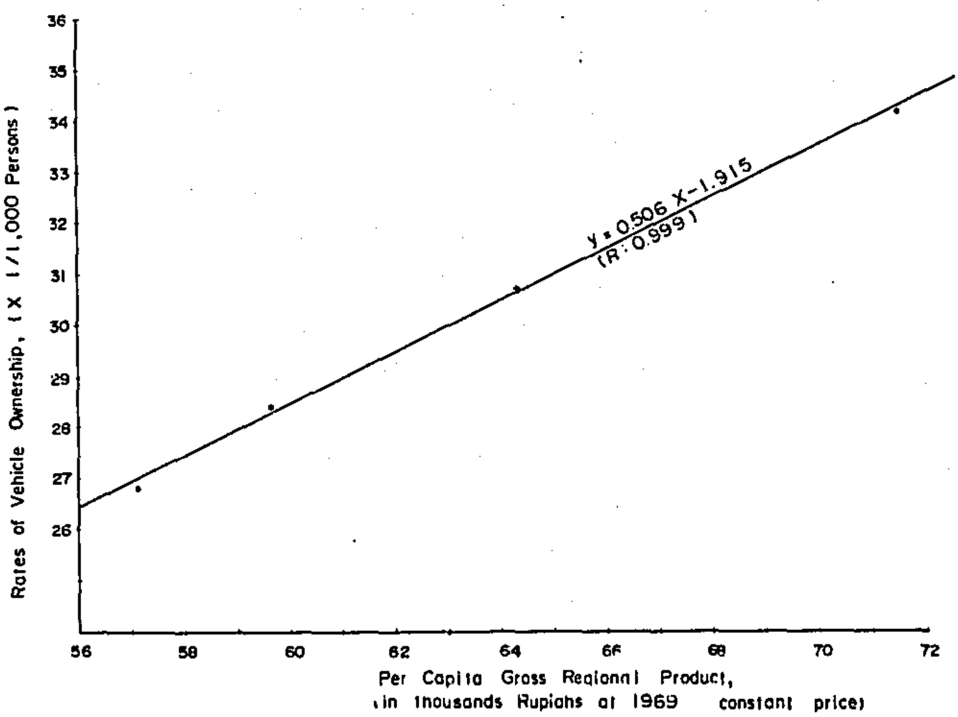


Fig.1-5 RATES OF VEHICLE OWNERSHIP & PER CAPITA G.R.D.P. IN D.K.I JAKARTA



rate of ownership of Jakarta is 8 times that of the national average.

In terms of ownership by vehicle type, it can be seen from Fig. 1 that passenger vehicles increase by 1.60 times from 1971 to 1975 with an average annual growth rate of 12.5%, whereas the same for truck is 2.04 times and 20.0% growth rate, and for bus is 1.69 times and 14.0% growth rate.

The growth of the number of trucks was most rapid due probably to the increase in demand for goods transport in Jakarta.

The total growth for all vehicles was 1.69 times from 1971 to 1975, showing a high average annual growth rate of 14.0%.

Generally, the rate of vehicle ownership shows a good correlation with the GRDP per capita, and by computing the parameters of a linear correlation equation for the two factors by regressive analysis, a very good relation was obtained.

Table 1-11 Relation between Per Capita GRDP and Rate of Car Ownership

	1971	1972	1973	1974
Per Capita GRDP (at 1969 constant price)	57,136	59,545	64,293	71,512
Vehicles/1,000	26.8	28.4	30.7	34.2

Regressive equation:

$$Y = 0.506\ x - 1.915 \quad (R: 0.999)$$

where, X: per capita GRDP in 1,000 rupiah

Y: vehicles/1,000 persons

R: correlation coefficient

The correlation is shown in Fig. 1-4, 1-5.

1.5 Good Flow

1-5-1 Main Commodity Items

The following main commodity items were selected for analysis from the points of availability of data, method of statistical classification, the effect of the volume on goods flow, and also the characteristics of Jakarta as well as the forecast future volume of production and consumption.

(1) Agriculture, forestry and fishery

1) Agricultural products

a. Farm good crops
b. Estate crops
c. Livestock and its products

2) Fishery products

3) Forestry products

(2) Industry

1) Food, beverages and tobacco

2) Textile, clothing, paper, furniture and other household wares.

3) Raw materials and auxiliary

4) Cement and other construction materials

5) Iron and steel products

6) Fertilizer and pesticides

7) Fuel

8) Small scale and family manufacture products

9) Others

According to the above classification, computation is made for the production and consumption for the whole of Indonesia from all available data and estimate is also made for the goods flow of Jakarta.

As for mining products, there is no significant production or demand in the city of Jakarta and also the port of Tanjung Priok has not handled any significant volume of mining products so that this item may be neglected as having no effect on the goods flow in Jakarta.

1-5-2 Flow of Main Commodities in Indonesia

The estimation of the flow of the main commodity items was started with the computation or estimation of the volume of production and consumption of each item in Indonesia.

(1) The volume of production of commodities by main items

Of the farm food products, the one item that occupies a great weight in relation to goods flow is rice. However, statistics volume of milled rice, a conversion ratio of 68% is adopted. Other farm food crops include maize, cassava, sweet potato, peanuts, soybeans, fruits, vegetables and potatoes.

According to the agricultural census in 1963, there were 12,260 thousand self-employed agricultural households working for an area of 12,880 thousand hectares. The same census in 1973 showed that there were 14,400 thousand households for a total area of 14,170 thousand hectares, indicating an increase in household of 2,140 thousand and an area of 1,290 thousand hectares over a ten year period. The harvest per unit area also indicated an increase over the past years as seen in the following table, showing that the target of increasing productivity in the agricultural sector in the first and second Repelita were bearing fruit.

Table 1-12 Productivity of Farm Food Crops in Indonesia

(100 kg/ha)

	1968	1969	1970	1971	1972	1973	1974
Paddy	27.97	29.39	31.06	31.70	32.10	33.43	34.81
Maize	9.83	9.42	9.61	9.92	10.44	10.75	12.23
Cassava	75	74	75	76	71	78	91
Sweet potato	58	61	61	62	61	63	88
Peanuts	7.27	7.18	7.40	7.55	7.98	6.98	7.70
Soybeans	6.20	7.02	7.17	7.59	7.43	7.28	7.30

Source: Statistical Year Book of Indonesia, 1975

(2) Production of estate crops

The Estate Census of 1973 showed that there were 1,801 large estates with an area of 2,220 thousand hectares. Of these, the rubber estates had the largest area of 455.5 hectares followed by oil palm with 155.7 thousand hectares and sugar cane with 88.2 thousand hectares. However, when the total is taken of the large and small estates, the total production was largest for coconuts which recorded 1,287 thousand tons in 1973, followed by rubber with a dry production of 844 thousand tons, refined sugar with 820 thousand tons, and palm oil with 290 thousand tons. These products accounted for 83% of the total estate crops production.

(3) Livestock and its products

As seen in the following table, the number of livestock showed a general increase since 1970.

Table 1-13 Production of Livestock

(unit: thousand head)

	1970	1971	1972	1973	1974
Cattle	5,130	6,243	6,354	6,682	
Buffalo	2,976	2,976	2,898	2,870	
Goat	6,336	6,943	7,354	7,468	
Sheep	3,362	3,146	3,001	3,207	
Pig	3,169	3,382	2,901	4,048	
Horse	692	665	680	689	
Chicken	-	-	-	99,769	109,679
Duck	-	-	-	13,810	15,879

Source: Directorate General of Veterinary Department of Agriculture Ministry.

The number of buffaloes showed a decreasing trend but that of cattle, goat, and horse showed a gradual increase whereas the number of pigs rapidly increased from 1972 to 1973. As for fowls, chickens occupied a very large number.

From the point of the number of livestock slaughtered by region, it is seen that whereas the number of cattle bred in Jakarta was only 5 thousand, the number of cattle slaughtered came to 88.5 thousand, showing that almost all cattle slaughtered in Jakarta were transported from other regions.

The number of livestock slaughtered and the volume of meat production are as shown in Table 1-14 and 1-15.

Table 1-14 Number of Livestock Slaughtered in Indonesia (1970 - 74)

(unit: 1,000/head)

	1970	1971	1972	1973	1974
Cattle	823	670	724	686	699
Buffalo	187	166	167	181	178
Goat	702	947	549	593	(777)
Sheep	234	177	218	243	
Pig	427	501	567	560	841
Horse	7	3	4	7	6

Table 1-15 Production of Meat in Indonesia 1973

(unit: 1,000/head)

	Java	Outer Java	Indonesia
Cattle	103.2	37.6	40.8
Buffalo	22.4	17.4	39.8
Goat	24.8	9.3	34.1
Sheep	15.1	1.1	16.2
Pig	14.8	95.0	109.8
Horse	0.8	0.7	1.5
Poultry	40.0	42.6	83.0
Duck	2.0	3.4	5.4
Total	223.5	207.1	430.6

From the production of meat, it is seen that the production of cattle beef in Java was about 3 times that of other region whereas that of pork (pig) was only 15% of other regions. This trend may be deducted for various other regions, indicating the regional difference in economic, cultural and religious conditions.

As for daily products, production is estimate for milk and eggs from statistical data.

Generally, the consumption of husbandary and daily products increases together with the improvement in income and living level, this stimulating the latent production potential in Indonesia. In the second Repelita, the annual rate of livestock and dairy products were planned at 7% for meat, 10% for egg and 11% for milk.

(4) Fishery products

The total fishery haul in Indonesia was 1,390 thousand tons in 1975, of which marine fishery was 994 thousand tons and inshore fishery was 396 thousand tons. A characteristic of fishery in Indonesia is the large share of inshore fishery which occupied 33% of the total haul in 1974. This provides very important source of animal protein for the inhabitants of the inland area where transport is inconvenient. The main regions of fishery production are Sumatra, Kalimantan and Java which accounted for a total of nearby 80% of total haul. Kalimantan and Java together also occupied about 70% of total inshore fishery production, whereas Sumatra occupied about 40% of total marine fishery production as seen in the following table.

The marine fishery production capacity of the Indonesia territory water and neighboring water is estimated to be 5.8 million tons while that of inshore waters is about 1.8 million tons for a total fishery production capacity of 7.6 million tons, showing that fishery is an important food source for the population and the development of fishery is highway expected.

Fishery Production in Indonesia

(in tons)

	1971	1972	1973	1974
Marine fishery	820,447	836,289	860,000	893,000
Inshore fishery	424,108	432,620	440,000	449,000
	1,244,555	1,268,909	1,300,000	1,342,000

The productivity per fisherman in Indonesia is at a low level of about one ton per year, which is considerably lower than the standard international fishery productivity. Under domestic demand and strengthened import, the production is planned at 4% increase per year and export volume planned at 25% increase per year. Also, improvement of water supply, transport and communication and other infrastructures for fishery regions were also planned. Moreover, plans were also made for the increase of fishery instructors and for provision of financing facilities to the fisherman who are weakest in the financing and technical aspects.

(5) Forestry products

Indonesia is very rich in forestry resources, with an area of 122 million hectares, or 63% of national land area covered with forest. The situation of forestry resources in 1973 by region and by usage are as shown in Table 1-12.

Table 1-16 Situation of Forestry Resources, 1973

(in million hectares)

Area	Total area of forest land	Designated forest land for: Protection forest land	Production forest land	Protection & production forest land	Nature Conservation	Total
Sumatra	28,420	5,256	8,657	176	1,534	15,622
Java & Madura	2,819	835	1,745	-	280	2,895
Kalimantan	41,470	456	21,238	1,840	606	24,140
Bali and Nusatenggara	2,036	1,095	85	68	130	1,378
Sulawesi	9,910	3,487	1,944	2,672	132	8,235
Maluku	6,000	-	1,169	-	39	1,208
Irian Jaya	31,500	-	590	-	320	910
Indonesia	122,227	11,535	35,429	4,691	3,084	54,742

From the above table, it is seen that productive forest area occupied 29% of the total forest area. The production volume in 1963 was 196 million cubic meters but had rapidly increased to 2,635 million cubic meters in 1973, and the annual growth rate after 1968 was 48%, as seen in Table 1-13. In the second Repelita, while increase in production was contemplated, emphasis were also put on the strengthening of forestry industry supervision, foresting, and replanting in order to ensure efficient usage and to provide protection to the forestry resources, and also to develop the labor force on forestry. For the promotion of export of processed timber, it was also made compulsory for forestry enterprises to construct timber processing factories.

Table 1-17 Timber Production

(in thousand m^3)

Kind of logs	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Teak wood	492	474	444	373	424	473	477	568	470	597	676
Jungle wood	1,469	1,396	1,241	1,550	1,540	3,355	5,729	10,331	13,236	17,120	25,671
Total	1,961	1,870	1,685	1,923	1,964	3,828	6,206	10,899	13,706	17,717	26,347

(6) Food and beverages

In the manufacturing industry sector, the food and beverages had shown very rapid development, growing at an annual rate of 9% during the first Repelita period. 31% of this food and beverage industry is of middle size enterprise, and the industry occupied a total of 35% of the labor force in all manufacturing industries. However, since small scale food enterprises are not included, it is estimated that the total labor force including small enterprises of the food and beverages industry came to 40% of the total labor force. Also, the production amount of food products had a share of 50% of all manufacturing industry. From the 1973 statistics, it is seen that the processing of rice, fish meat and other canned food made up 67% whereas tobacco production came to 27% of all food and beverages production.

In 1970, rice, refined sugar, palm oil, tapioca and tea processing were the main items, having a 90% share in the food and beverages industry. From 1971, such new industries as ice manufacturing, meat processing noodle-making, bread bakery came into the picture and factories for canning of fish, and vegetables, processing of powder milk, flow and biscuits also began to appear. Also, factories for frozen fish and prawns were rapidly developed, and investment in food and beverages industry had, after the first Repelita, continued to be accorded high priority within the manufacturing industry in the second Repelita, in which the annual growth rate is planned at 10.4%.

(7) Textile, clothing, paper, furniture & other household were products.

In this category are included the manufacture of textile, leather, paper, furniture, rubber products, chemical and plastic materials, and also household wares.

This category had a 30% share of production amount in the manufacturing industry and absorbed 11.5% of the labor force.

The textile industry saw satisfactory development in the first Repelita so that cloth and woven thread respectively increased by 100% and 87% during the 5 years period. Generally, the textile industry depends mainly on foreign supply in raw materials, semi-processed materials and also its capital investment, and the ratio are as shown below.

Materials, Capital	Import ratio
Cotton	99%
Chemical fibre	100%
Woven thread	50%
Dyes and chemicals	95%
Machinery	99%

The scale of textile industry in Indonesia is generally small and 70% of the factories are with less than 50 machines in each factory. It is planned that the production of cloth and woven thread would increase by respectively 31% and 71% by the end of the second Repelita period, in 1978/1979.

The most important item in the paper industry is pulp industry, for which the production in the first Repelita were as follows.

Year	Production (ton)
1969/70	17,000
1970/71	22,000
1971/72	30,000
1972/73	39,000
1973/74	40,000

The production of other household wares from chemical and plastic materials has a great share in this category, but since the production of these materials will require enormous investment in the basic industry, the development in this category cannot be too greatly expected.

(8) Raw materials and auxiliary

In this category are included the chemical materials, plastic materials, chemical fibre and timber materials for the paper industry. For the petro-chemical industry, a factory with a yearly production capacity of 20 thousand tons of polyprophylene was constructed at Plaju and its operation commenced in 1973. Furthermore, studies were made for the production of ethelene, propylene from naptha or natural gas. Production of caustic soda, soda ash and hydrochloric acid from salt is also underway. In the second Repelita, efforts are made to improve the quality of these products.

(9) Cement and other construction materials

In 1972, there was only one cement factory in Gresik, Surabaya with an annual production capacity of 500 thousand tons. There are plans to construct a new factory of a capacity of 500 thousand tons in Cibinong, Bogor, another of 400 thousand tons capacity in Cilacap, and also to expand the Gresik factory by another 500 thousand tons. There are also plans for cement factories in Southern Sumatra, Northern Sumatra and Aceh. The production and import volume of cement factory in the first Repelita are as follows.

(in 1,000 tons)

Year	Production	Import	Total
1969/70	541	513	1,054
1970/71	568	703	1,271
1971/72	530	919	1,449
1972/73	722	1,083	1,805
1973/74	850	1,100	1,950

In the second Repelita, the production and demand are planned as follows, forecasting self sufficiency by 1977 and allowance for export in subsequent years. However, it is reported that there is some delay in the planning or construction of new factories which were planned to go into operation by 1975.

Table 1-18 Targets in Repelita II

(in 1,000 tons)

Year	Production	Demand	Import
1974/75	970	2,200	1,310
1975/76	1,650	2,660	1,010
1976/77	3,125	3,135	10
1977/78	4,363	3,710	(655)
1978/79	5,135	4,395	(740)

Other construction materials include timber, brick stone and metalic construction materials and the production volume had a share of 25% in weight in all productions.

(10) Steel and iron products

There are about 20 iron scrap reclaiming factories which manufacture reinforcing steel and pipes. However, all iron and steel materials depend on import, and the imported materials are used for galvanizing or pipe production or for fabrication.

The planned productions in the second Repelita are as follows:

Year	Steel pile	Steel pipe	Others
1974/75	-	35	200
1975/76	-	50	250
1976/77	100	60	350
1977/78	150	75	550
1978/79	150	100	650

(11) Fertilizers and pesticides

For fertilizer production, there are the Petrokimia factory in Gresik, East Java and the Pusri factory in Palembang and the production capacities are as follows:

(tons/year)

	Petrokimia	Pusri I	Pusri II
Urea	60,000	10,000	380,000
Ammonimm Sulphate	120,000	-	-
Ammonia	7,000	-	-

Promotion of fertilizer production occupies a very important position in Indonesia in relation to agricultural development, and since 1970, plans have been made to construct factories for Urea production with the abundant natural gas as its material in order to turn the annual import into export. Thus in second the Repelita, new factories for fertilizers are planned in West Java, and East Kalimantan, respectively with daily production capacity of 1,000 tons and 1,500 tons. The East Kalimantan factory is planned to have daily production of 1,000 tons of urea and 500 tons of other fertilizers.

(12) Fuel production

The flow of fuels, the petroleum products which has a great effect on the goods flow in Jakarta are mainly conveyed into the city via the Tanjung Priok Port. However, since the volume of oil refined in Java Island has only a meager share of 1.8% of the national total, the flow of fuel into Jakarta by land transport may be completely neglected.

Consumption quantity in Indonesia by commodity items

The volume of consumption of each commodity item is calculated from the data of the previous paragraphs by adding the production volume and import volume and deducting the export volume and the results are listed in Table 1-19.

1-5-3 Flow of Main Commodities in Jakarta

The flow of main commodities in Jakarta were also calculated for each item by calculating the production and consumption of the items from statistical data in order to grasp the pattern of goods flow from the balance of production and demand.

(1) The volume of production of commodities by main items

1) Farm food crops production

The share of agricultural production in GRDP of Jakarta fell from 6.41 to 2.40% in 1974. The production index also fell to 64.46 in 1974 assuming an index of 100 for 1969. The production of crops particularly showed a decrease whereas the production of livestock, dairy and fishery products was on an increasing trend.

Table 1-19 Production and Consumption of Goods in Indonesia, 1973

(unit: ton)

Goods	Production	Import	Export	Consumption
Farm Food Crops:				
Rice	19,101,777	1,862,700		21,064,477
Maize	3,689,802		181,280	3,508,522
Cassava	11,185,592		76,688	11,108,904
Sweet potato	2,386,764			2,386,764
Peanuts	290,104		21,390	268,714
Soybeans	541,040		36,001	505,039
Fruits	4,500,000		441	4,499,559
Vegetables	2,401,000		30,380	2,370,620
Potatoes	178,000		3,668	174,332
Estate Crops	3,899,800		1,419,900	2,479,900
Animal Husbandry:				
Livestock slaughtered	337,307		24,497	312,810
Eggs	137,259			137,259
Fresh milk	31,093			31,093
Meat	430,600	1,612		432,212
Fishery Products	1,300,000		5,868	1,294,132
Forest Products	21,077,600		14,770,180	6,307,420
Industrial Products:				
Food, beverages & tobacco	6,994,485	196,400	56,172	7,134,713
Textile, clothing, furniture, etc.	674,743	448,100		1,122,843
Raw materials & auxiliary	2,726,423			2,726,423
Cement	752,158	1,496,800		2,248,958
Other construction materials	3,594,562			3,594,562
Iron & steel products		585,600		585,600
Fertilizer & pesticides	254,822	673,700		928,522
Fuel				8,000,000
Small & household manufacturing	9,841,312			9,841,312
Other manufacturing products	208,566	3,253,100		3,461,666

The annual production of farm food crops is as shown in the following table which shows that except for 1970, the production of rice is generally stable, although maize has greatly decreased and the production of cassava, peanuts and sweet potato for 1974 has dropped to one-tenth of that in 1969. Other products are soybeans and greenpeas, etc., but their production is too small to warrant any notice.

Table 1-20 Production of Farm Crops

(ton)

CROPS	1969	1970	1971	1972	1973	1974
Paddy	45,367	37,354	46,350	45,326	45,186	48,185
Maize	3,879	596	696	493	143	90
Sweet potato	7,315	7,145	3,150	1,701	836	1,171
Peanut	2,532	1,477	541	499	271	238
Vegetable	172,757	236,170	218,573	113,408	110,438	112,862
Fruit	106,981	107,000	127,397	98,835	60,678	47,074

Following the growth of commercial and industrial activities in Jakarta, the production of farm crops is expected to further decrease although cultivation of rice and vegetable will continue in the suburb of Jakarta.

2) Estate crops production

As estate crops are almost not produced in Jakarta, it is expected that the goods flow will be mainly the transport of the products from other areas to meet demand in Jakarta.

3) Livestock and its products

A great different is seen between the number of livestock bred and that slaughtered in Jakarta, indicating a flow of very large quantity from other regions into Jakarta.
The livestock population and the number slaughtered in 1973 are as follows:

(heads)

Livestock	Population	Slaughtered
Cattle	5,000	88,500
Buffalo	4,000	16,500
Goat	14,000	60,000
Sheep	14,000	13,300
Pig	32,000	110,000
Horse	2,000	36

Source: Statistical Year Book of Indonesia, 1976.

In the conversion into weight of meat, the following unit weight per head of livestock is assumed.

Cattle	310 kg
Baffalo	360 kg
Goat	35 kg
Sheep	35 kg
Pig	52 kg
Horse	166 kg

Chicken cultivation is carried by middle size enterprises in the periphery of Jakarta and the production is increasing. The number of chicken for food use increased from 780 thousand in 1969 by 15 times to 11.51 million in 1974. The production of eggs has consequently also increased. On the other hand, no significant change is seen in the production of milk which remained at around 4 million liters from 1969 to 1974.

4) Fishery products

The total fishery haul of Jakarta in 1973 was about 10 thousand tons in 1973 of which 70% was marine fishery and 30% inshore fishery.

Jakarta is the largest consumption market of fisher products in Indonesia and is also the center of collection and distribution of the product within Indonesia.

Considering the anticipated future increase in unit consumption following improvement in income and living level, it can be expected that future consumption will further increase.

Supply of fresh fishery products to Jakarta is made from five landing points and the Pasar Ikan fish market is the largest supply base, so that some supply to the other landing points are also transferred to Pasar Ikan for sale.

Dried salted fish is mainly transported by small sale boats from Sumatra and Kalimantan and unloaded in Pasar Ikan or Kali Baru, but a small portion is transported from the central and western region of Java Island to Jakarta by trucks.

Fresh water fish is transported by truck from central and western region of Java into Jakarta.

Pasar Ikan is the largest fish unloading port of Indonesia but the facilities are old, narrow and of poor sanitary conditions and is lacking in both quantity and quality for the various facilities necessary for a healthy development of the fishery industry. The improvement of such facilities and also of the transport structure as well as the mechanization of fishing boats and introduction of large boats will contribute towards the increase in production of the fishery products.

5) Forestry products

Production of forestry products in Jakarta is negligible and the demand of forestry products is met from external supply.

6) Industrial products

From the statistical data for Jakarta, it is not possible to obtain the data on the production in weight divided into individual items. The average value of unit weight of each item is therefore calculated from the national average and conversion of the production volume in weight is made from the statistics of production value of the items for Jakarta. As for fuel, an estimation is made from the statistics of volume of the flow into Jakarta via Tanjung Priok. The results are as shown in Table 1-15.

(2) Consumption quantity in Jakarta by commodity items

Due to lack of available data in this regards, the consumption quantity is estimated by the following method.

1) The per capital consumption of farm crops and fresh fish are assumed to be the same as the national average.

2) The consumption quantity of livestock and dairy products, timbers, food and beverages, textile, apparels and household wares are calculated as a share of national consumption, assuming the same share as the share of GRDP of Jakarta in the national GDP.

Table 1-21 Production and Consumption of Goods in Jakarta, 1973

(unit: ton)

Goods	Production	Consumption	Surplus	Deficit
Farm Food Corps:				
Rice	30,726	747,789		717,063
Maize	143	124,553		124,410
Cassava	8,486	394,366		385,880
Sweet potato	836	84,730		83,894
Peanuts	282	9,539		9,257
Soybeans	0	17,929		17,929
Fruits	60,678	159,734		99,056
Vegetables	110,438	84,157	26,281	
Potatoes	2,250	6,189		3,939
Estate Crops	0	253,719		253,719
Animal Husbandry:				
Livestock slaughtered	5,966	41,863		38,283
Eggs	3,299	11,298		7,999
Fresh milk	4,080	2,559	1,521	
Meat	39,460	35,575	3,885	
Fishery Products	9,751	45,942		36,191
Forest Products	0	519,164		519,164
Industrial Products:				
Food, beverages & tobacco	313,951	587,258		273,307
Textile, clothing, furniture, etc.	164,082	92,421	71,661	
Raw materials & auxiliary	122,884	278,940		156,056
Cement	0	236,905		236,905
Other construction materials	214,277	378,651		164,374
Iron & steel products	28,671	60,445		31,774
Fertilizer & pesticides	44,541	5,255	39,286	
Fuel	0	1,223,377		1,223,377
Small £ household manufacturing	232,877	810,038		577,161
Other manufacturing products	83,617	354,163		270,546

Table 1-22 Production and Consumption of Goods by Category in Jakarta, 1973

	Production	Consumption	Difference
A. Agricultural Products	266,644	2,368,802	2,102,158
1. Farm Food Crops	213,839	1,954,784	1,759,845
2. Estate Crops	0	304,463	304,463
3. Livestock & its Products	52,805	109,555	56,750
B. Fishery Products	9,751	55,130	45,379
C. Forest Products	0	622,997	622,997
D. Industrial Products	1,566,369	5,235,689	3,957,782
1. Food, Beverages & Tobacco	408,136	763,435	355,299
2. Textile, Clothing, Paper, Furniture & Other Household Wares	213,307	120,147	93,160
3. Raw Materials & Auxiliary	159,749	362,622	202,873
4. Cement	0	307,977	307,977
5. Other Construction Materials	278,560	492,246	213,686
6. Iron & Steel Products	37,272	78,579	41,307
7. Fertilizer & Pesticides	57,903	6,832	51,071
8. Fuel	0	1,590,390	1,590,390
9. Small & Household Manufacturing	302,740	1,053,049	750,309
10. Other Manufacturing Products	108,702	460,412	351,710

(unit: ton)

3) The share by Jakarta of the net production value of manufacturing sector in the national total is made applicable to the national consumption of estate crops products and raw materials and auxiliary as well as to 70% of the national consumption of iron and steel products to obtain the consumption of Jakarta for these items.

4) The share by Jakarta of the net production value of construction sector in the national total is made applicable to the national consumption of cement and other construction materials as well as 30% of the national consumption of iron and steel products to obtain the consumption of Jakarta for these items.

5) The consumption of fertilizers is estimated from the Jakarta share in net production value of farm food crops in the national total.

The production and consumption quantity by items is as in Table 1-21. In consideration of the disparity between urban and rural areas in production and consumption, an extra 20% for agriculture and forestry products and an additional 30% for industrial products were added for both the production and consumption in Jakarta and the results by category are as shown in Table 1-22.

1-5-4 Modal Distribution of Goods Transport

Goods flow between Jakarta and other regions is handled by ship, rail, air and truck.

(1) Ship transport

The main ports in Jakarta are Tanjung Priok, Sunda Kelapa and Kali Baru. The ports of Sunda Kelapa and Kali Baru are mainly used for inter-insular trade purpose, while international trade is almost entirely handled by Tanjung Priok. The volume of goods handled at the various ports are as follows.

Ports	1970	1971	1972	1973	1974
Tg. Priok	4,794,973	5,045,585	5,877,559	7,834,432	8,447,225
Sunda Kelapa	524,959	566,610	652,444	793,139	733,667
Kali Baru	91,020	58,986	75,095	112,121	124,918
Total	5,410,952	5,671,181	6,605,098	8,739,692	9,305,810

Source: Cargo loading and unloading at Ports in Indonesia, 1970-74.

(2) Rail transport

As there were no data available on goods handled by rail in Jakarta, the volume was estimated from the rail goods volume in Java & Madura region and also from reports of past studies.

(3) Air transport

The international and domestic air cargo handled are as shown below, showing that the share by air transport of total goods flow is very small.

Table 1-23 Trends in Air Traffic

(unit: ton)

	International		Domestic		
	Departure	Arrival	Departure	Arrival	Total
1969	1,266	4,672	2,433	767	9,138
1970	1,203	8,404	2,736	937	13,280
1971	1,209	9,185	3,667	1,649	15,710
1972	1,502	7,967	5,353	2,212	17,034
1973	1,806	10,097	7,867	2,462	22,232
1974	1,770	12,190	10,621	2,949	27,530
1975	2,441	13,215	13,353	3,557	32,566

Source: Statistical Year Book of Jakarta, 1976.

(4) Truck transport

The volume of goods flow by truck between Jakarta and other regions is estimated from the data of goods flow by truck through Bekasi, Pasas Reko and Kalideres and also from the truck O-D survey by B/M in 1972.

The resultant modal distribution of goods transport is summarized in Table 1-24.

Table 1-24 Modal Distribution of Goods Transport

(x 1,000 ton)

Year	Vessel	Truck	Air	Rail	Total
1970	5,410	3,139	13	757	9,319
1971	5,671	4,261	16	866	10,814
1972	6,605	6,290	17	920	13,832
1973	8,739	8,705	22	1,034	18,500
1974	9,305	9,216	27	954	19,502

1.6 Existing Traffic Situation and Traffic Survey

1-6-1 Transportation Network in Jakarta

(1) Road network

According to statistics, there were about 1,800 km of roads and streets in use in Jakarta in the year 1975. The road density in quite high in the central business district (CBD) and in such districts as Kebayoran Baru where improvement has been accomplished through urban planning, and the road surface condition is generally good. However, in the other districts, the density of road is low, and except for the main trunk roads, the road surface condition is poor. The network pattern in Jakarta is such that the CBD is with a grid pattern whereby over ten roads extend radially from the center to the peripheral areas. The Jl. Let Jen S. Parman - Jl. Jendral Gatot Subroto, which runs in a circular direction at about 4 km from the urban centre, is the only ring linking these radial roads, so that the traffic congestion along the radial roads is conspicuous. This network may be said to serve the existing urban activities of Jakarta in a center-concentrated pattern.

(2) Railroad network

The railroad may be grouped into a circular route encompassing the CBD, four radial routes extending to the rural area and a route connecting CBD and Tanjung Priok. At present, the railroad does not serve as a means of intra urban transportation but rather has the characteristics of an inter-regional transport route.

(3) Port

The ports in the city of Jakarta are the international port of Tg. Priok and the domestic ports of Kalibaru and Sunda Kelapa. The former is a commercial and industrial port whereas the two latter are more of fishery ports in characteristics.

(4) Airport

The Halim International Airport is situated at about 12 km to the southeast of the CBD of Jakarta, and there is another Kebayoran Airport 3 km away for domestic use. The airports

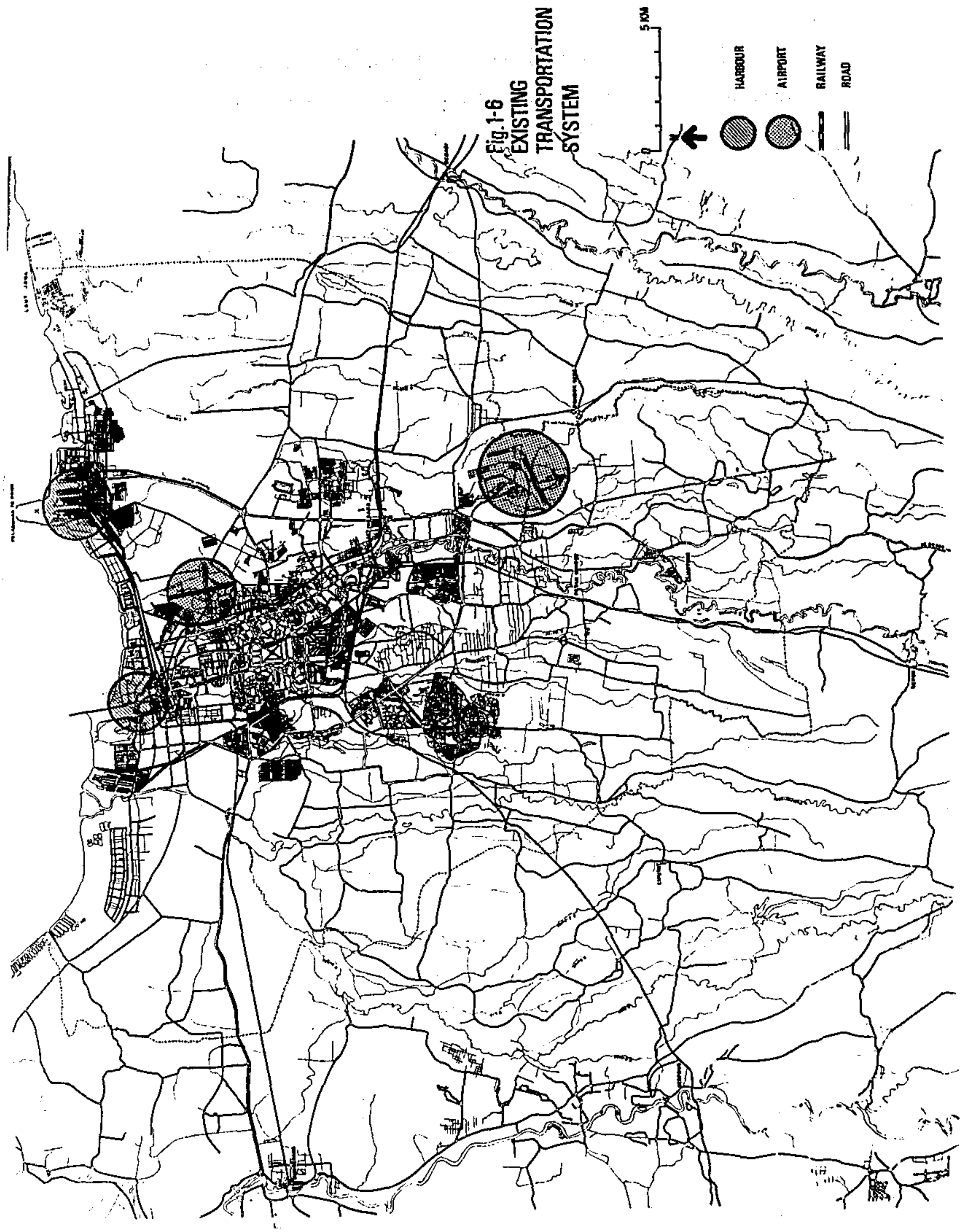


Fig.1-6 EXISTING TRANSPORTATION SYSTEM

serve as connecting points for road and air transport. In future, another new international airport is planned to the West of Jakarta at about 20 km from CBD.

1-6-2 Traffic Volume by Mode of Transport

The traffic volumes of both goods and passengers by modes of transport in Jakarta for the year 1975 are as shown in Table 1-25. (This figures of ports are for 1974)

Goods transport were mainly handled by sea and by air. For air cargo, there was an excess of inflow volume for international traffic and an excess in outflow for domestic traffic, and it can be deducted that there was considerable transfer at the airport. Tg. Priok handled over 90% of cargo by sea transport.

Table 1-25 Traffic Situation in Jakarta

TRUCK	Incoming goods	Outgoing goods	Total
Thousand ton per year	3,259	1,304	4,563

TRAIN	Passengers within the city	Passengers outside the city	Total
Thousand person per year	197	2,955	3,152

PASSENGER VIA JAKARTA AIRPORT	International	Domestic	Total
Thousand person per year	907	1,710	2,617

AIR CARGO VIA JAKARTA AIRPORT	International			Domestic			Total
	Departure	Arrival	Total	Departure	Arrival	Total	
Thousand ton per year	2,441	13,215	15,656	13,353	3,557	16,910	32,566

(thousand ton per year)

CARGO LOADED AND UNLOADED AT PORTS	International			Inter Island			Total
	Unloaded	Loaded	Total	Unloaded	Loaded	Total	
Tg. Priok	4,477	155	4,632	3,374	440	3,814	8,446
Sunda Kelapa	-	-	-	517	217	734	734
Kali Baru	-	-	-	114	11	125	125
Total	4,477	155	4,632	4,005	668	4,673	9,305

1-6-3 Existing Cross Section Traffic Volume of Roads

The traffic volumes of main road sections in Jakarta for the year 1976 are as shown in Table 1-26. From the table it is seen that the average peak ratio was 8% and average daytime ratio was 1.36. Due to a shortage of road compared to traffic demand, during the 12 hour daytime period, especially the hours before and after the peak period, considering congestion occurred. 40% of the location had the peak hours concentrated at the 7:00 to 9:00 a.m. and 20% of the locations had peak hours at 4:00 to 6:00 p.m., due mainly to the commuting traffic.

For the traffic situation at the peripheral areas, 12-hour traffic survey from 6:00 a.m. to 6:00 p.m., were carried out in April, 1977, for 6 vehicle types at 11 locations which are the junctions of the Ring Road and other main roads for the purpose of the study, and the results are as shown in Table 1-27 and Table 1-28. From the results, it is noted that 85,000 vehicles crossed the proposed Ring Road in 12 hours and the average peak ratio against 12 hours traffic volume for all locations was 9.6% which is considerably lower than the corresponding peak ratio of 11% for the urban center. However, this is the average of traffic in both directions and in the morning hours) came to 12.5% indicating the high rate of inflow from the periphery. The average heavy vehicle ratio for all 11 locations was 25% which is higher than the ratio in the urban center.

The trend of traffic volume change outside the Jakarta city is as shown in Table 1-29 and Fig. 1-8. It is seen that for all direction, the traffic volume increased drastically after 1974, the increase being particularly conspicuous in the southern

Table 1-26 Traffic Volume in DKI Jakarta

Post No.	Traffic Volume 12 hrs.(6∿18)	24 hrs.	Peak Traffic Hour	Volume	Peak ratio (%) Vs-12hrs.	Vs-24hrs.	Day-time ratio
1	6601	9371	11:00∿12:00	626	9.5	6.7	1.42
2	6421	8559	16:00∿17:00	821	12.8	9.6	1.33
3	8995	9980	7:00∿ 8:00	1321	14.7	13.2	1.11
4	7337	8434	11:00∿17:00	767	10.5	9.1	1.15
5	16079	19922	8:00∿ 9:00	1599	9.9	8.0	1.24
6	26099	35769	8:00∿ 9:00	2926	11.2	8.2	1.37
7	12095	19910	16:00∿17:00	1376	11.4	6.9	1.65
8	18410	24271	7:00∿ 8:00	1978	10.7	8.1	1.32
9	20797	27997	8:00∿ 9:00	2533	12.2	9.0	1.35
10	18735	23614	7:00∿ 8:00	2069	11.0	8.8	1.26
11	21631	28381	13:00∿14:00	2896	13.4	10.2	1.31
12	47991	64520	16:00∿17:00	5136	10.7	8.0	1.34
13	16522	21070	7:00∿ 8:00	2164	13.1	10.3	1.28
14	17734	21606	7:00∿ 8:00	2264	12.8	10.5	1.22
15	37887	49369	6:00∿ 7:00	4084	10.8	8.3	1.50
16	28372	45230	17:00∿18:00	3026	10.7	6.7	1.59
17	29643	38339	14:00∿15:00	3111	10.5	8.1	1.29
18	17857	23442	7:00∿ 8:00	2241	12.5	9.6	1.31
19	51821	71435	9:00∿10:00	5256	10.1	7.4	1.38
20	27235	36443	8:00∿ 9:00	2984	11.0	8.2	1.34
21	13856	18778	7:00∿ 8:00	1403	10.1	7.5	1.36
22	18328	25270	9:00∿10:00	1911	10.4	7.6	1.38
23	17304	22351	8:00∿ 9:00	1765	10.2	7.9	1.29
24	22907	31115	7:00∿ 8:00	2335	10.2	7.5	1.36
25	4570	8877	11:00∿12:00	548	12.0	6.2	1.94
26	5288	7584	16:00∿17:00	565	10.7	7.5	1.43
27	15088	19544	11:00∿12:00	1604	10.6	8.2	1.30
28	59221	92565	14:00∿15:00	7707	13.0	8.3	1.56
29	51439	68828	8:00∿ 9:00	5276	10.3	7.7	1.34
30	23733	26813	8:00∿ 9:00	2093	8.8	7.8	1.13
31	36434	50553	7:00∿ 8:00	3578	9.8	7.1	1.39
32	21888	29846	9:00∿10:00	2521	11.5	8.4	1.36
33	37930	51657	9:00∿10:00	4505	11.9	8.7	1.36
34	9642	12124	16:00∿17:00	1106	11.5	9.1	1.26
35	38732	52475	16:00∿17:00	3987	10.3	7.6	1.35
36	42970	60091	10:00∿11:00	4316	10.0	7.2	1.40
37	27584	39030	15:00∿16:00	2894	10.5	7.4	1.41
38	41196	56992	7:00∿ 8:00	4768	11.6	8.4	1.38
39	22353	26430	8:00∿ 9:00	2687	12.0	10.2	1.18
40	10480	14134	17:00∿18:00	1199	11.4	8.5	1.35
41	17273	21349	13:00∿14:00	1745	10.1	8.2	1.24
Total	976478	1324068	–	107691	11.0	8.1	1.36

Table 1-27 COMPOSITION OF TRAFFIC ON THE RADIAL ROADS

No. of Post	Sepeda	Opelet	Sedan	Bus	Pick up	Truck	Total
1.	6485 (-)	4179 (29.6)	3922 (27.8)	651 (4.6)	1796 (12.8)	3556 (25.2)	20589 (100.0)
%	31.5	20.3	19.0	3.2	8.7	17.3	100.0
2.	3961 (-)	1460 (33.1)	2084 (47.3)	204 (4.6)	438 (10.0)	221 (5.0)	8368 (100.0)
%	47.3	17.5	24.9	2.5	5.2	2.6	100.0
3.	2024 (-)	599 (16.8)	2370 (66.5)	183 (5.1)	295 (8.3)	117 (3.3)	5588 (100.0)
%	36.2	10.7	42.4	3.3	5.3	2.3	100.0
4.*	3804 (-)	2075 (18.4)	5088 (45.1)	483 (4.3)	1096 (9.7)	2538 (22.5)	15084 (100.0)
%	25.2	13.8	33.7	3.2	7.3	16.8	100.0
5.*	4749 (-)	883 (8.0)	7033 (64.0)	771 (7.0)	1059 (9.7)	1243 (11.3)	15738 (100.0)
%	30.2	5.6	44.7	4.9	6.7	7.9	100.0
6.	2176 (-)	1455 (32.7)	2260 (50.7)	70 (1.6)	392 (8.8)	277 (6.2)	6630 (100.0)
%	32.8	21.9	34.1	1.1	5.9	4.2	100.0
7.	2164 (-)	1571 (40.5)	1003 (25.8)	260 (6.7)	286 (7.4)	759 (19.6)	6043
%	35.8	26.0	16.6	4.3	4.7	12.6	100.0
8.	5341 (-)	7635 (36.5)	6945 (33.2)	1289 (6.1)	1885 (9.0)	3181 (15.2)	26276 (100.0)
%	30.3	29.1	26.4	4.9	7.2	12.1	100.0
9.	1628 (-)	297 (43.2)	245 (35.6)	6 (0.9)	98 (14.3)	41 (6.0)	2315 (100.0)
%	70.3	12.8	10.6	0.9	14.3	6.0	100.0
10.	703 (-)	186 (28.2)	132 (20.0)	2 (0.3)	98 (14.9)	241 (36.6)	1362 (100.0)
%	51.6	13.7	9.7	0.1	7.2	17.7	100.0
11.*	3717 (-)	3697 (26.6)	2729 (19.6)	847 (6.1)	1658 (11.9)	4985 (35.8)	17633 (100.0)
%	21.1	21.0	15.5	4.8	9.4	28.2	100.0
Total	36752 (-)	24037 (27.1)	33811 (38.0)	4766 (5.4)	9101 (10.2)	17159 (19.3)	125626 (100.0
%	29.3	19.1	26.9	3.8	7.2	13.7	100.0

Notes: In the parenthesis shown the figures excluding two-wheeled.

* shows the total inflow volume to the intersection.

Table 1-28 TRAFFIC VOLUME ON THE RADIAL ROADS BY THE SURVEY IN 1977

No. of Post	Direction	Traffic Volume 6:00 - 12:00	Traffic Volume 12:00 - 18:00	Traffic Volume Total	Peak Hour Hour	Peak Hour Volume	Peak Hour Ratio(%)
1.	1 - 2	4822	5417	10239	17:00-18:00	1026	10.0
	2 - 1	5479	4871	10350	7:00- 8:00	1347	13.0
	Total	10301	10288	20589	7:00- 8:00	2180	10.6
				(14104)		(2307)	(9.3)
2.	1 - 2	1461	2922	4383	13:00-14:00	679	15.5
	2 - 1	2347	1638	3985	7:00- 8:00	639	16.0
	Total	3808	4560	8368	7:00- 8:00	918	11.0
			(4407)			(458)	
3.	1 - 2	1650	1364	3014	7:00- 8:00	613	13.7
	2 - 1	948	1626	2574	17:00-18:00	316	12.3
	Total	2598	2990	5588	17:00-18:00	606	10.8
			(3564)			(380)	(10.7)
4.	1 - 2	1588	2214	3802	17:00-18:00	438	11.5
	2 - 1	2173	2172	4345	13:00-14:00	680	15.6
	Total	3761	4386	8147	13:00-14:00	961	11.8
			(7897)			(662)	(8.4)
	2 - 3	1154	1472	2626	17:00-18:00	295	11.2
	3 - 2	1248	1467	2715	14:00-15:00	294	10.8
	Total	2402	2939	5341	14:00-15:00	522	9.8
				(4086)		(424)	(10.4)
	1 - 3	370	347	717	7:00- 8:00	85	11.9
	3 - 1	404	475	879	15:00-10:00	93	10.6
	Total	774	822	1596	7:00- 8:00	170	10.7
				(957)		(93)	(9.7)
5.	1 - 2	1172	1429	2601	16:00-17:00	289	11.1
	2 - 1	1260	1337	2597	16:00-17:00	253	9.7
	Total	2432	2766	5198	16:00-17:00	542	10.4
				(3824)		(386)	(10.1)
	2 - 3	397	401	798	7:00- 8:00	98	12.3
	3 - 2	386	433	819	16:00-17:00	91	11.1
	Total	783	834	1617	16:00-17:00	163	10.0
				(1152)		(105)	(9.1)
	1 - 3	2099	2284	4383	16:00-17:00	436	9.9
	3 - 1	2587	1953	4540	7:00- 8:00	555	12.2
	Total	4686	4237	8923	7:00 -8:00	938	10.5
				(6013)		(608)	(10.1)
6.	1 - 2	1707	1570	3357	7:00- 8:00	336	10.9
	2 - 1	1633	1640	3273	7:00- 8:00	416	12.7
	Total	3420	3210	6630	7:00- 8:00	782	11.8
				(4454)		(532)	(11.9)
7.	1 - 2	1176	1750	2926	14:00-15:00	364	12.4
	2 - 1	1824	1293	3117	7:00- 8:00	520	16.7
	Total	3000	3043	6043	7:00- 8:00	726	12.0
				(3879)		(404)	(10.4)
8.	1 - 2	6679	6757	13436	11:00-12:00	1267	9.4
	2 - 1	6574	6266	12840	7:00- 8:00	1348	10.5
	Total	13253	13023	26276	7:00- 8:00	2521	9.6
				(20935)		(1909)	(9.1)
9.	1 - 2	551	642	1193	16:00-17:00	126	10.6
	2 - 1	530	592	1122	16:00-17:00	122	10.9
	Total	1081	1234	2315	16:00-17:00	248	10.7
				(687)		(69)	(10.7)
10.	1 - 2	261	422	683	16:00-17:00	98	14.3
	2 - 1	302	377	679	16:00-17:00	98	14.4
	Total	563	799	1362	16:00-17:00	196	14.4
				(659)		(105)	(15.9)
11.	1 - 2	4064	3936	8000	9:00-10:00	808	10.1
	2 - 1	3209	3606	6815	16:00-17:00	705	10.3
	Total	7273	7542	14815	16:00-17:00	1477	10.0
				(12864)		(1149)	(8.9)
	2 - 3	436	418	854	8:00- 9:00	95	11.1
	3 - 2	331	341	672	8:00- 9:00	71	10.6
	Total	767	759	1526	8:00- 9:00	166	10.9
				(968)		(82)	(8.5)
	1 - 3	424	331	755	8:00- 9:00	84	11.1
	3 - 1	259	278	537	16:00-17:00	70	13.0
	Total	683	609	1292	8:00- 9:00	141	10.9
				(720)		(69)	(9.6)

Notes: 1) In the parenthesis, figures show the volume excluding two-wheeled traffic.

2) Peak ratios show the one to the total volume of 12 hours traffic.

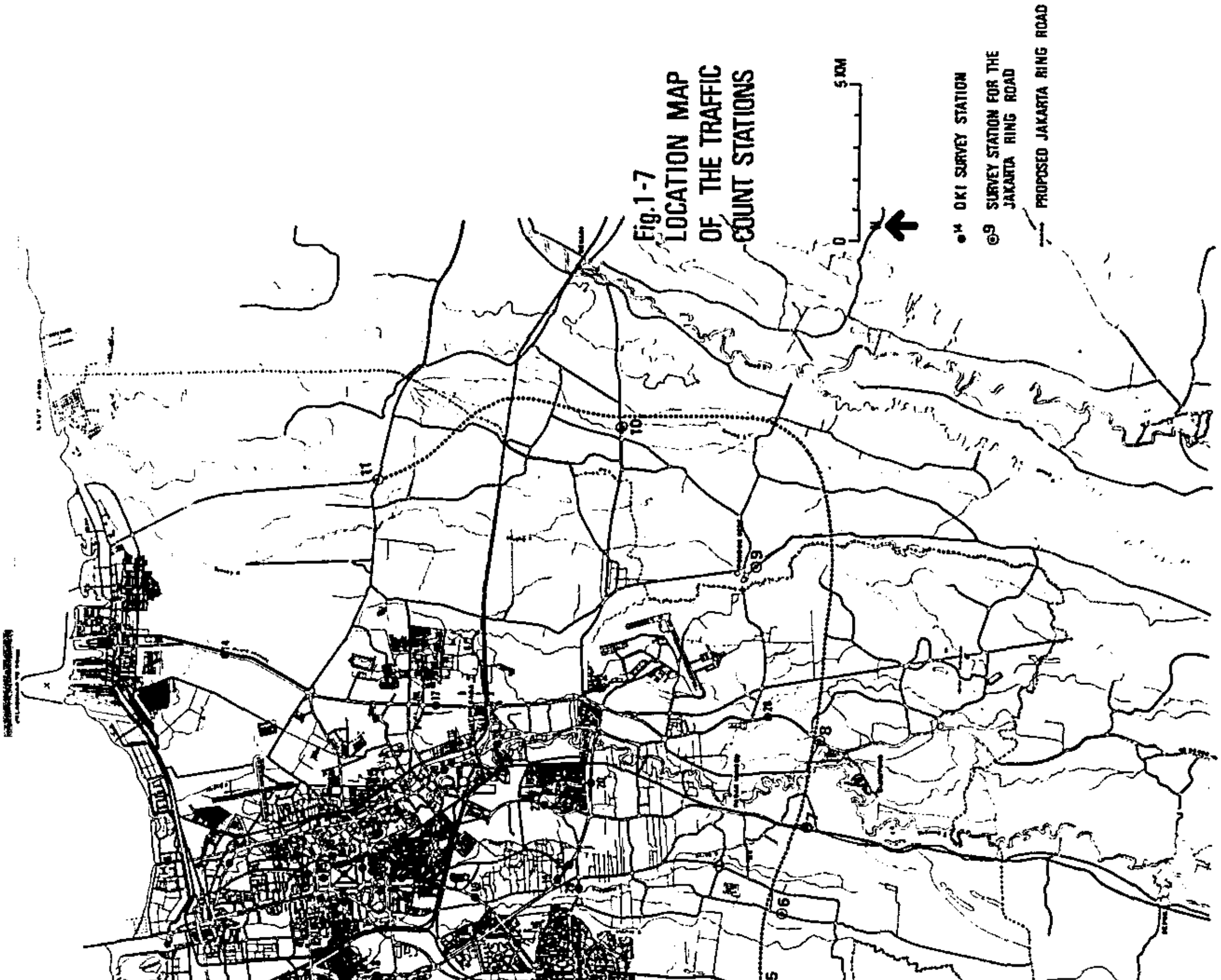


Fig.1-7 LOCATION MAP OF THE TRAFFIC COUNT STATIONS

directions, the share of passenger vehicles was increasing but in the eastern direction the volume of truck traffic exceeded that of passenger vehicles.

Table 1-29 Traffic Count for Screen Check

			1971	1972	1973	1974	1975
Region Area	West ward (A005)	Passenger Car	3,547	3,114	4,452	6,524	7,099
		Truck	427	653	878	1,215	932
		Bus	1,442	2,500	2,548	3,203	3,225
		Total	5,416	6,267	7,878	10,942	11,256
	South ward (A016) (A257)	Passenger Car	8,524	5,505	9,059	14,127	16,861
		Truck	1,184	1,347	1,525	2,714	2,000
		Bus	1,351	2,828	4,845	13,032	8,661
		Total	11,059	9,680	15,429	29,873	27,522
	East ward (A006)	Passenger Car	2,604	2,817	2,720	4,196	6,106
		Truck	843	1,131	1,037	998	891
		Bus	3,041	4,002	2,089	6,518	6,592
		Total	6,488	7,950	7,846	11,712	13,589
Out of DKI.	West ward (C004)	Passenger Car	1,377	1,061	650	3,410	4,540
		Truck	329	228	295	509	355
		Bus	481	399	363	1,493	2,052
		Total	2,187	1,688	1,308	5,412	6,947
	South ward (C017) (C258)	Passenger Car	5,916	3,849	6,379	8,188	11,429
		Truck	773	1,224	1,969	1,716	1,914
		Bus	2,221	2,791	3,847	8,095	5,530
		Total	8,910	7,864	12,195	17,999	18,873
	East ward (C007)	Passenger Car	1,752	1,526	1,345	2,885	3,925
		Truck	397	407	401	858	789
		Bus	2,555	2,647	2,606	3,734	5,251
		Total	4,704	4,580	4,352	7,477	9,965

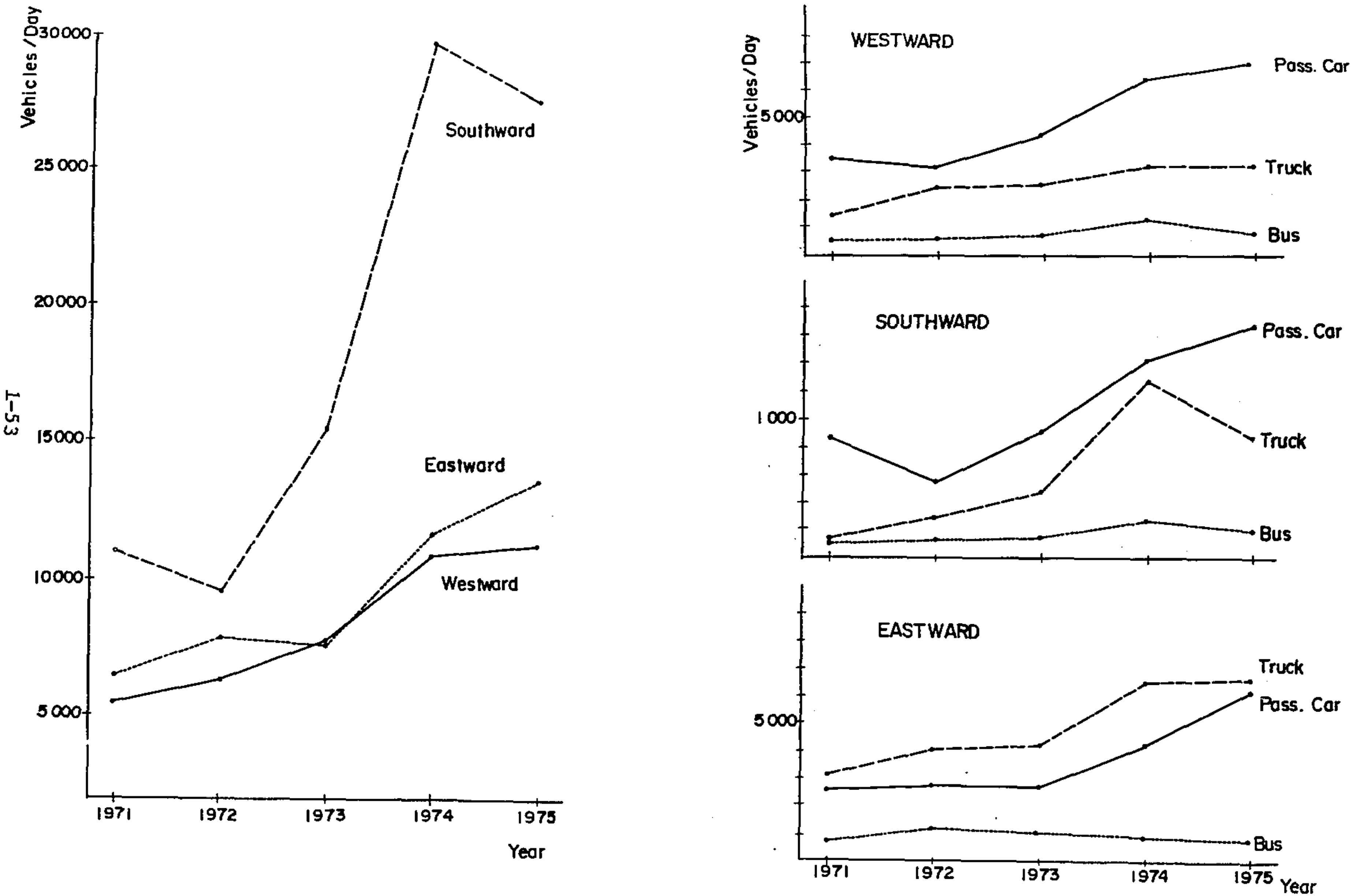
Note: In the parenthesis shown the survey point number by B/M.

1-6-4 Existing Situation of Travel Speed

A travel speed survey was conducted for the roads in Jakarta to understand the travel speed of the road sections of the existing road network, the state of congestion, the situation of vehicle stopping and restarting, and the reasons for the survey was in the following process.

(1) A passenger car was made to travel along the road section under survey and the distance between check points (usually the major junctions) was recorded from the speedmeter in

Fig. 1 - 8 NUMBER OF VEHICLES PER DAY BY DIRECTION



the vehicle while the travel time between check points were recorded by stopwatches.

(2) If the vehicle is forced to stop along the route, the duration of stopping was recorded by stopwatches and the reason for stopping noted.

The travel speed survey was carried out for a 6 day period from 14 to 19 April, 1977 and the results are as in Table 1-30 and Table 1-31 and Fig. 1-9.

From the survey, it was noted that the average travel speed for all road sections was 32.8/km which is quite high, considering the existing traffic condition in the urban center. This is due to the fact that travelling conditions are more favorable on the peripheral road, particularly the new roads of higher standard (such as Jl Komodor Yos Sudarso, etc.).

As for stopping time, the traffic signal and traffic congestion are the major causes for stopping in the main trunk road in the urban area, whereas for minor streets, especially those with two traffic lanes, the interference by right-turning vehicles and by stopping of buses are the main causes.

Table 1-30 Distribution of Travel Speed

Travel speed	Percentage
60	4.2
55	1.8
50	11.4
45	16.1
40	13.9
35	18.6
30	21.3
25	6.0
20	5.3
5	1.5
	100.0

Table 1-31 Main Results of Travel Speed Survey

Total distance of road survey	:	336.1 km			
Total travel time	:	10 hrs. 13 min. 53 sec.			
Total stopping time	:	1 hr. 7 min. 15 sec.			
By reason:					
1. Traffic signal	:	2,121 sec,	(52.6%),	71 times	
2. Congestion	:	1,333 sec,	(33.0%),	62 times	
3. Weaving at round-about	:	184 sec,	(4.6%),	10 times	
4. Accidents	:	153 sec,	(3.8%),	2 times	
5. Interference by right-turning car	:	97 sec,	(2.4%),	10 times	
6. Congregation along road	:	56 sec,	(1.4%),	4 times	
7. Bus stopping	:	53 sec,	(1.3%),	8 times	
8. Others	:	38 sec,	(0.9%),	5 times	
Average travel speed	:	32.8 km/hour			

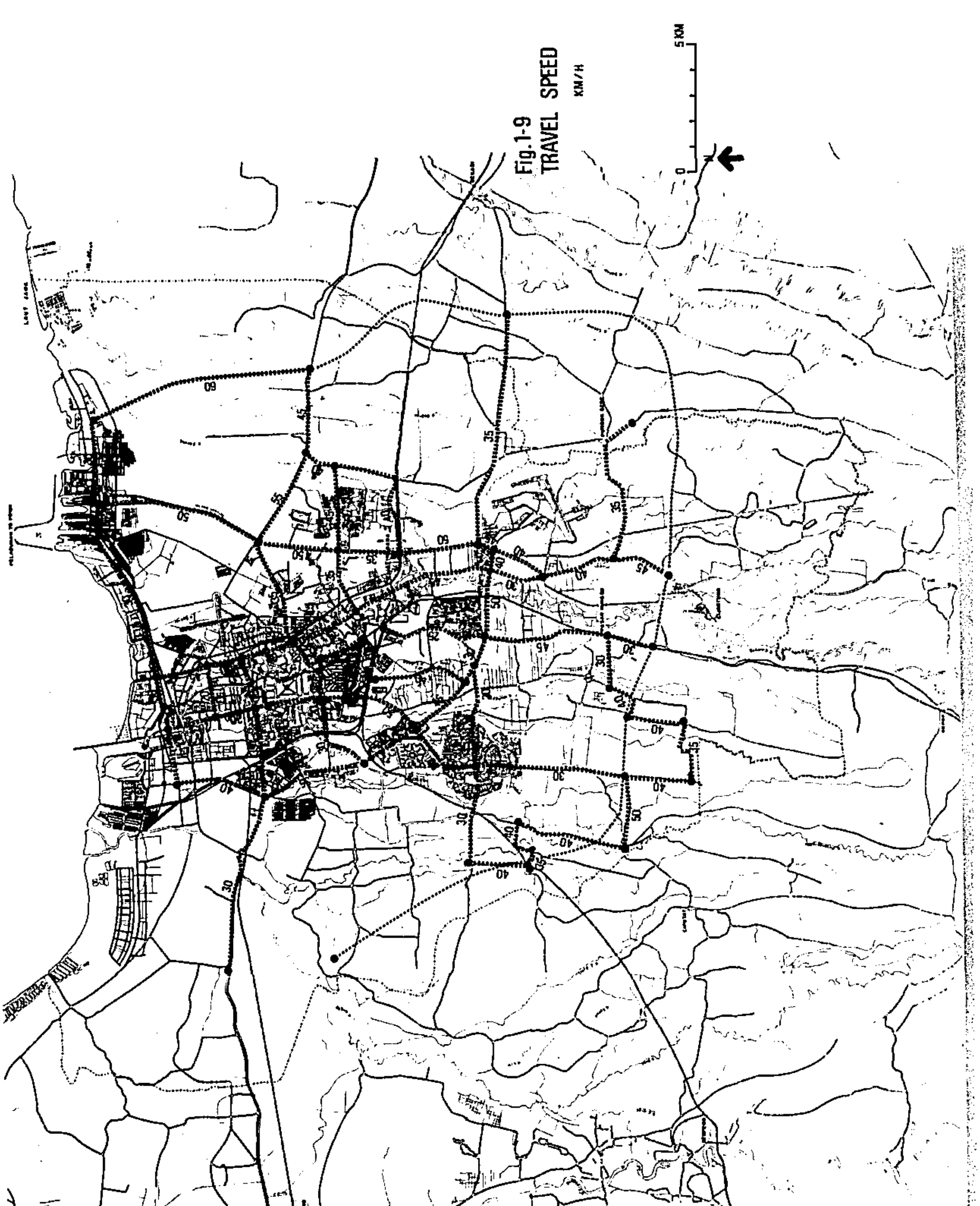


Fig.1-9
TRAVEL SPEED

1.7 Existing Landuse Situation

1-7-1 Overall

The total area of Jakarta in 1976 was about 65,000 ha and the landuse pattern is of the center core pattern centering around the old urban center.

The development of the business and commercial area runs longitudinally along the north-south axis, and residential district, development is mainly in the south and southwest directions.

The distribution of land use in area is obtained from the land use map (1:20,000 in scale) of 1973 as follows:

Table 1-32 Landuse in Jakarta, 1973

	Area(ha)	%
Residential Area	18,324	28.0
Administrative, commercial and Business Area	1,396	2.1
Industrial Area	1,033	1.6
Public Facilities excluding Administrative Area	570	0.9
Agriculture & Green Area	44,168	67.4
Total	65,490	100.0

Source: Landuse map of Jakarta, 1973 (scale = 1:20,000)

The landuse distribution in 1972 is as follows:

Table 1-33 Landuse in Jakarta, 1972

	Area (ha)		%
Illegally occupied land	9,097		27.4
Legal residential area	6,339		
Industrial area	910		1.9
Indivisual service industry area	180		
Commercial area	734		1.3
Agricultural area	27,767	49.3	
Land for infrastructure	8,521		69.4
Recreation area	984	20.1	
Unused land	1,830		
Total	56,362		

Source: JMATS

The population of Jakarta by district (Wilaya) and the population density are as shown in Table 1-34. The population varies greatly from district to district, and the central (Pusat) district is with an extremely high density of 286 persons/ha.

The population in Bo-Ta-Bek area and the population density are as shown in Table 1-35, showing that the density is very los compared with Jakarta, indicating that there is further ground for development.

Table 1-34 Population Density in Jakarta, 1975

District		Area (ha)	Population (in 1,000)	Density (person/ha)
Pusat	(Central)	4,955	1,419.6	286
Utara	(North)	13,748	715.4	52
Barat	(West)	13,124	1,011.9	77
Timur	(East)	19,096	1,031.5	54
Selatan	(South)	14,568	1,298.3	89
Total		65,490	5,476.0	83.6

Table 1-35 Population Density of Bo-Ta-Bek Area, 1975

Region	Area (ha)	Population (in 1,000)	Density (person/ha)
Bogor	328,689	2,022	6.2
Tangerang	134,627	1,155	8.6
Bekasi	147,252	897	6.1
Total	610,568	4,074	6.7

1-7-2 Residential Area

In Jakarta, about 10% of the population is residing in the residential area constructed by the Dutch (high class residential area) during the colonial days, such as Kebayoran Baru Area, and followed up with planned development after the war. The Kebayoran Baru area, covered with green vegetations, is a very favorable tropical residential area for Jakarta, and the population density was 136 persons/ha in 1976.

On the other hand, 50% of the population are living in Kampungs where urban facilities are not well provided or squatter areas

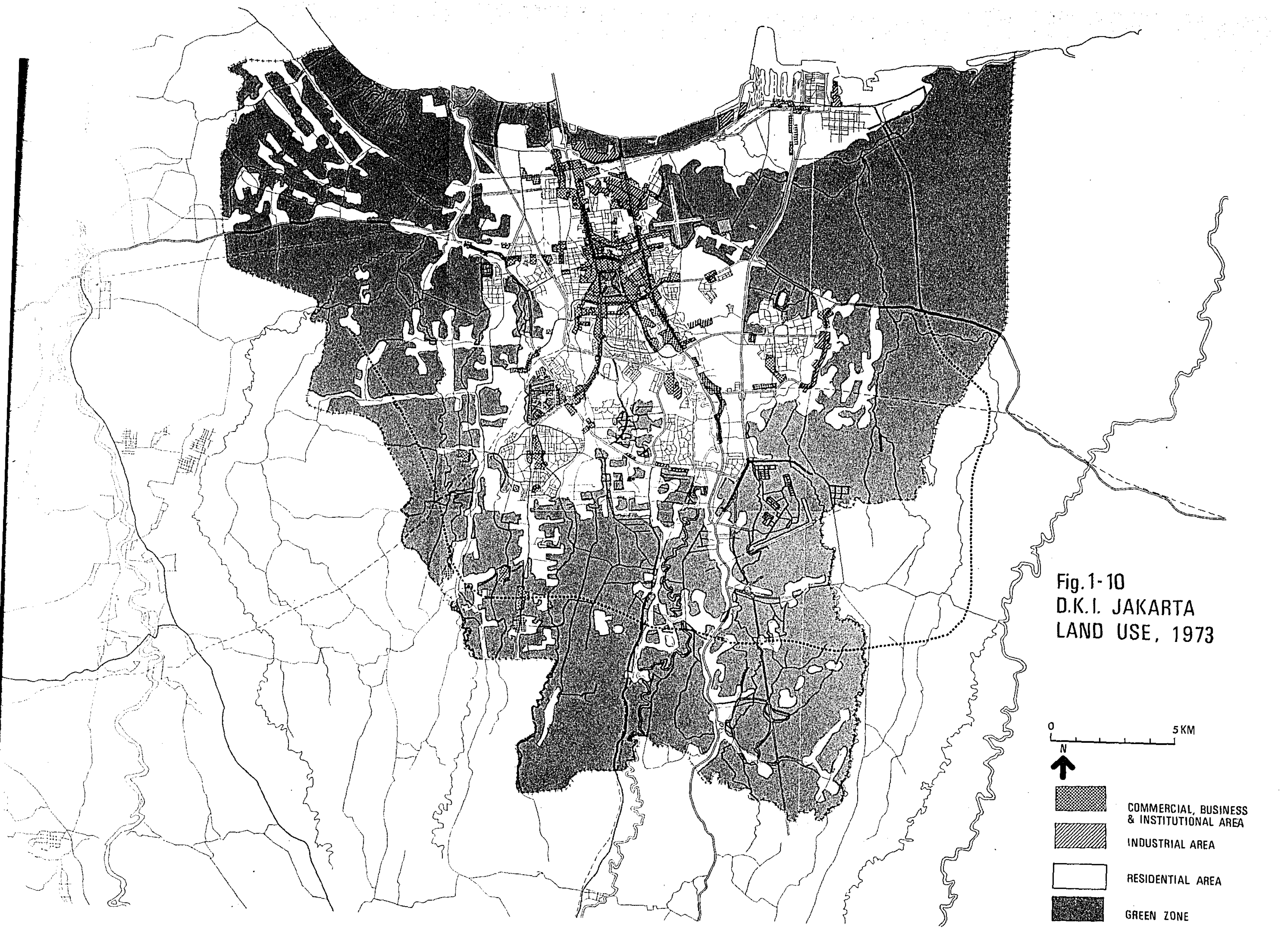


Fig. 1-10
D.K.I. JAKARTA
LAND USE, 1973

where the density is high and the sanitary condition is very poor, so that on the whole housing condition in Jakarta may be said to be very poor. In 1976, the total area of Kampungs was 5,700 ha with a population of 2.4 million so that the population density in Kampungs averaged 418 persons/ha.

The reddish brown volcanic clay that extends over Jakarta is the material for making bricks and tiles, providing very cheap construction materials. In the urban centers most of the buildings are brick layed single layer houses covered with undecorated tiles. The construction cost increases rapidly with the increase in number of stories of the houses so that the unit cost of a four stories flat is double that of a single stories houses. Due to the land cost being comparatively cheap, flats are not commonly found in Jakarta, but it is anticipated that together with the future rise in land cost, more flats will be constructed.

In the Kampung and the squatter area, the government is now making effort to provide local streets, drains schools, etc., through the Kampung program. For the poverty stratum of the population, core housing units (skeleton unit with columns, roof and toilet only) are provided for sale together with land both by the government and private developers.

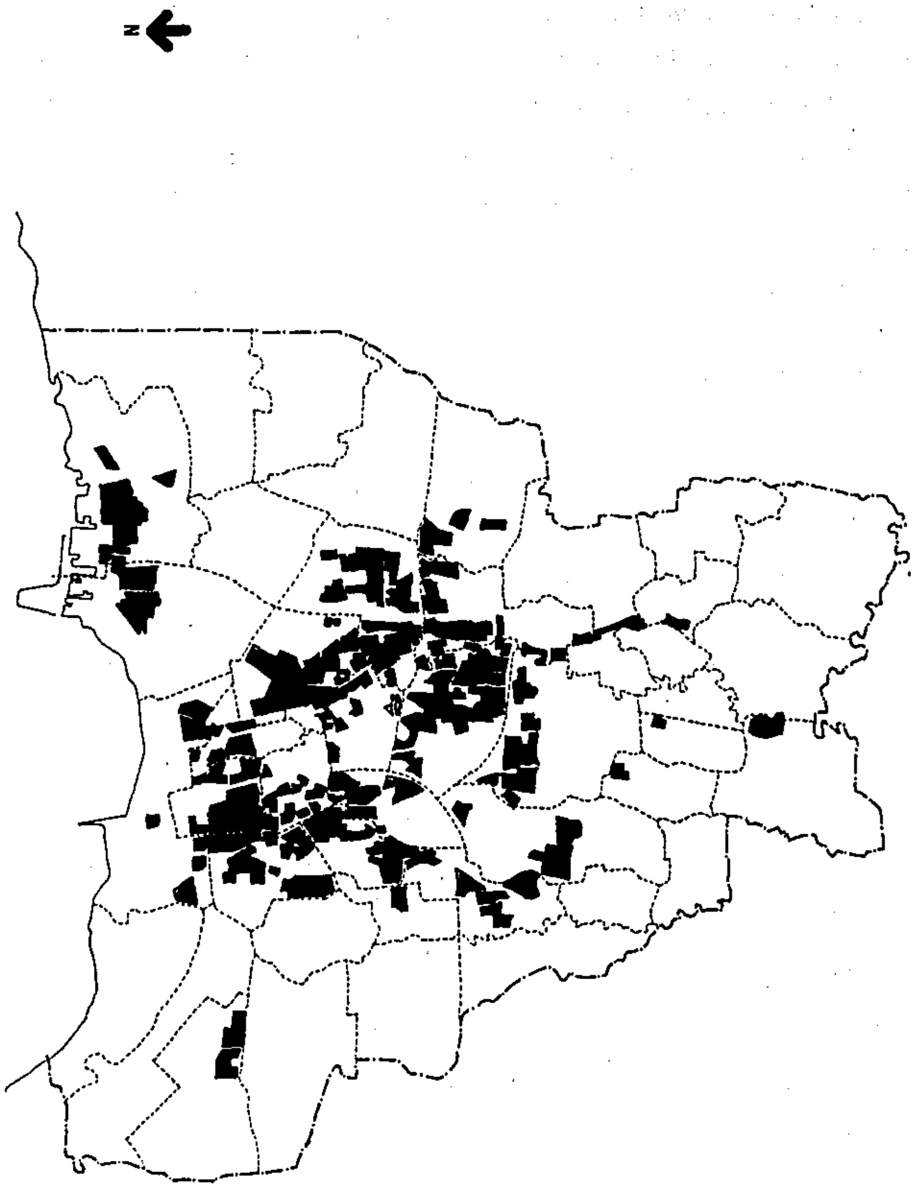
For the low income stratum population, low cost housing units are constructed and sold by the government and private developers. In Depok area, a large scale low cost housing estate is under development.

For the middle and high income strata, typical housing units and high class houses are developed by private developers.

The standard living space is planned at $9m^2$/person by the national government to $12m^2$/person by the Jakarta municipality. Since the average household is of 5 persons, an average housing is therefore about 45 - 60 m^2.

For reference purpose, it is noted that the target standard for 1988 for a typical household of 4 persons in Japan is planned at 50 m^2 as a minimum and 86 m^2 as the average.

Fig. 1-11
LOCATION OF
KAMPUNGS, 1975



1-7-3 Commercial and Business Area

The commercial and business area of Jakarta is concentrated around the Independence Monument. Therefore during the rush hours in the morning and evening many vehicles crowd on the intersection of the two north-to-south trunk roads on both sides of the independence memorial plaza, namely, J. Thamrin and Jl. Gajahmada with Jl. Pasar and Jl. Gunung Sahari, often causing traffic congestion.

There are not 32 activity centers in Jakarta, and the total area of the commercial and business area is about 1,600 ha.

1-7-4 Industrial Area

As seen from Fig. 1-10, the industrial areas in Jakarta are quite evenly distributed over the city. The industrial zones as planned in the masterplan for Jakarta area as follows:

(1) Pulogadung district
The industrial area of Jakarta starts from here due to its connection with the port, and all types of industries are allowed. The employed labour in this district is planned to occupy one-tenth of the entire employed industrial labour of Jakarta.

(2) Cilincing district
Goods processing industry will be allowed in this district.

(3) Ancol district
This is planned as a goods assembly factory zone.

(4) Pluit district
Assembly factory and electronic factory area.

(5) Along Jakarta - Tangerang Highway
Dirty factories are concentrated here.

(6) Along Jakarta - Serpong Railway (Pal. Merah)
It is planned that the family industry for batik now located in the city center will be moved to here.

(7) Along the highway to Bogor (Gandaria)

Since factory waste from here will greatly affect Jakarta, it is planned that only clean factories are allocated here.

Assuming that of the total employed labor in the secondary industry in 1976, 60% were in the manufacturing industry, then the density of labor employed in factories would be about 140 employees/ha.

Table 1-36 Distribution of Factories in Jakarta (1975)

District	%
Utara	14
Barat	19
Timur	22
Pusat	21
Selatan	24
Total	100

1-7-5 Recreation Area

According to JMATS, the total park area in Jakarta was 1974 ha in 1972, or an average of 2m2/person.

The following are the three large parks developed.

(1) Ancol Park (Sea-side park)

(2) The zoo

Situated in Kandang district towards the southwest of the junction between Jakarta - Depok Railway and the Ring Road.

(3) Taman mini park

Situated towards the northeast of the junction between Jagorawi Highway and the Ring Road.

1-7-6 Various Terminal Facilities

The locations of existing and planned taxi and bus terminals are as shown in Fig. 1-11, whereas the wholesale markets are as follows:

(1) Pasas Minggu : Agricultural products market

(2) Kuramat Jati : Agricultural products market

(3) Cengkareng : Agricultural products market (planned)

(4) Cipinang : Rice market

(5) Cakung : Construction materials market (planned)

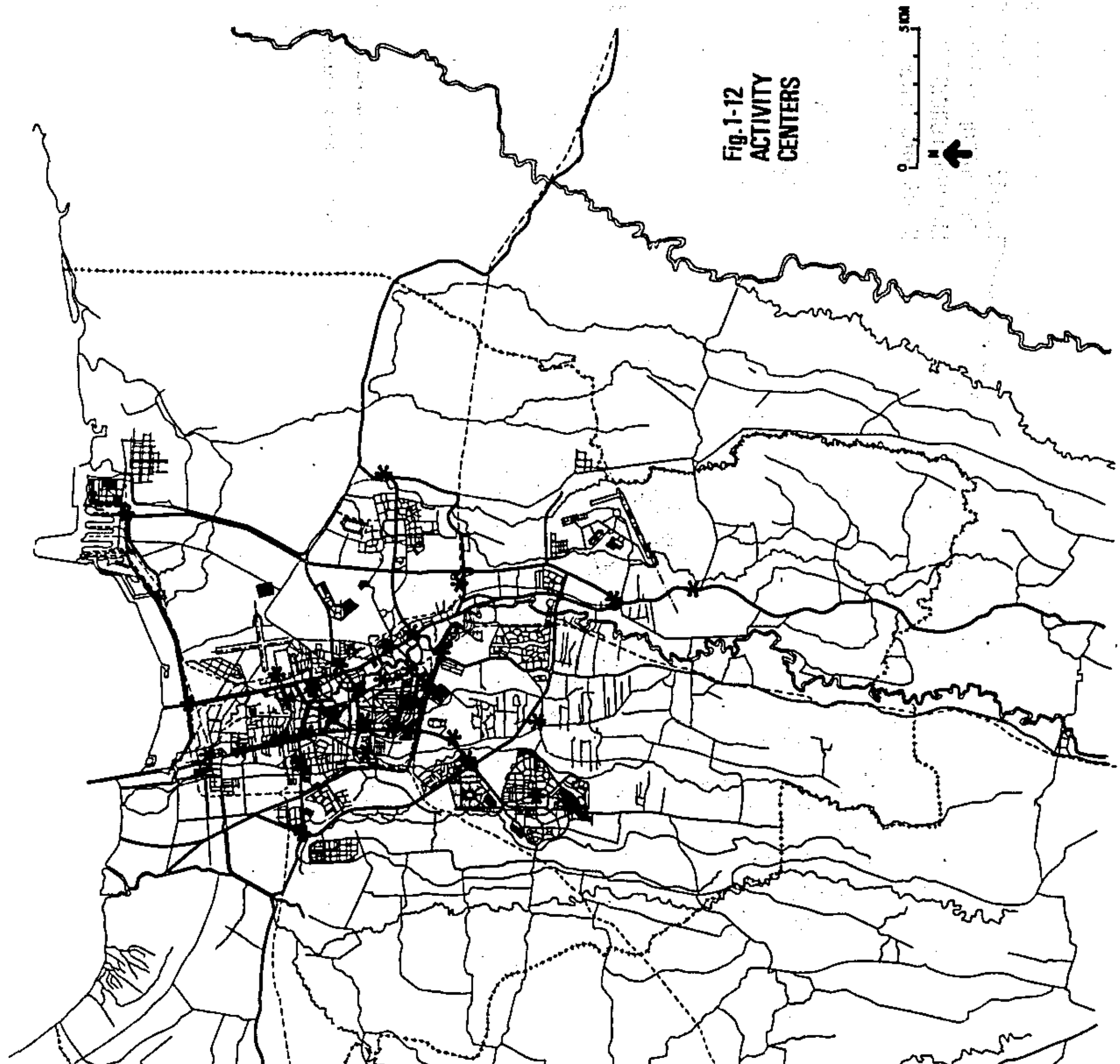


Fig.1-12 ACTIVITY CENTERS

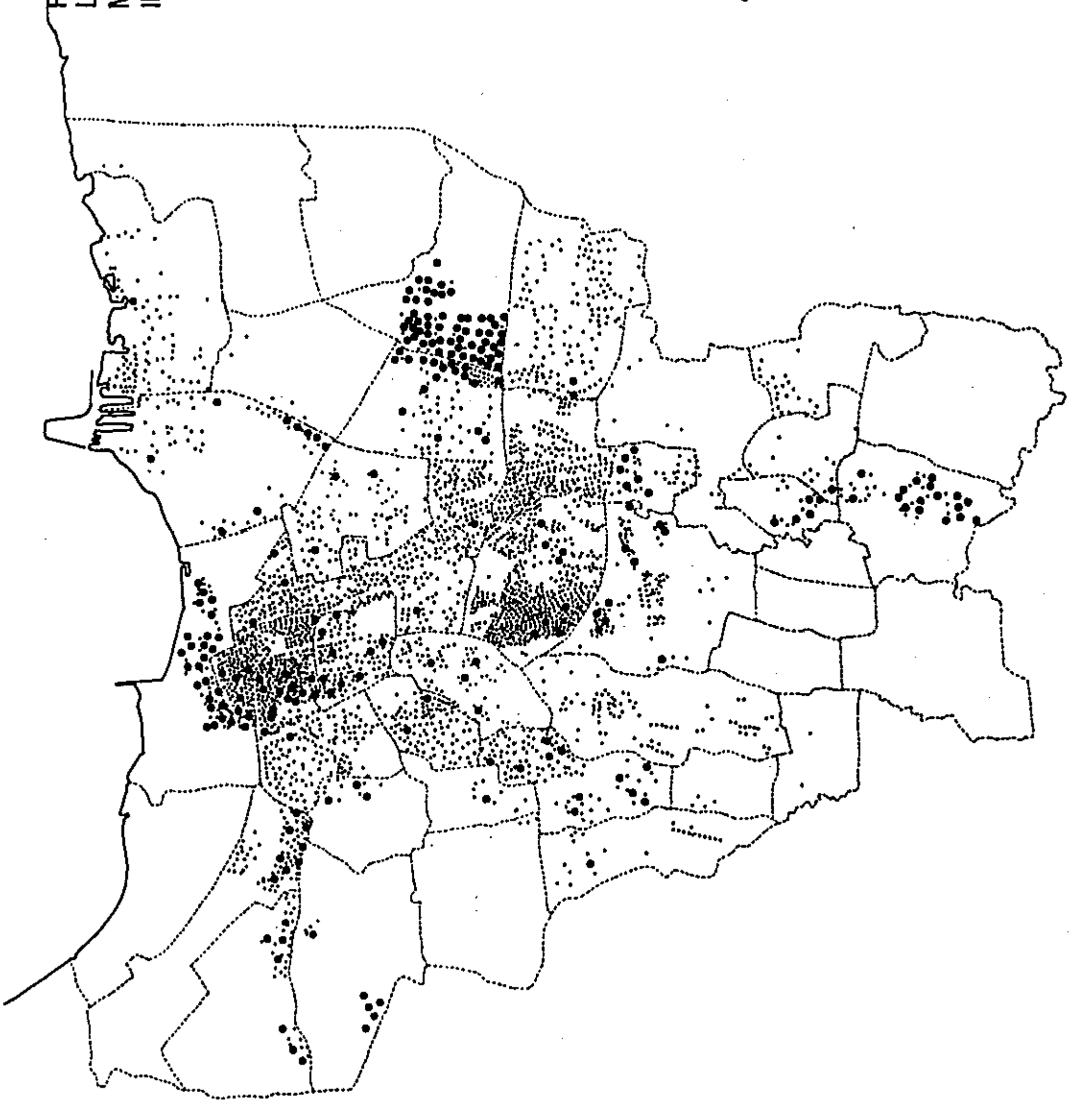


Fig. 1-13
LOCATION OF
MANUFACTURING
INDUSTRIES, 1975

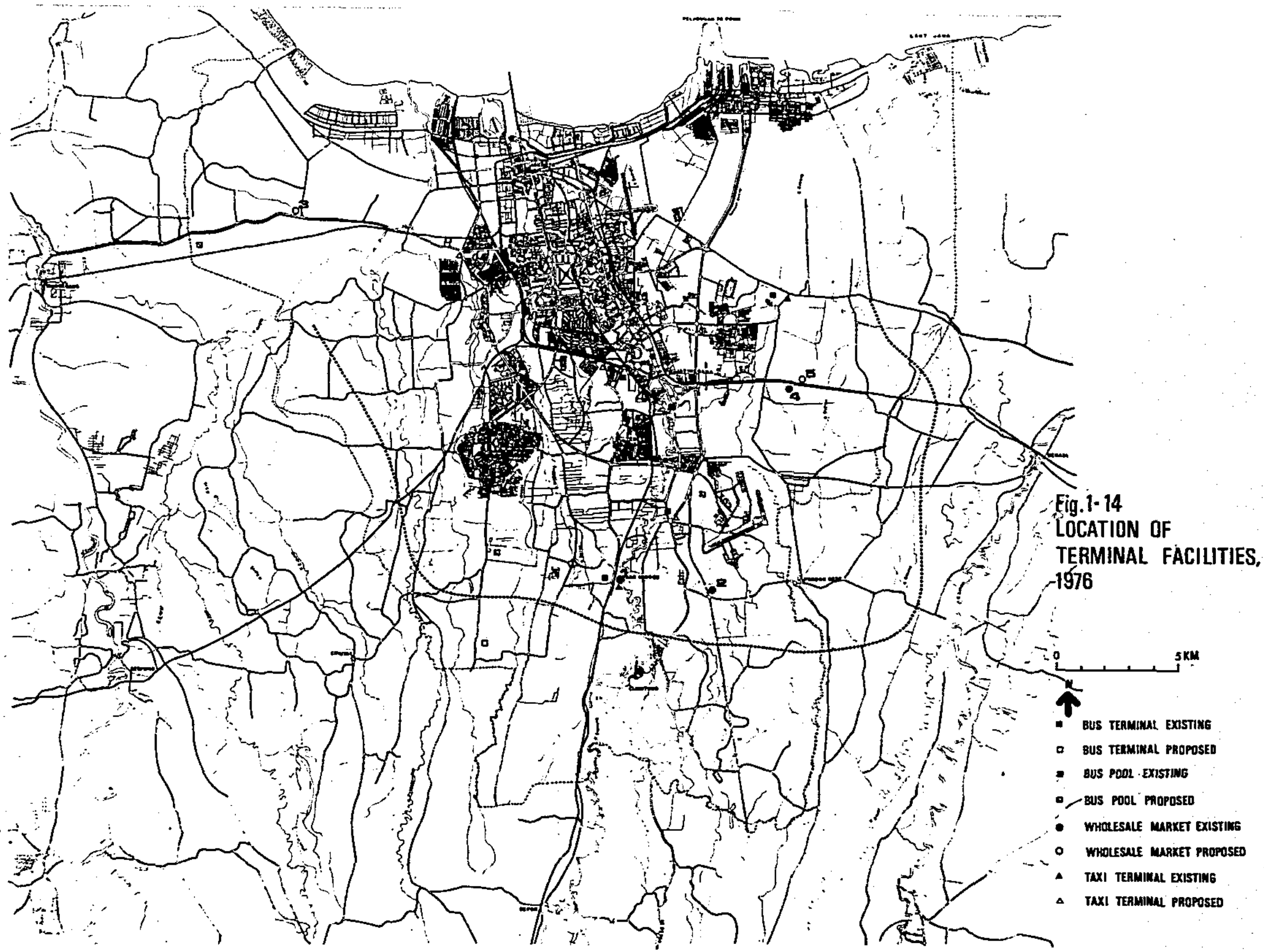


Fig.1-14
LOCATION OF
TERMINAL FACILITIES,
1976

CHAPTER 2 LAND USE PLAN

2.1 Review of reports available from the aspect of DKI Jakarta Land Use

In reports which deal with the land use of DKI Jakarta, those listed below are going to be reviewed, here. They are:

- 'The Master Plan of DKI Jakarta, 1965-1985,' 1966;
- 'Jakarta Metropolitan Area Transportation Study,' 1975; and
- 'JABOTABEK,' 1973, 1975.

2-1-1 'The Master Plan of DKI Jakarta, 1965-1985,' 1966

The 'Master Plan' in this report was made in 1965 on the assumption of the future population of 6.5 millions in 1985. Characteristics about its land use concept can be summarized as follows:

- concentration of population on the central part of DKI Jakarta;
- less reliance on the public transportation system that the private transportation system;
- clear separation of residential areas from work places;
- a compact CBD without dispersion of sub-centers around;
- a 3 to 4 KM wide green belt 15 KM away from the CBD to be a recreation zone;
- an industrial area with large scale industries on the east of the CBD extending towards the further east in fugure; and
- grid street pattern of ring and radial roads.

Table 2-1 Land Use in 'The Master Plan of DKI Jakarta,1965-1985'

	Area (ha)	%
Residential	25,543	40.5
Retails & Office	3,065	4.7
Industry	6,745	10.3
Institutional	867	1.3
Green	28,270	43.2
Total	65,430	100.0

2-1-2 'Jakarta Metropolitan Area Transportation Study,' 1975

Those assumptions on which 'The Master Plan of DKI Jakarta, 1965-1985' was made have been outdated by the overwhelming population concentration onto DKI Jakarta.

Fig. 2-1 Methodological Flow Chart of Population Forecast, Land Use Planning, Employment Situation Forecast, etc.

Notes:

Ja.: Jakarta

Bo.: Bogor+Tangerang+Bekasi

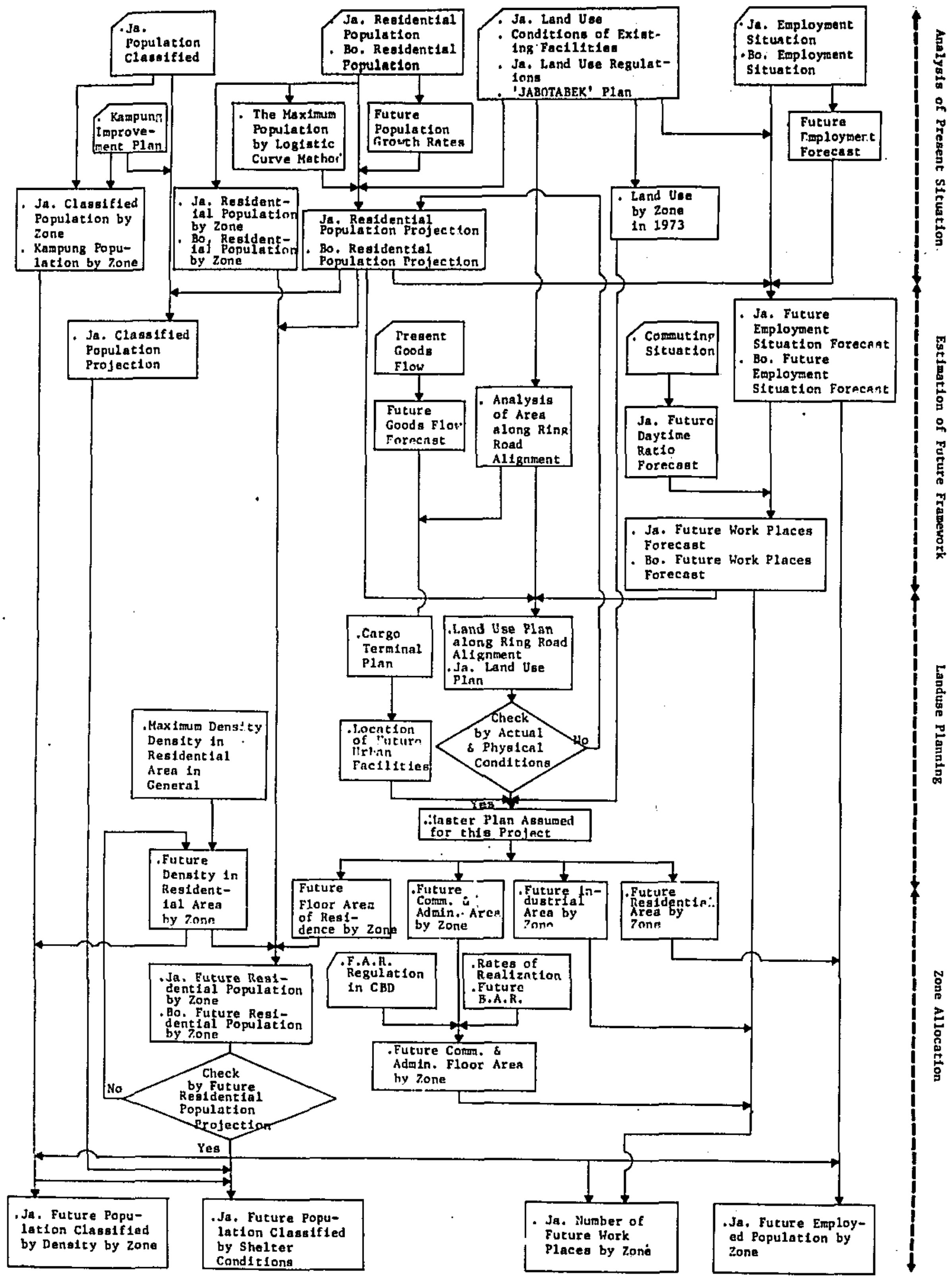
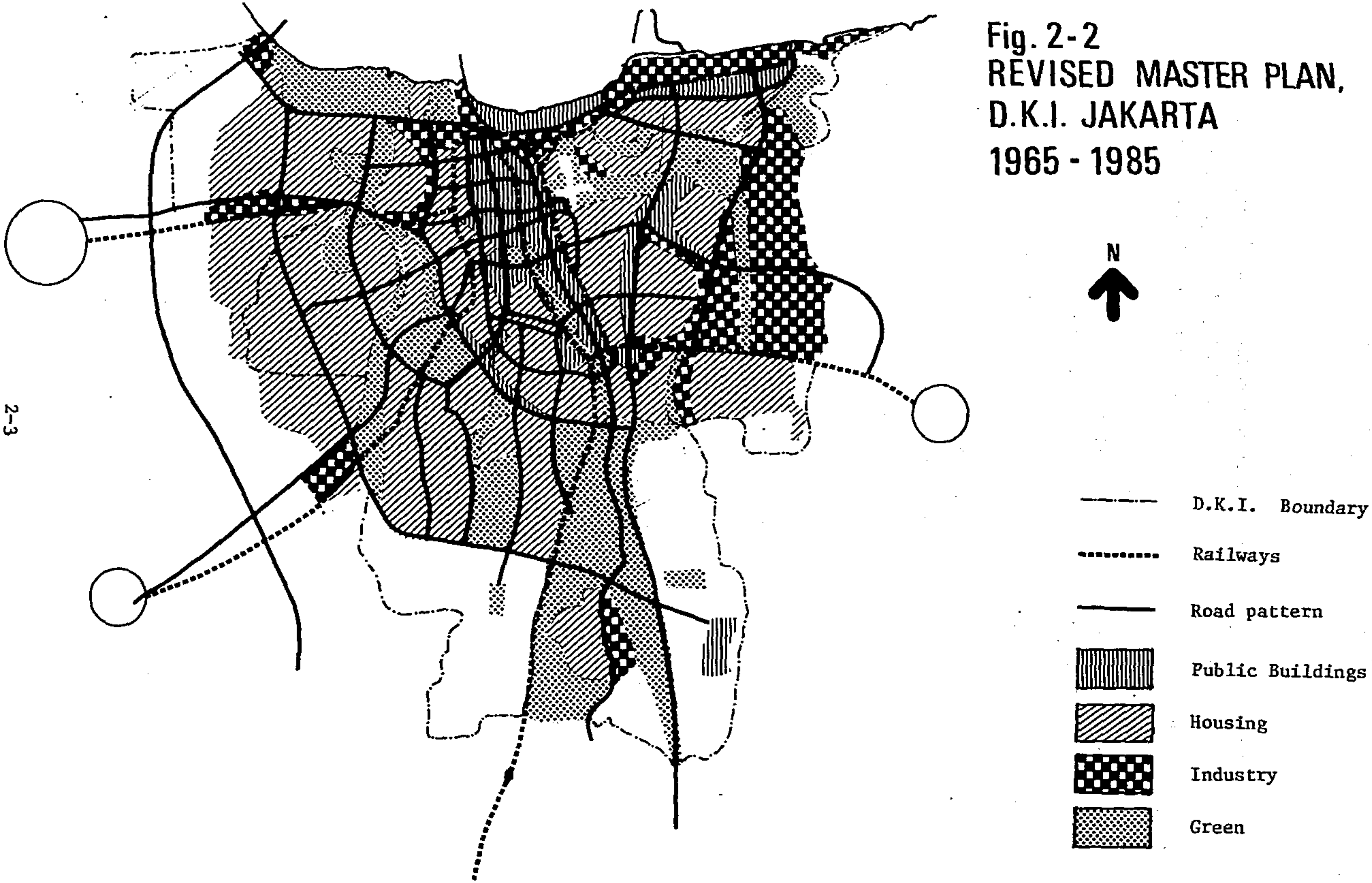


Fig. 2-2
REVISED MASTER PLAN,
D.K.I. JAKARTA
1965 - 1985



'Jakarta Metropolitan Area Transportation Study' proposes the 'Adjusted Master Plan' based on radically different land use concept, and then, made a comparison with the 'Master Plan' from various economic aspects.

Characteristics about the land use concept of the 'Adjusted Master Plan' can be summarized as follows:

- several urbanized sub-centers on the periphery of DKI Jakarta; and
- developing residential areas along radial highways deep into the surrounding green areas.

By combining those mentioned above, several advantages are generated, and they are:

- easy access to work places from residential areas because both of them are located along highways;
- neighbouring of radially separated residential areas by introducing recreational areas in between; and
- easy goods supply to residential areas through commercial areas along major highways.

The comparison between the 'Adjusted Master Plan' and the 'Master Plan' suggests the superiority of the former in many ways. The report proposes the 'Improved Master Plan' based on the findings in the process of comparing. In the 'Improved Master Plan' the capacity of population absorption by the CBD has been improved by its organized mastertransportation system.

2-1-3 'JABOTABEK,' 1973, 1975

The 'JABOTABEK' report deals with the wider region surrounding DKI Jakarta aiming at dispersion of urban facilities over the hinterland. The area dealt with is conventionally called the JaBoTaBek region including Kabupatans of Bogor, Tangerang and Bekasi, and also, DKI Jakarta.

As alternative development patterns the 'Concentric Pattern' and the 'Linear Pattern' are studied.

(1) <u>Concentric Pattern</u>

The semi-circular link of sub-centers along the periphery of DKI Jakarta is proposed.

Disadvantages of this pattern are:

- Different links among sub-centers from those connecting sub-centers and the CBD have to be developed; and
- In developing the area around sub-centers independently the balanced development of the integrated JaBoTaBek region might not be preserved.

(2) <u>Linear Pattern</u>

The development is focused on the three radial areas on the axis between Bogor, Tangerang and Bekasi, and DKI Jakarta.

Advantages of this pattern are:

- Existing facilities are mostly utilized; and
- As the potential population absorber the area along the Serpong - D.K.I. Jakarta axis on which only a railway truck runs at present can be developed.

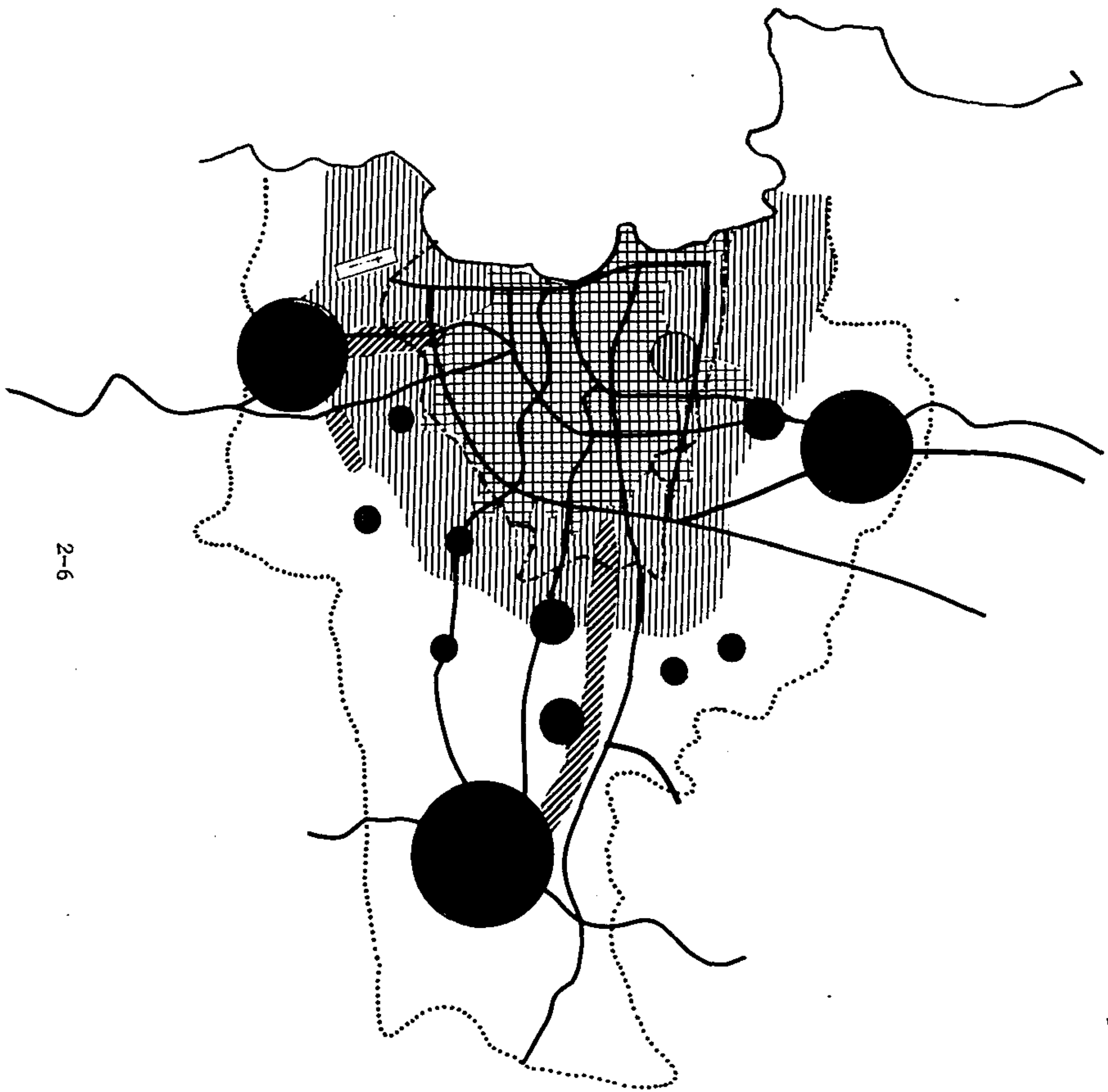
From the two patterns mentioned above the 'Linear Pattern' which has the larger capacity of population absorption with an economical development has been adopted, and then, the capacity of its population absorption is compared with the future JaBoTaBek population forecasted.

As a result, it has become clear that D.K.I. Jakarta cannot even meet the amount of its natural population increase, while it is possible for the whole JaBoTaBek region to absorb it.

When the increase by migration is taken into account, the absorption capacity of the JaBoTaBek region will be far smaller than the total future population.

Then, based upon above analyses, various methods of population control are proposed.

Fig. 2-3
JABOTABEK PLAN



N

D.K.I. Boundary

Main Highway Networks

City Centers

Developed Area

Industrial Area

Future Development

Cengkareng Ariport

2.2 Forecast of Population and Employment

2-2-1 Forecast of Future Population

(1) Indonesia and Java/Madura

The annual population growth rate of Indonesia in 1975 was 2.4% and that of Java/Madura was 2.2%. The effect of the 'Family Planning' campaign will become visible gradually. Therefore, it would be reasonable to assume that the population growth rate of Indonesia would decline to around 1.7% and that of Java/Madura to 1.6% in the year 2000. Then, the future population would be as shown in Table 2-2 and Table 2-3.

Table 2-3 Population Forecast in Java/Madura

	Population (x 1,000,000)	Annual Growth Rates (%)	Average Annual Growth Rates (%)
1975	83.5	2.2	
76	85.3	2.1	
77	87.1	2.1	2.1
78	88.9	2.1	
79	90.8	2.1	
80	92.7	2.2	
81	94.7		

Source: Proyeksi Denduduk Indonesia 1971 - 1981

	Population (x 1,000,000)	Average Annual Growth Rates for each 5 Years (%)
1980	92.7	2.05
85	102.6	1.9
90	112.7	1.8
95	123.2	1.65
2000	133.7	1.5
2005	144.0	1.4
2010	154.4	

Table 2-2 Population Forecast in Indonesia

	Population (x 1,000,000)	Annual Growth Rates (%)	Average Annual Growth Rates (%)
1975	132.1	2.3	
76	135.2	2.3	
77	138.3	2.4	2.4
78	141.6	2.3	
79	144.9	2.3	
80	148.3	2.4	
81	151.9	2.4	

Source: Proyeksi Penduduk Indonesia 1971 - 1981

	Population (x 1,000,000)	Average Annual Growth Rates for each 5 Years (%)
1980	148.3	2.2
85	165.3	2.1
90	183.4	1.9
95	201.5	1.8
2000	220.3	1.7
2005	239.7	1.6
2010	259.5	

Fig. 2-4 POPULATION GROWTH RATES IN INDONESIA

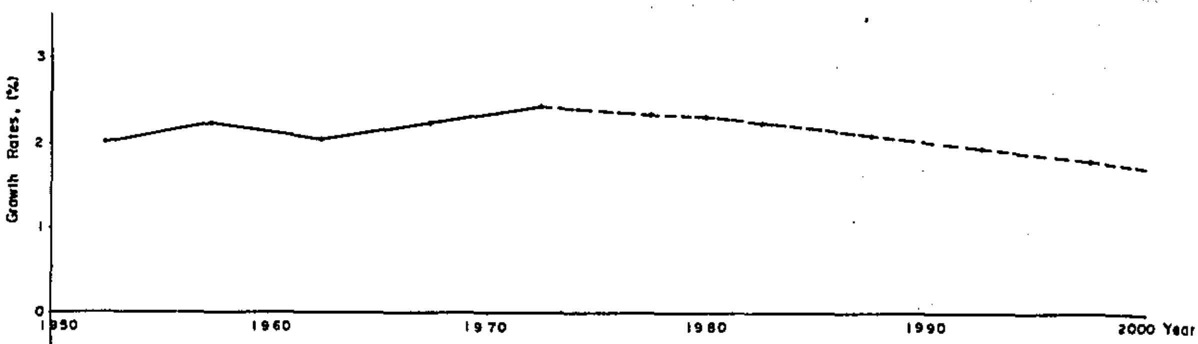


Fig. 2-5 POPULATION GROWTH RATES IN JAVA/MADURA

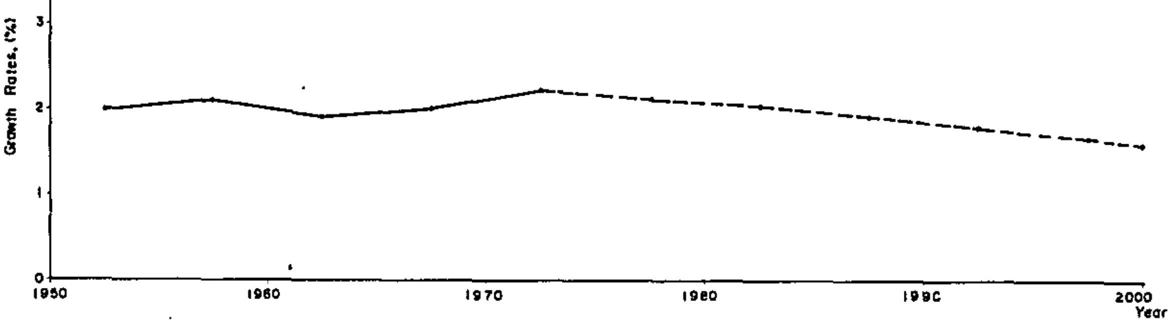
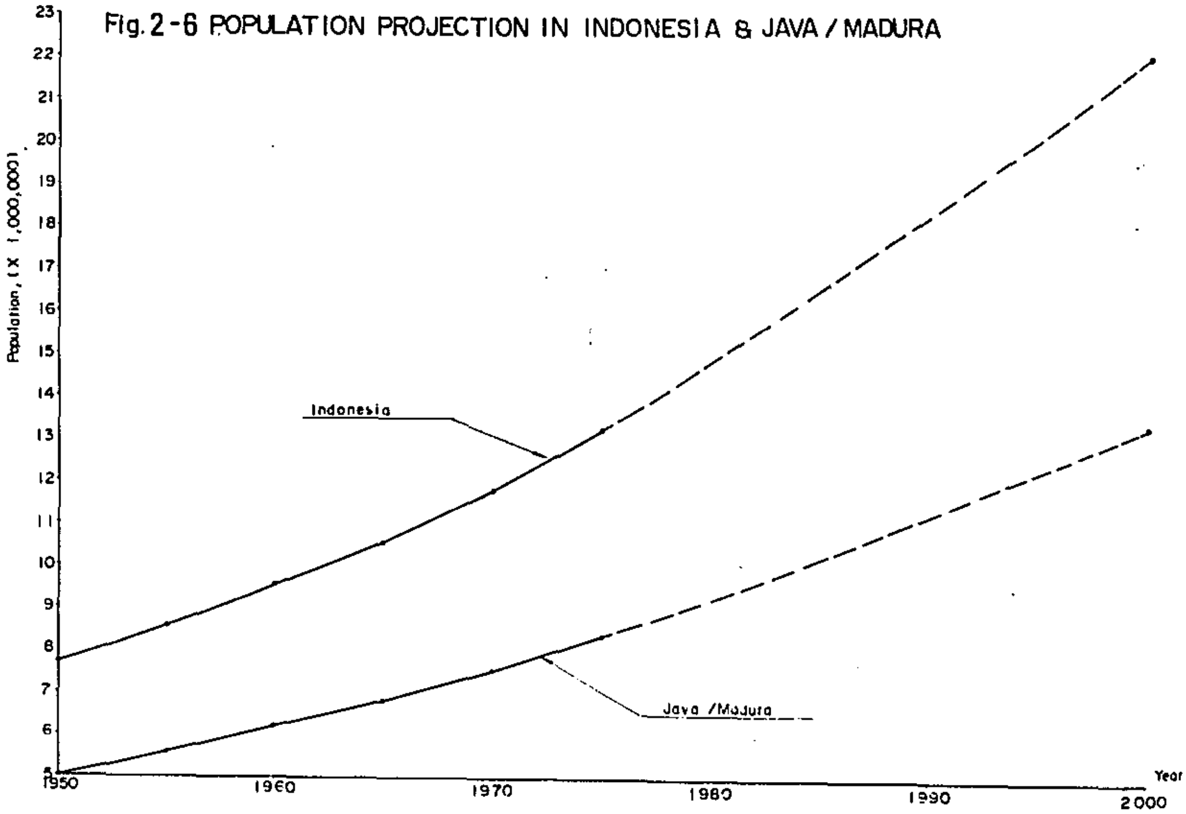


Fig. 2-6 POPULATION PROJECTION IN INDONESIA & JAVA/MADURA



(2) DKI Jakarta

The population forecast in DKI Jakarta is done through two steps as in Fig. 2-1. They are estimation of the maximum population by the logistic curve projection method and population forecast by growth rates.

1) Estimation of the maximum population of DKI Jakarta by the logistic curve projection method.

A logistic curve is defined as follows:

$$y = \frac{K}{1 + me^{-at}}$$

where, y = population

t = time

a = gradient of the curve

m = coefficient determining of the curve

k = coefficient showing the maximum population

By differentiating the above equation by t, the following equation can be obtained.

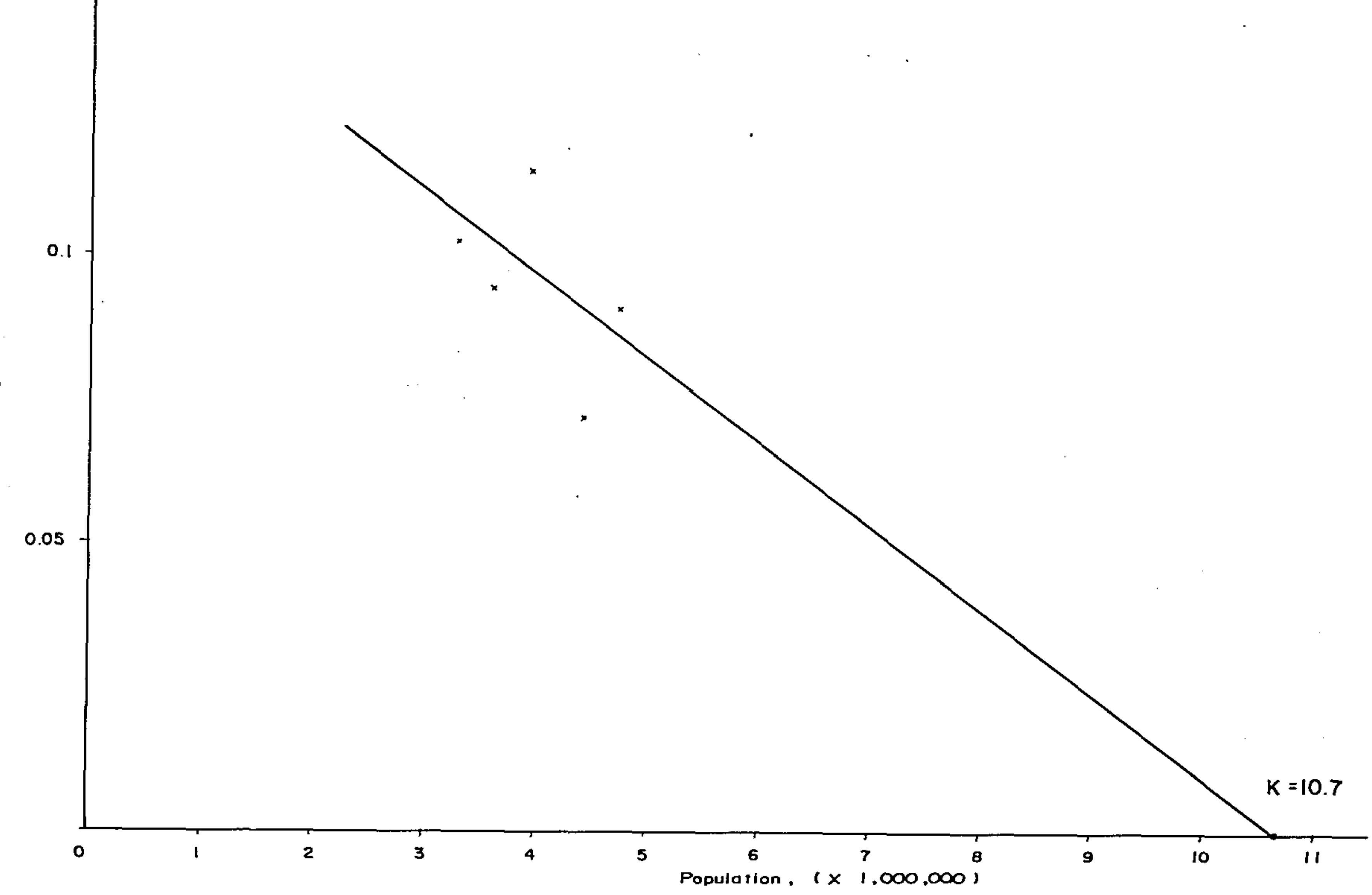
$$\frac{dy}{dt} = ay - \frac{a}{ky}^{2}$$

This indicates that the note of population growth is proportional to the population at that moment in the course of population development, and also, that it receives a resistance which is proportional to a square of the population.

In calculating the real number of K being the maximum population, populations of DKI Jakarta in the past are used and the maximum population of DKI Jakarta is forecasted to be 10,690 x 10^3 persons.

2) Population forecast in DKI Jakarta by growth rates
The annual population growth rate of DKI Jakarta was 4.3% in 1975 of which the growth rate of natural increase was 2.0% and the rest was the growth rate of migration.

Fig. 2-7 THE MAXIMUM POPULATION OF D.K.I. JAKARTA, [K], PROJECTED BY LOGISTIC CURVE TRANSFORMATION



Due to the effect of the 'Family Planning' campaign the growth rate of natural increase can be supposed to decline gradually. We assume it would become about 1.5% in the year 2000.

The migration into DKI Jakarta would also decline, if the 'Trans-Migration Policy' by the government is successfully carried out. So, we assume 0% migration growth rate in the year 2000, as shown in Fig. 2-7. The upper and the lower curves indicate the case of the % growth rate in 2010 and 1990.

The population projection in DKI Jakarta in Fig. 2-8 is based on the above assumptions of three different growth rates curves.

Our projection is much steeper than that of 'The Master Plan of DKI Jakarta, 1965-1985' and it is fairly close to 'JMATS' projection. Expecting different growth rates at each point on the course of population growth, our projection has a sort of convex shape while assuming the same population as 'JMATS' in the year 2000.

3) BoTaBek area

The annual population growth rate of the BoTaBek area was about 2.2% in 1975, and a large part of it was the natural increase. The natural increase would decline as in the case of DKI Jakarta, and it is assumed to become around 1.5% in the year 2000.

As the development of the BoTaBek area proceeds and the capacity of population absorption by DKI Jakarta approaches its limit, the migration into the BoTaBek area from other parts of DKI Jakarta, and also, a sort of trans-migration from DKI Jakarta would increase steadily. In Fig. 2-11 the maximum projection is the case of the 0% growth rate of migration in 2020, the medium is in 2010 and the minimum is in the year 2000.

Fig. 2-8 ANNUAL POPULATION GROWTH RATES D.K.I. JAKARTA

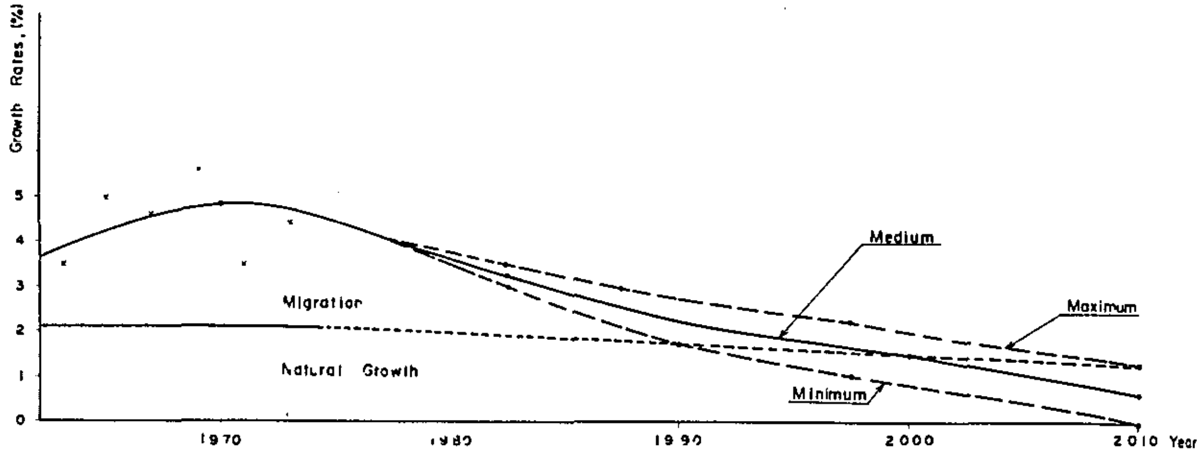
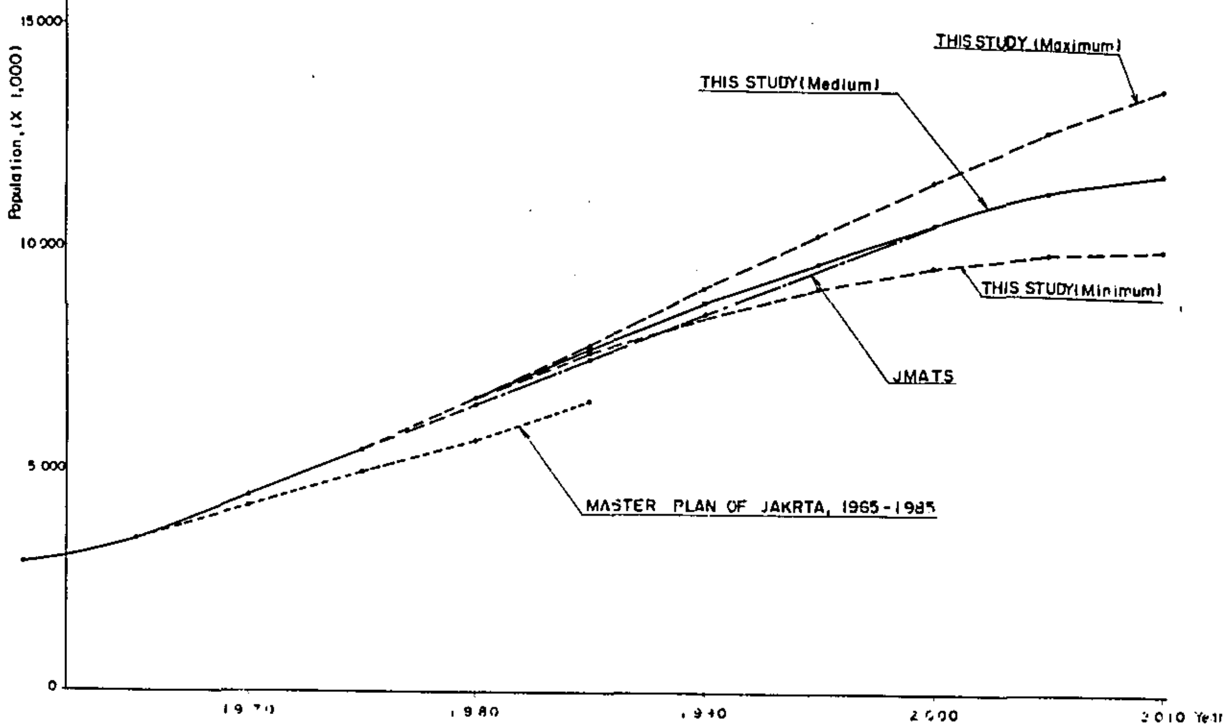


Fig. 2-9 POPULATION PROJECTION IN D.K.I. JAKARTA



Consequently, the future population in the BoTaBek area would be as shown in Table 2-6. Population projection of this study in the BoTaBek area is steeper than the 'JMATS' projection but not so than the 'West Java Tollway System Study' projection.

a) Forecasted by West Java Tollway System Study

(x 1,000)

	Bogor	Tangerang	Bekasi	Total
1985	2,910	1,645	1,391	5,946

b) Forecasted by JMATS

(x 1,000)

	1985	1990	2000
BoTaBek	5,490	6,050	7,250

4) JaBoTaBek area

By adding the future population of DKI Jakarta and that of the BoTaBek area, that of the JaBoTaBek region as a whole can be obtained to be about 19.1 millions.

The annual growth rates of the JaBoTaBek area population would decline after 1980 due to the earlier drop of the DKI Jakarta population growth rates.

In comparing the projection of this study to that of the 'JABOTABEK' report, it has to be taken into account that the JaBoTaBek area in the 'JABOTABEK' report includes the wider hillside area which is out of the boundary of this study.

(million persons)

	JABOTABEK Area by the Report	THIS STUDY
1971	7.0	8.3
1985	12.1	13.2
2000	18.3	19.1

Table 2-4 Population Forecast in D.K.I. Jakarta

	Maximum		Medium		Minimum	
	Average Annual Growth Rates for 5 years.	Population (x 1,000)	Average Annual Growth Rates for 5 years.	Population (x 1,000)	Average Annual Growth Rates for 5 years.	Population (x 1,000)
1975	4.0	5,410	4.0	5,410	4.0	5,410
80	3.5	6,580	3.25	6,580	3.0	6,580
85	3.0	7,810	2.5	7,667	2.0	7,630
90	2.5	9,050	2.0	8,730	1.5	8,420
95	2.25	10,240	1.75	9,640	1.0	9,070
2000	1.85	11,450	1.25	10,510	0.65	9,530
2005	1.50	12,550	0.85	11,180	0.25	9,840
2010		13,520		11,660		9,960

Table 2-5 Other Population Forecasts in D.K.I. Jakarta

	Jakarta Master Plan	JMATS
1975	4,900	
80	5,600	6,400
85	6,500	7,500
90		8,500
95		-
2000		10,500

Table 2-6 Population Forecast in Bo. Ta. Bek. Area

	Maximum		Medium		Minimum	
	Average Annual Growth Rates for 5 years.	Population (x 1,000)	Average Annual Growth Rates for 5 years.	Population (x 1,000)	Average Annual Growth Rates for 5 years.	Population (x 1,000)
1975	2.5	4,074	2.5	4,074	2.5	4,074
80	3.7	4,609	3.4	4,609	3.2	4,609
85	4.1	5,527	3.7	5,447	3.2	5,335
90	3.6	6,757	3.15	6,532	2.7	6,315
95	2.8	8,064	2.4	7,627	1.8	7,215
2000	2.3	9,258	1.8	8,587	1.2	7,888
2005	1.9	10,373	1.4	9,388	0.8	8,373
2010		11,397		10,064		8,713

Fig 2-10 ANNUAL POPULATION GROWTH RATES IN BOTABEK

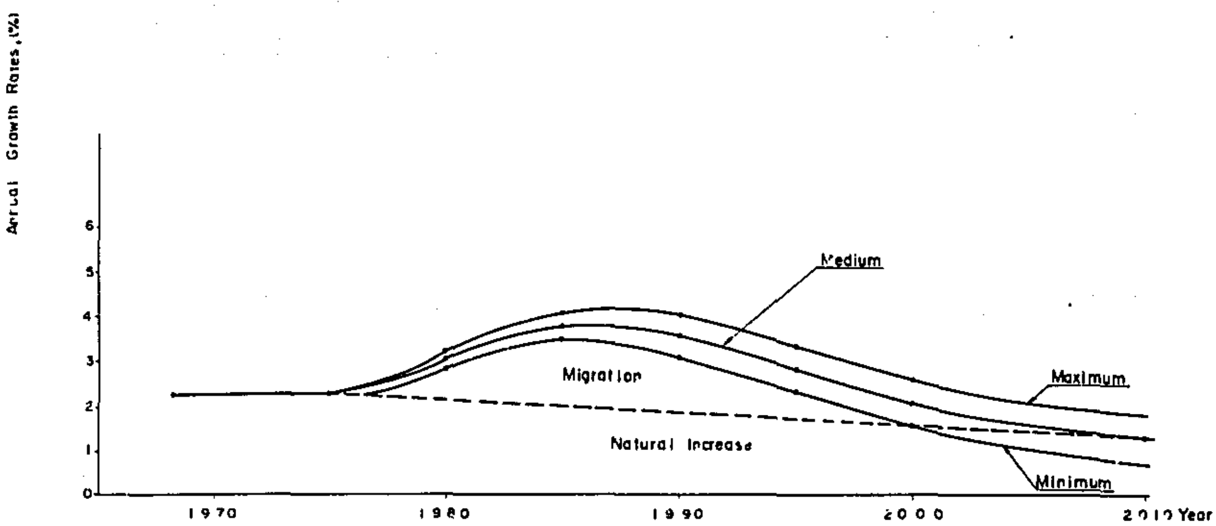


Fig. 2-11 POPULATION PROJECTION IN BOTABEK

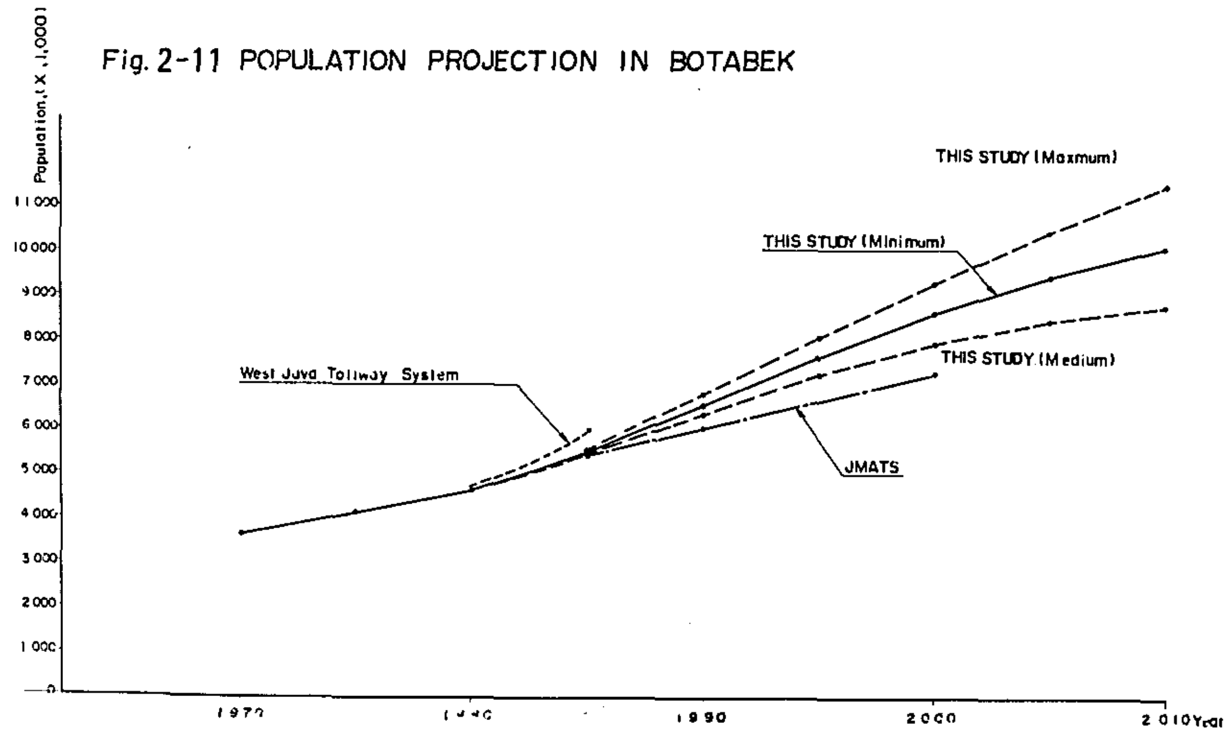


Table 2-7 Population Forecast in Ja.Bo.Ta.Bek.

	Maximum		Medium		Minimum	
	Average Annual Growth Rates for each 5 years.	Population (x 1,000)	Average Annual Growth Rates for each 5 years.	Population (x 1,000)	Average Annual Growth Rates for each 5 years.	Population (x 1,000)
1975	3.4	9,484	3.4	9,484	3.4	9,484
80	3.6	11,189	3.3	11,189	3.1	11,189
85	3.5	13,337	3.0	13,167	2.5	13,025
90	3.0	15,807	2.5	15,262	2.0	14,735
95	2.5	18,304	2.0	17,267	1.4	16,285
2000	2.1	20,708	1.5	19,097	0.9	17,418
2005	1.7	22,923	1.1	20,568	0.5	18,213
2010		24,917		21,724		18,673

2-2-2 Classified Population

The number of people without permanent address was 11.0% of the total population in 1975. It is unrealistic to predict that this will be less than 5% in the year 2000. These people will be a part of population classified into Temporary by their shelter conditions.

At present, the population in Kampungs is about 2.4 millions and its average growth rate is about 1.3%. Therefore, it will be 3.3 millions, or 31% of the total DKI Jakarta population in the year 2000.

Assuming that 80% of the Kampung population would be Semi-Permanent and 20% of it would be Permanent, the Semi-Permanent population will be 25% of the total, and that of Permanent will be 70% in the year 2000.

Fig. 2-12 ANNUAL POPULATION GROWTH RATES IN JABOTABEK

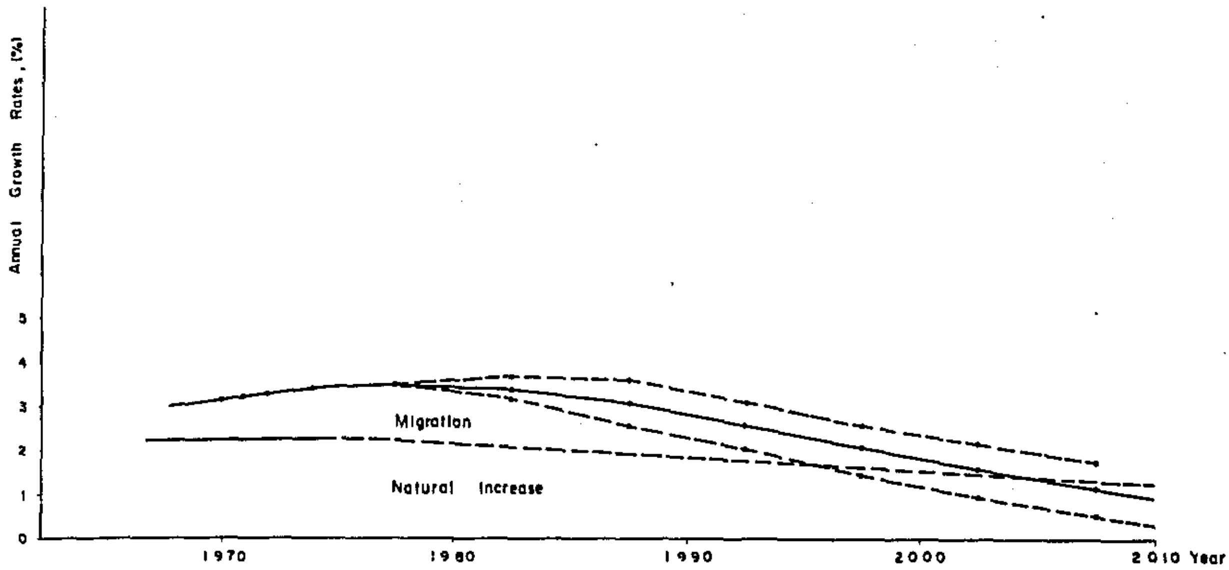


Fig. 2-13 POPULATION PROJECTION IN JABOTABEK

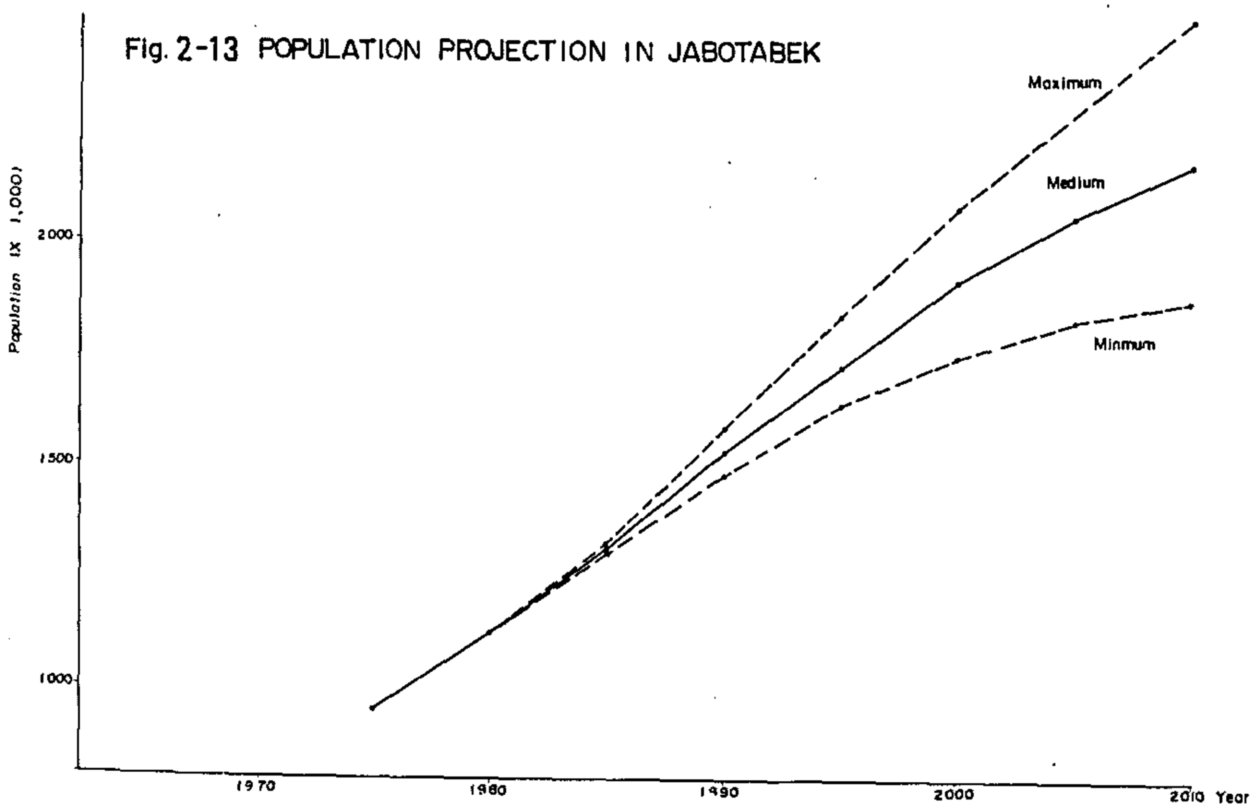


Fig. 2-14 FUTURE DISTRIBUTION OF POPULATION CLASSIFIED BY SHELTER CONDITIONS,

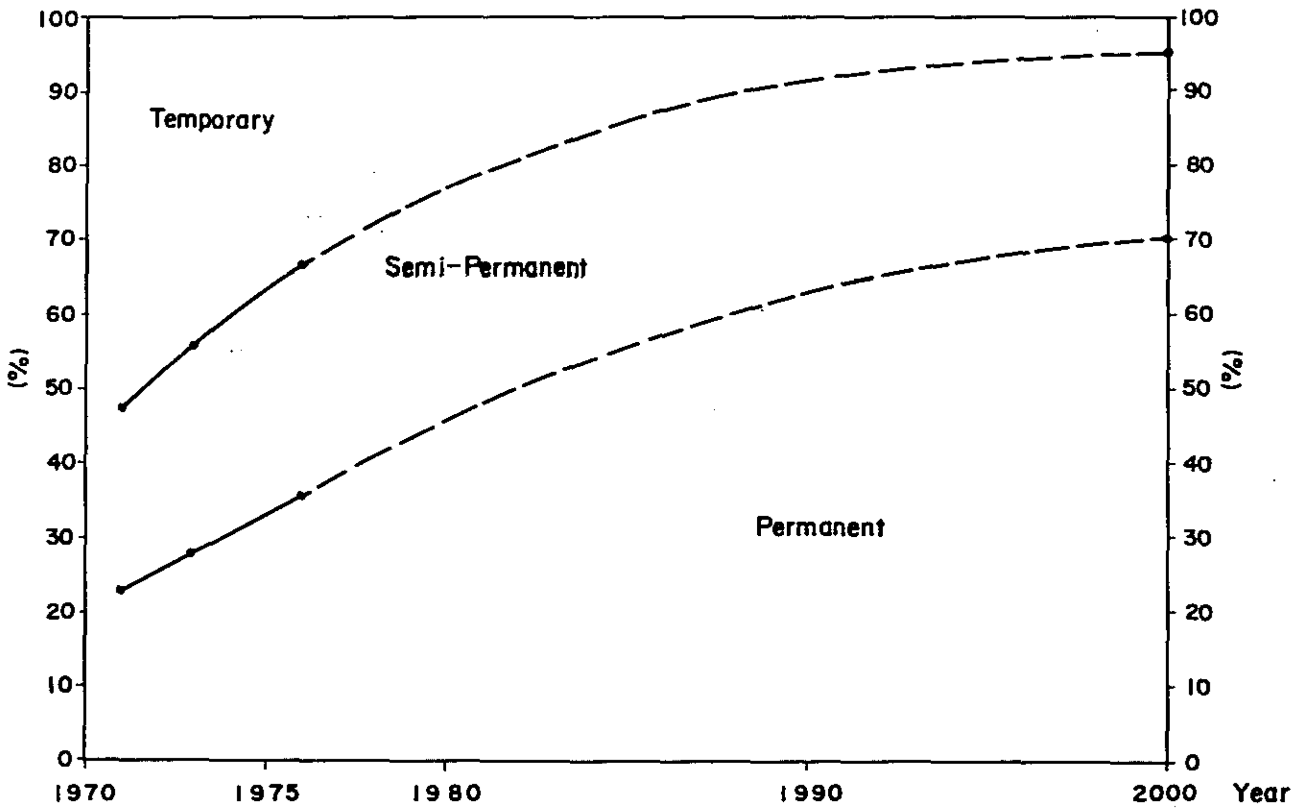


Table 2-8 Future Distribution of Classified Population by Shelter Conditions, D.K.I. Jakarta

	Permanent (%)	Semi-permanent (%)	Temporary (%)
1971	22.76	24.98	52.26
73	27.61	28.22	44.17
76	35.64	31.26	33.10
80	46.00	31.00	23.00
85	55.00	32.00	14.00
90	62.50	28.50	9.00
2000	70.00	25.00	5.00

2-2-3 Forecast of Employed Population

(1) Rate of employment

a) DKI Jakarta

The rate of employment in DKI Jakarta was 25.8% in 1971. It is assumed to be 31.0% in the year 2000, due to the larger economically active population and the improvement of economic situations.

b) BoTaBek area

The rate of employment in the BoTaBek area was 20.3% 1971. In the year 2000, it would be considerably lower than in DKI Jakarta, due to the lower rate of its economically active population, and it is assumed to be 28%.

(2) Rate of employment by sector

The rate of employment by sector in the year 2000, can be figured out from the area of various kinds of land uses. However, the BoTaBek area dealt with in this report includes the wider hillside area than that in the 'JABOTABEK' report. This is the reason of the higher rate of employment in Sector I, 8.0%, than that of the 'JABOTABEK' report, 5.0%.

2-2-4 Work Places

The commuting population into the JaBoTaBek region from outside is negligible. Therefore, in the whole JaBoTaBek region the

Table 2-9 a) Employment in D.K.I. Jakarta

		1971	'73	'76	'85	'90	2000
Population (x 1,000)		4,576	4,973	5,640	7,720	8,730	10,510
Rate of Employment		26.8	26.2	26.7	28.3	29.2	31.0
Employed		1,179	1,302	1,506	2,185	2,549	3,258
Distribution by Sector(%)	Sector I	3.6	3.1	2.5	1.3	1.0	0.5
	Sector II	16.9	17.8	19.4	24.3	27.0	32.5
	Sector III	79.5	79.1	78.1	74.4	72.0	67.0
Number of Employed by Sector (x 1,000)	Sector I	42	40	37.5	29	25	16
	Sector II	200	232	292	531	688	1,059
	Sector III	938	1,031	1,176	1,626	1,835	2,183

Table 2-10 b) Emplo'ment in Bo. Ta. Bek. Area

		1971	'73	'76	'85	'90	2000
Population (x 1,000)		3,761	3,898	4,164	5,447	6,532	8,590
Rate of Employment		20.3	20.8	21.6	24.0	25.4	28.0
Employed		763	811	899	1,307	1,659	2,405
Distribution by Sector(%)	Sector I	42.8	41.2	39.0	31.5	27.0	19.0
	Sector II	13.8	15.5	37.0	23.0	26.0	32.0
	Sector III	43.4	43.3	44.0	45.5	47.0	49.0
Number of Employed by Sector (x 1,000)	Sector I	326	334	351	412	448	457
	Sector II	105	126	153	301	431	770
	Sector III	331	351	396	595	780	1,178

Table 2-11 c) Employment in Ja. Bo. Ta. Bek. Area

		1971	'72	'76	'85	'90	2000
Population		337	8,871	3,804	13,167	15,262	19,100
Rate of Employment		23.3	23.8	24.5	26.5	27.6	29.6
Employed		1,944	2,113	2,405	3,494	4,207	5,663
Distribution by Sector(%)	Sector I	18.9	17.7	16.2	12.6	11.2	8.4
	Sector II	15.7	16.9	18.5	23.8	26.6	32.
	Sector III	65.3	65.4	65.4	63.6	62.2	59.3
Number of Employed by Sector (x 1,000)	Sector I	368	374	389	441	473	473
	Sector II	305	358	445	832	1,119	1,829
	Sector III	1,269	1,332	1,572	2,221	2,615	3,361

Table 2-12

Future Sectoral Distribution Forecast by 'Ja. Bo. Ta. Bek Plan'

	1971	1985	2000
Sector I	20	10	5
Sector II	15	30	35
Sector III	65	60	60

Note: The area dealt with in 'Ja. Bo. Ta. Bek. Plan' includes wider periphery area which is outside of our Ja. Bo. Ta. Bek. Boundary.

Table 2-13 a) WORK PLACES IN D.K.I. JAKARTA, (x 1,000)

	1971	1973	1976	1985	1990	2000
- Residential population	4,576	4,973	5,640	7,720	8,730	10,150
- Growth Rates of Daytime Population (%)	1.4	1.6	2.0	3.1	3.8	5.0
- Daytime population Increased	64	80	113	239	332	526
- Section II Increased	6	8	11	24	33	53
- Section III Increased	58	72	102	215	233	473
- Section I	42	40	38	29	25	16
- Section II	206	240	303	555	721	1,112
- Section III	996	1,103	1,278	1,841	2,134	2,656
Total:	1,244	1,383	1,619	2,425	2,880	3,784

Table 2-14 b) WORK PLACES IN BOTABEK AREA, (x 1,000)

	1971	1973	1976	1985	1990	2000
- Sector I	326	334	351	412	448	457
- Sector II	99	118	142	277	398	717
- Sector III	273	279	294	380	481	705
Total:	698	731	787	1,069	1,372	1,379

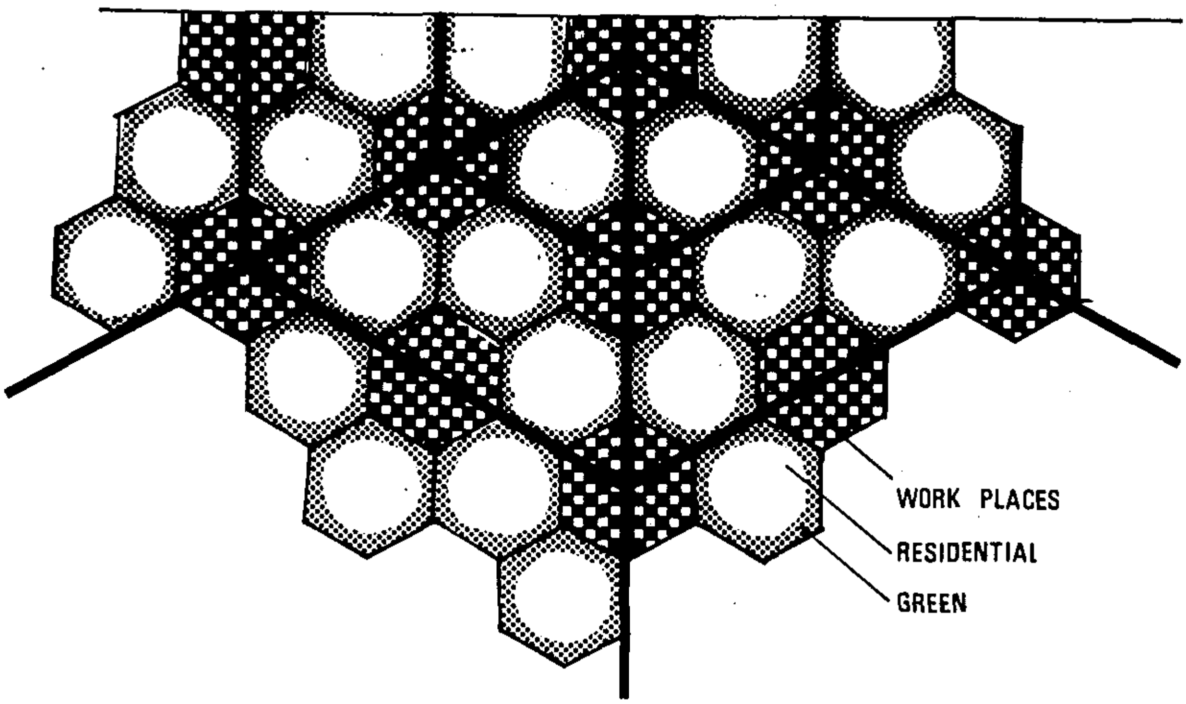
number of work places is considered to be that of employed population. According to the traffic survey in May, 1977, the commuting population from the BoTaBek area into DKI Jakarta was about 110,000 and it is about 2.0% of the total DKI Jakarta daytime population.

In the year, 2000, the increase of the daytime population in DKI Jakarta by commuting is assumed to be about 5.0%, due to the improved Traffic System.

The Sector II employees are in most cases reside close to industrial areas, and so, the ratio of commuting population between in Sector II and Sector III is assumed to be about 1:9.

Taking those commuting population into account, the number of work places in DKI Jakarta by sector would be as shown in Table 2-13.

Fig. 2-15 LAND USE CONCEPT



2.3 Land Use Planning along the Ring Road Alignment

2-3-1 Land Use Planning in DKI Jakarta

According to the doctrine of the 'Modern Urban Design Movement' which has been so popular almost all over the world since the last war, the field of the whole human activities is divided into several major types with their special facilities in the process of design.

Therefore, it should be tried to generate communities of a proper size with not only residential facilities, but also, with work places of commercial and institutional facilities. In the 'Master Plan of DKI Jakarta, 1965-1985' a large industrial area is proposed on the east of the CBD, but it would be also reasonable to blend smaller industrial facilities into residential areas, as long as they do not cause environmental problems. It is also reasonable to disperse medium size commercial and administration areas outside of the CBD creating a chain of sub-centers easily accessible from residential areas. Accessible green areas, even if they are rather small, evenly distributed over a residential areas would be very beneficial for up-grading of their living conditions when the tropical climate of Indonesia is taken into consideration.

2-3-2 Functions of the Ring Road

The alignment of the Jakarta Ring Road we are proposing is about 12 to 15 km from the CBD. When the population of DKI Jakarta exceeds 10 millions, the residential area will extends into the area further than 20 km from the CBD. Therefore, the land use planning along the alignment should fully reflect the above situation, and at the same time, the design of the Ring Road will be affected by it.

The functions of the Ring Road from the aspect of the land use planning are as follows:

1) The traffic flow incoming to and outgoing from DKI Jakarta is at present largely concentrated on the few radial highways

causing congestions at several junctions. The Ring Road with interchanges will help to make this traffic flow more multi-directional.

ii) A portion of the congested CBD traffic is the through-traffic, and the Ring Road would remove it considerably by allowing by-passing giving the land use of CBD more freedom, and also, making the peripheral area of DKI Jakarta more integrated.

iii) The supply of goods into DKI Jakarta is done almost evenly from all three major directions, while the place of consumption depends on specific commodities. The location of cargo terminals near inter-changes would give some effect on the layout of the place of consumption, namely industrial and commercial areas in DKI Jakarta.

iv) As mentioned earlier, to improve the capacity of population absorption is essential in land use planning when the massive population increase in future is taken into consideration. The Ring Road will integrate the functions of facilities along its alignment creating larger capacity of population absorption.

2-3-3 Analysis of the Area along the Alignment

As a base of realization of those functions of the Ring Road mentioned in the previous section, the existing conditions of the area along the Ring Road are going to be analized, here. The analysis can be itemized as follows:

a) Soil conditions and topography
By Maps of Soil Conditions and Topography of the area along the alignment, and also, by the information collected during the field survey, the physical conditions of the site are analyzed.

b) Present land use and development in near future
By aero-photos (Scale: 1/5000) and the field survey the actual land use and the condition of facilities are analyzed.

The authorized land use plan is studied to envisage the situation in near future.

c. Land use regulation and future traffic conditions

By the 'Master Plan' (Scale: 1/20,000) and the Land Use Regulation Map' the future traffic conditions are studied.

Next, by dividing the whole alignment into ten portions as shown in Table 2-14, the appropriate land use of the area around each portion is studied as tabulated in Table 2-15.

Table 2-15 Division of Alignment

No.	Location of Junction with the Ring Road	Section
1	Jakarta Murak Highway	
		I
2	Proposed Jakarta Serpong Highway	
		II
3	Jakarta Serpong Railway	
		III
4	Krukut River	
		IV
5	Jakarta Bandung Railway	
		V
6	Existing Bogor Highway	
		VI
7	Jagorawi Highway	
		VII
8	Sunter River	
		VIII
9	Jakarta Cikampek Highway	
		IX
10	Jakarta Surabaya Railway	
		X
11	End of Ring Road	

The area assigned for industrial use in the 'Master Plan' is also reasonable by our judgement. It is suggested to distribute industrial areas along the alignment without concentrating onto Pulogadung area only.

The areas suitable for commercial and/or administration uses are the south of Pondok Indah and Pasar Minggu. The improvement of the Jakarta-Bogor Railway would contribute to the development around Pasar Minggu.

The area around the junctions of the extension of the Ring Road and the Tangerang Highway, and also, that of the Ring Road and the Bekasi-Highway would be also suitable for commercial and/or administration uses.

Table 2-16 Suitable Land Use by Section

	Section	Topography	Transportation Condition	Land Use Present & Near Future	Present Land Use Regulation	Suitable Land Use
Inside of Ring Road	Ii	Flat		Village	Residential	Residential
	IIi	Undulated		Residential & Village	Residential	Residential
	IIIi	Flat	Conveniate to CBD	Residential	Residential	Residential, Commercial & Administrative
	IVi	Flat	Conveniate to CBD	Residential	Residential & Village	Residential, Commercial & Administrative
	Vi	Flat		Residential & Village	Village	Residential
	VIi	Flat		Village	Village	Residential
	VIIi	Flat		Recreational & Village	Recreational & Village	Residential & Recreational
	VIIIi	Flat	Retain Isolated	Village	Without Regulation	Residential
	IXi	Undulated		Village	Without Regulation	Residential
	Xi	Flat, Partly Swampy		Village	Industrial	Industrial
		(Swamp, Cakung River)				
Outside of Ring Road	Io	Flat		Residential & Village	Residential	Residential
	IIo	Undulated		Residential & Village	Residential & Industrial	Industrial
		(Augke River)				
	IIIo	Partly Undulated		Residential & Village	Residential & Village	Residential
	IVo	Flat		Residential & Village	Residential & Village	Residential & Village
	Vo	Flat		Residential	Residential	Residential
	VIo			Industrial & Village	Industrial & Village	Residential
		(Cipinang River & Ciliwung River)				
	VIIo	Flat		Village & Hankaur	Village & Hankaur	Village & Hankaur
	VIIIo	Flat	Isolated	Village	Without Regulation	Village & Residential
	IXo	Undulated		Residential & Village	Without Regulation	Residential
		Undulated		Industrial & Village	Industrial & Village	Industrial Industrial & Residential
		(Cakung River)				

Fig.2-16
SOIL CONDITIONS

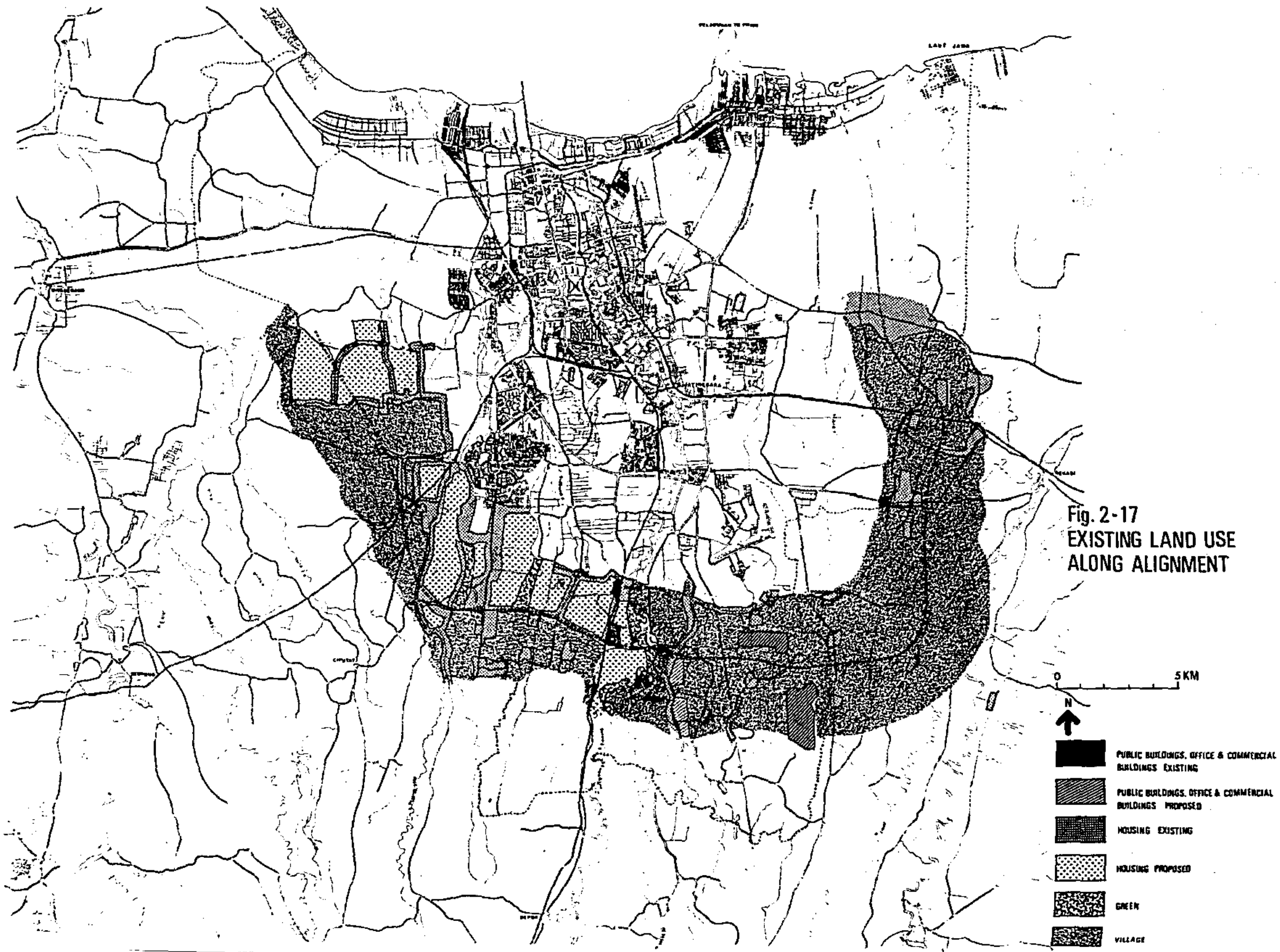


Fig. 2-17
EXISTING LAND USE
ALONG ALIGNMENT

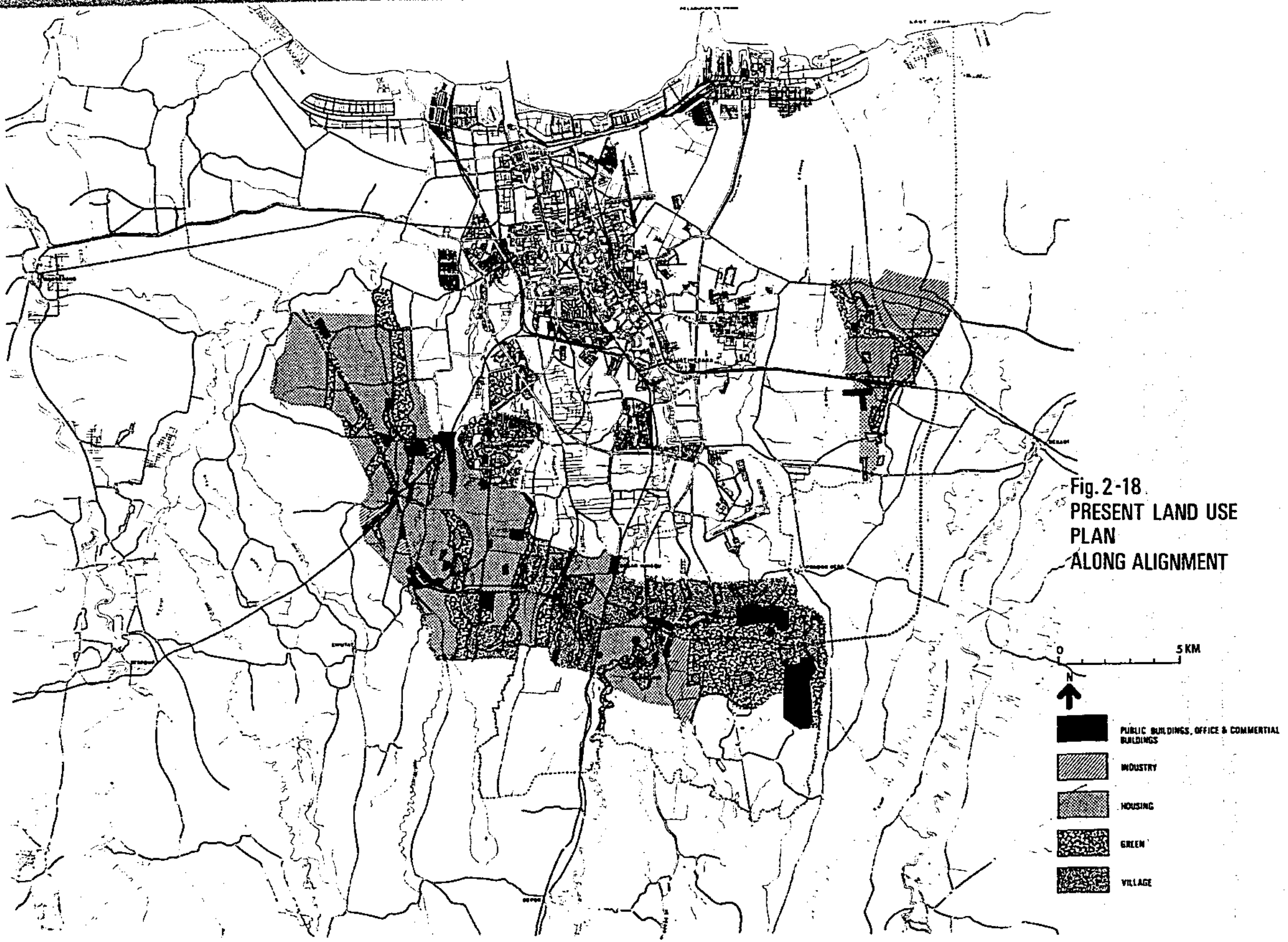


Fig. 2-18
PRESENT LAND USE PLAN ALONG ALIGNMENT

2-3-4 Land Use around Interchanges

The area around interchanges is expected to become more valuable than the rest of the area along the Ring Road alignment in general. Therefore, it would be urged to establish land use regulations as well as the land use planning authorized as quickly as possible. And also, it would be preferable to acquire the land for public or semi-public usage prior to its development, in order to reserve the flexibility in design.

Facilities suitable to the area around interchanges are:

(1) For interchanges near residential areas

within 0.1 km:	Green belt
within 1.0 km:	Parks, gas stations, bus terminals, restaurants, shopping centers, hospitals, banks, post offices, recreational facilities, etc.
within 5.0 km:	Housings, schools, hospitals, etc.

(2) For interchanges near industrial areas

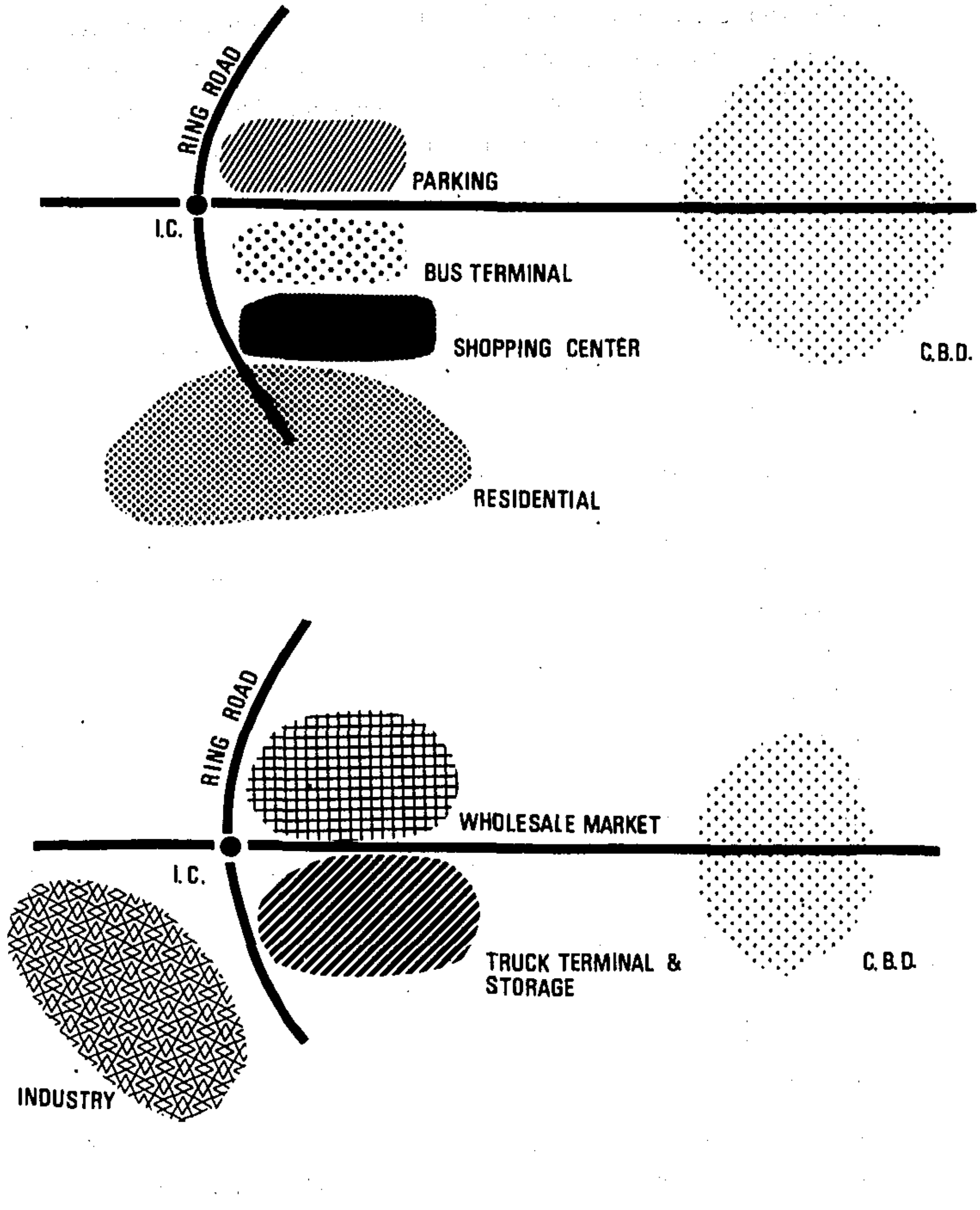
within 0.1 km:	Green belts
within 1.0 km:	Gas stations, cargo terminals (with truck terminals, storages, packing yards, wholesale markets and/or manufacturing facilities), etc.
within 5.0 km:	Industrial parks, research centers, etc.

2-3-5 Cargo Terminals

As the urbanization of DKI Jakarta proceeds, it will become more urgent to establish an efficient cargo traffic system. It is not only for the drastically increasing amount of goods consumption, but also, for freeing the CBD from congestions caused by the large volume of cargo traffics.

For this purpose, not only the organization of road networks or the improvement of vehicles, but also, cargo terminals of an adequate size and a proper location have to be constructed.

Fig. 2-19
EXAMPLES OF FACILITY LAYOUT
AROUND INTERGHANGE



The role of a cargo terminal can be divided as follows:

- Cargo transshipment;
- Storing; and
- Processing/Assembling

Among those listed above, the function of cargo transshipment is most basic. In the case of DKI Jakarta, in addition to it, the function of storing should not be neglected because of the lack of storages in DKI Jakarta. The function of processing/assembling will not be studied assuming that it would be taken care of by adjacent manufacturing facilities.

For alternative locations, we propose four inter-changes on the Ring Road shown below.

Alternative Locations

	A	B	C	D
Inter-change Number	1	9	11	13
Zone Number	16	31	Outside 05 D.K.I.	45
Priority	3	2	(4)	1

Those which will serve for the direction of Bekasi which is considered to become the largest in future are C and D. D which is next to the large industrial area is the best location. Next, B has the second priority because the flow in the direction of Bogor would become the second largest in future. C on the junction of the Ring Road and the Jakarta-Cikampek Highway is also important in terms of the traffic volume, but it has the low priority because of: the land use around; the long distance from the C.B.D., and also, its location outside of the D.K.I. boundary.

The relation between the number of truck terminals and storages, and the amount of goods carried by trucks is as follows:

- a cargo terminal for more than 5,000 tons/day of cargo carried;
- one additional cargo terminal when the amount of cargo exceeds 10,000 tons/day; and then,

- another additional cargo terminal when the amount of cargo exceeds 20,000 tons/day.

From the tonnage of cargo handled at cargo terminals, the proper size of truck terminals and storages can be calculated roughly as shown in Table 2-16.

For a cargo terminal with the function of transshipment and storing, the total ground area for those two facilities is said to be about 1/3 of the total area of a cargo terminal site as a whole including other facilities and the clearances between them. Therefore, when four terminals are constructed in the year, 2000, the total ground area would be about 115 ha with an average ground area of 86 ha per one terminal.

Fig. 2-20 PROJECTION OF GOODS CARRIED BY TRUCKS IN D.K.I. JAKARTA, (INCOMING + OUTGOING)

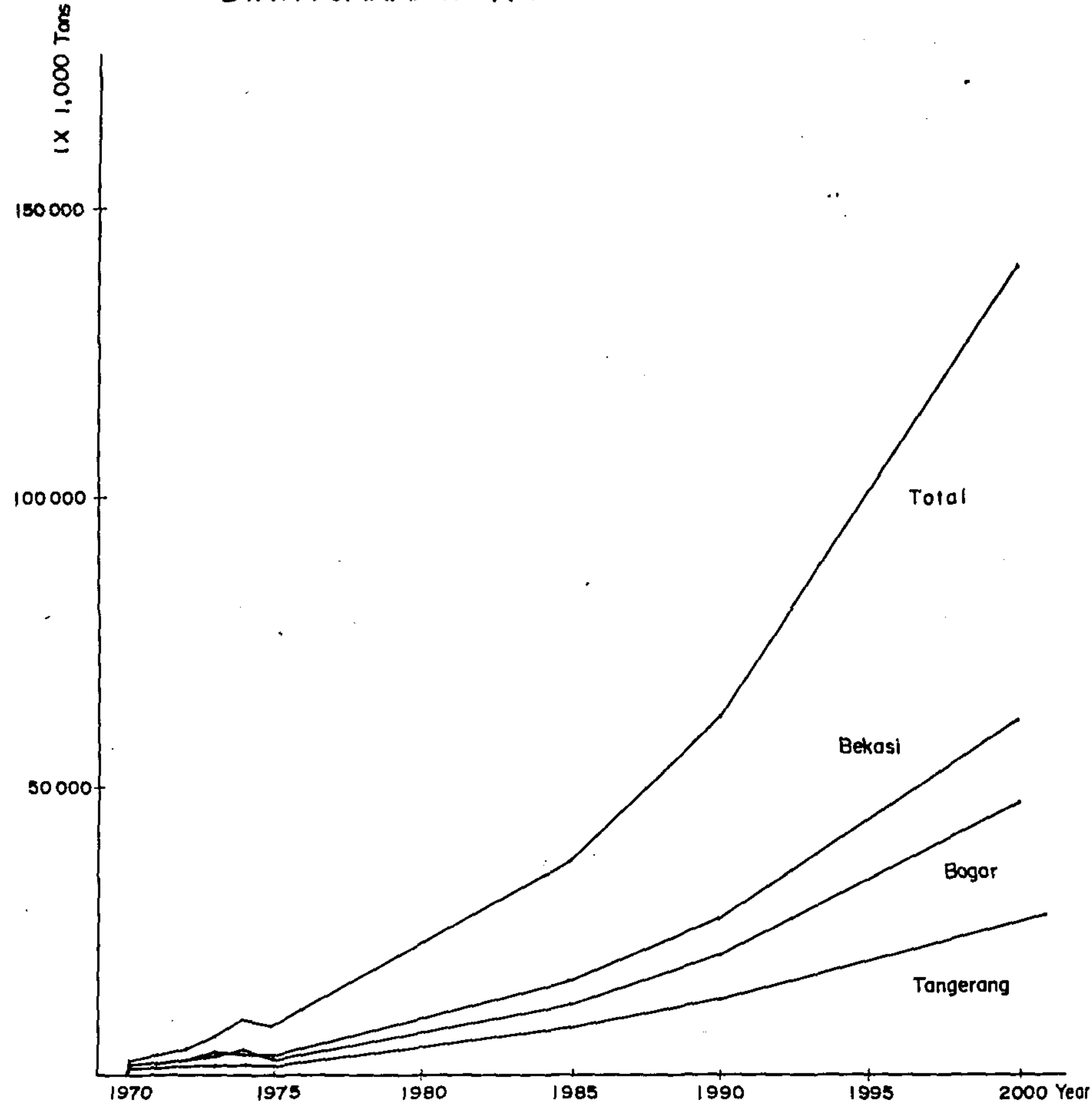


Table 2-17 AMOUNT OF CARGO & SIZE OF TERMINAL FACILITIES

	1985	1990	2000
Cargo Terminal			
- Cargo Handled at Cargo Terminal	1,625 (1,000 tons/ year)	3,914	10,593
- Percentage in Total Cargo Carried by Trucks	2.06 (%)	3.22	4.28
Truck Terminal			
- Cargo Handled at Truck Terminal	812.5 (1,000 tons/ year)	1,957	5,296
	3,250 (tons/day)	7,828	21,186
- Truck Terminal Area	7.5 (Ha)	18.1	48.9
- Number of Berths	108	260	706
Storage			
- Carto Stored	812.5 (1,000 tons/ yera)	1,957	5,296
- Storage Area	10.1 (Ha)	24.3	65.8
- Number of Cargo Terminals Constructed	1	2	3 or 4

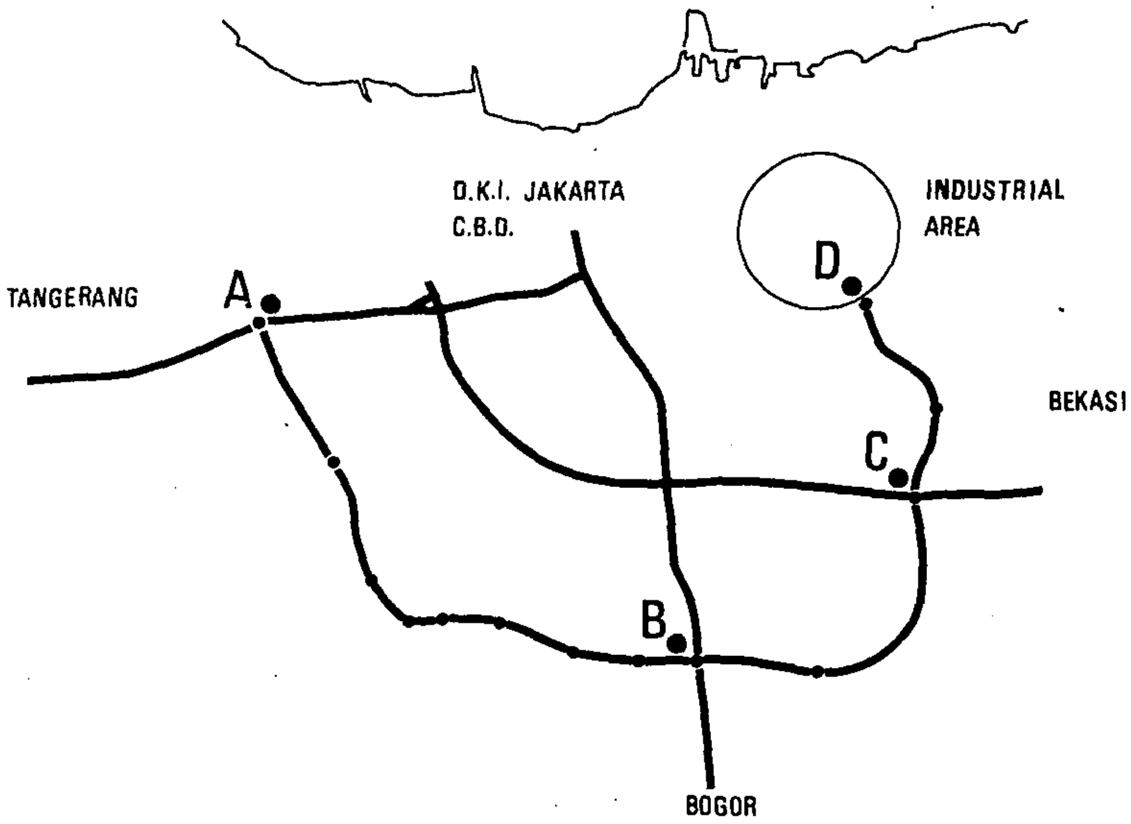
Notes: * Number of Average Cargo Terminal Operating Days per Year: 250 Days/Year.

* Unit Floor Area of Truck Terminal for Tonnage Cargo Handled: M^2/Ton.

* Frequency of Renewal of Cargo Stored: 6.2/Year.

* Unit Floor Area of Storage for Tonnage of Cargo Stored: 0.77 M^2/Ton.

Fig. 2 -21
ALTERNATIVE LOCATIONS OF
CARGO TERMINAL



2.4 Arterial Road Network

2-4-1 Existing Arterial Road Network

The existing arterial road network in DKI Jakarta reflects the pattern of present activities as well as the process of its development.

Roads of the primary importance are: those connect Sunda Kelapa and Tg. Priok with the C.B.D.; and those extend towards Tangerang, Bogor and Bekasi from the C.B.D.

All of those primary roads are radial and they reinforce the concentric pattern of traffic flow in DKI Jakarta, and consequently, traffic congestions in the C.B.D. occur not only at peak hours, but sometimes all day long.

The existing Ring Roads which work for distribution of the incoming traffic over different directions are Jl. Let Jan S. Parman and Jl. Jan. Cratot Subroto.

The existing arterial road network is shown in Fig. 2-22.

2-4-2 Situation of Road Construction, DKI Jakarta

Almost all the primary and secondary roads in DKI Jakarta have been paved by now, but their drainage system is not sufficient enough, causing troubles during rainy seasons. The total length of roads in DKI Jakarta in 1973 was 1,800 km as in Table 2-17. The government maintained and improved those already constructed roads. But after 1974, the construction of additional road networks was started again, due to the economic development and increased traffic volume.

Table 2-18 Roads Construction, DKI Jakarta

Year	Length of road	New road construction	Reconstruction	Up grading
1970	1,011 km	-	235 km	127 km
71	1,046	-	211	37
72	1,317	-	145	33
73	1,845	-	169	39
74	-	6.20 km	7,972 m^2	13
75	-	36,475	37,005 m^2	27,771 m^2

Source: Statistical Yearbook of Jakarta.

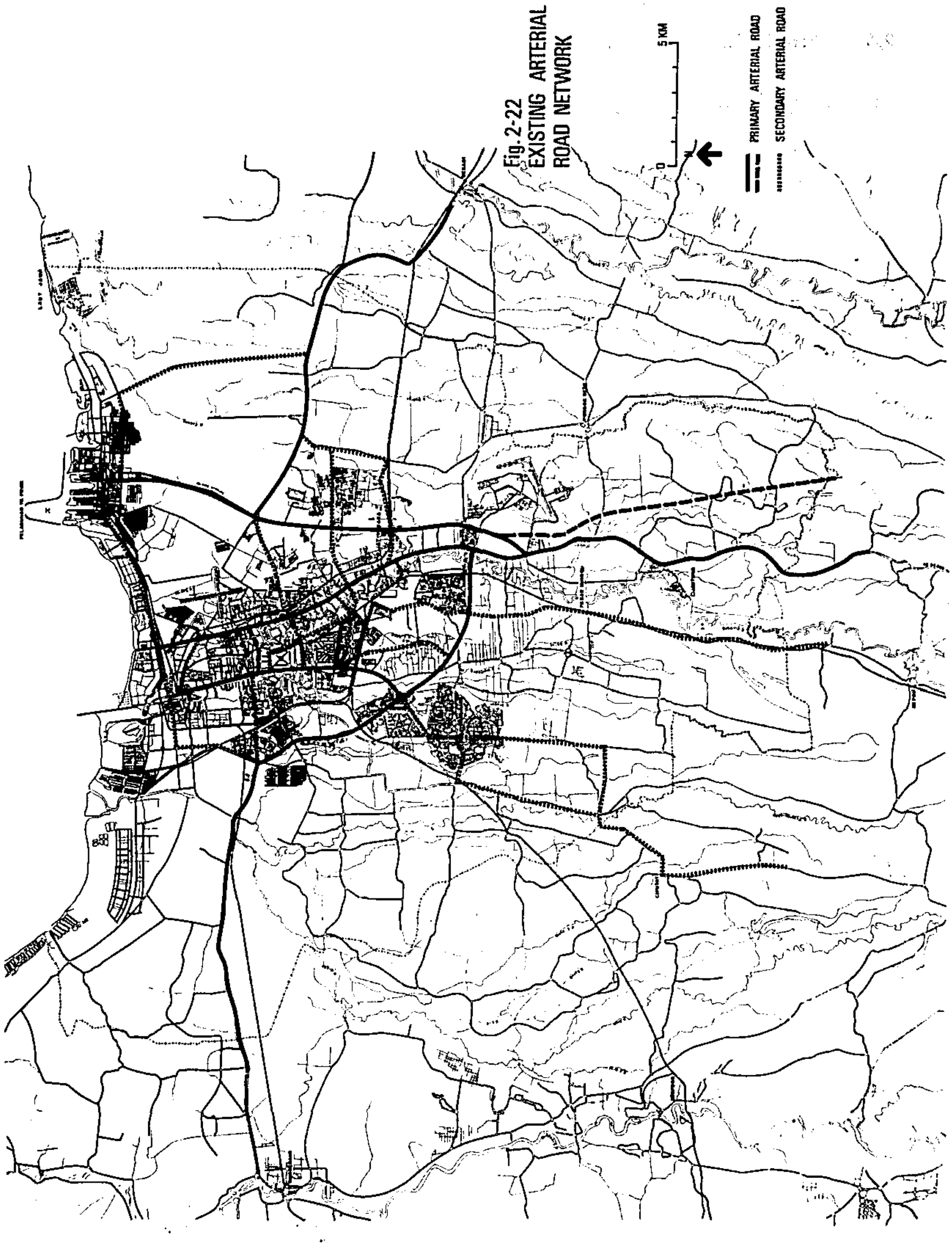


Fig. 2-22 EXISTING ARTERIAL ROAD NETWORK

2-4-3 Future Arterial Road Network Plan

The planning of the future arterial roads network is based on the following policies:

i) Three major Toll-Highways will serve for the incoming and outgoing traffic of DKI Jakarta and they are:

- The Jakarta-Tangerang Highway
- The Jagorawi Highway and
- The Jakarta-Cikampek Highway

ii) One of major roles of the Ring Road is to distribute efficiently the increasing radial traffic over destinations within it, after taking the incoming traffic on the periphery of DKI Jakarta.

iii) The Intra-Urban Toll Road serves mainly for the long distance traffic within DKI Jakarta reducing the congestion in the C.B.D.

iv) The Jakarta-Serpong Highway will be constructed, and also, other highways will be up-graded.

v) Secondary roads in the future traffic situation in DKI Jakarta are studied as a part of the future road network plan as a whole.

The future arterial road network completed in each year is assumed as in Fig. 2-23 after examining the priority among the alternative networks based on the policy mentioned previously.

The condition of the future main highways will be as in the following Table.

	1985	1990	2000
1° Ring Road	Three cases in each target year are going to be studied in this report. They are: Case 1 : Completion of the whole alignment Case 2 : Completion of the west part only Case 3 : Without the Ring Road		
Extention	imcompleted	completed	completed
2° Radial Highways: Jakarta - Tangerang; Jakarta - Cikampek; and - Jagorawi.	completed	completed	completed
3° Intra - Urban Tollway	completed	completed	completed

Note: Extension of the Ring Road is indicated by dots-line in Fig.2-23.

Consequently, the amount of roads constructions between 1976 and 2000 will be as in the table below.

	2 Lanes	4 Lanes	Total
1976 - 1985	49.0 KM	6.0 KM	51.0 KM, 122 LANE, KM
1985 - 1990	41.9	12.3	53.2 , 131
1990 - 2000	42.6	12.2	54.8 , 134

Note: The total length includes lanes added.

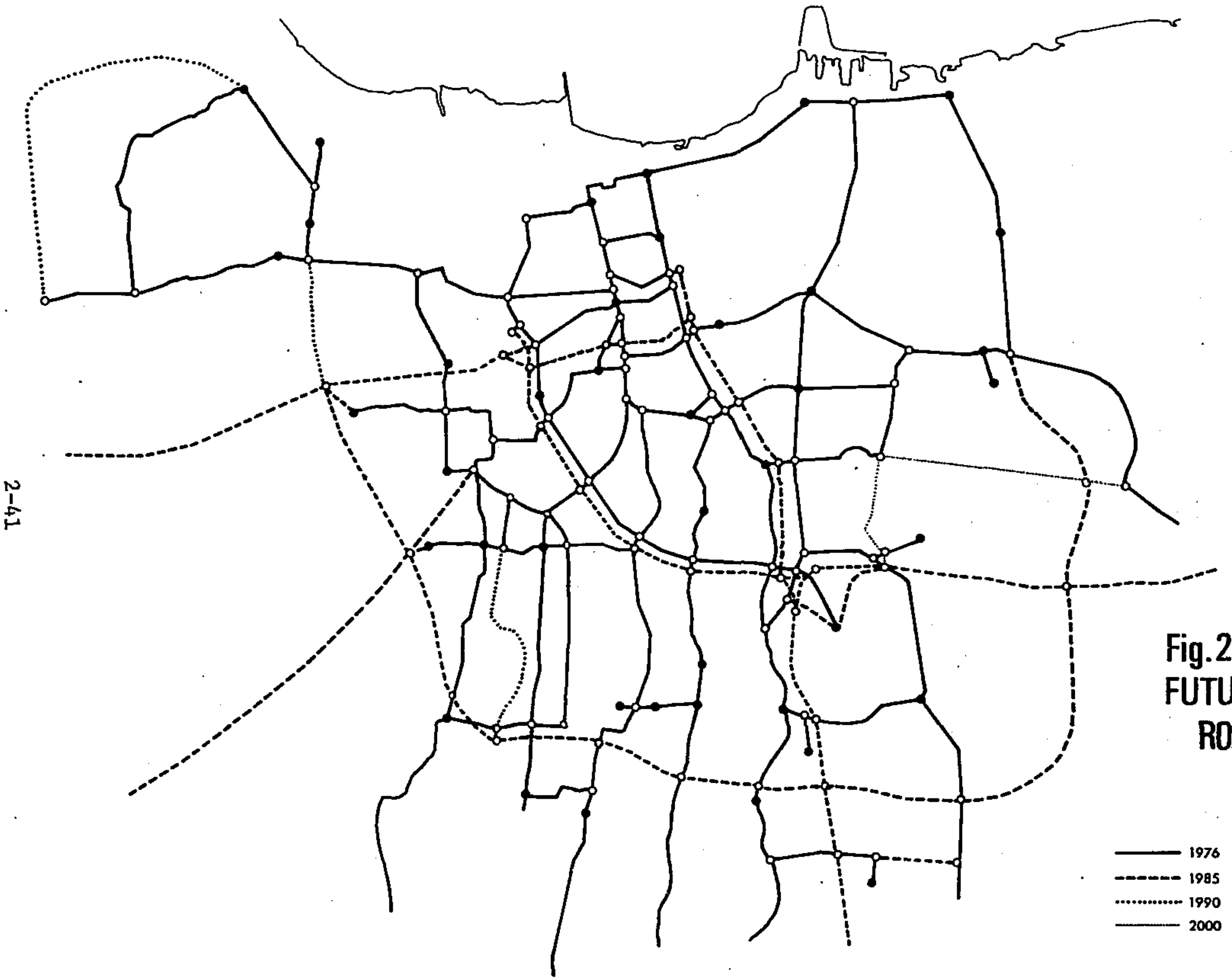


Fig. 2-23
FUTURE ARTERIAL
ROAD NETWORK

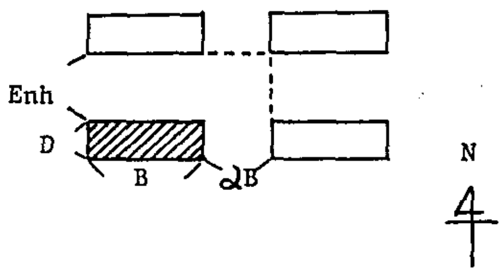
2.5 Land Use Planning, DKI Jakarta

2-5-1 Residential Area

The minimum amount of green within a residential area is indispensable under the tropical climate of DKI Jakarta. Individual houses or terrace houses with green around will make a desirable living condition. Even in a district of high density, high rised apartments should be avoided as far as possible.

In Jakarta during the dry season the wind blows from the east or the north-east and during the wet season from the north or the north-west. The sunshine at a low angle at the moment of sunrise and unset is strong enough to raise the interior temperature quickly. For those reasons, north facing houses with few openings on the east or the west are reasonable to take advantages of this specific climate.

The floor area ratio (F.A.R.) of a residential area with a group of residential buildings can be figured out from those figures in the diagram below. Among those, not only the ventilation or the amount of green, but also, the privacy depend on the ratio between the front clearance and the height of a building. Here, it is assumed to be about 1.5.



where, B = front

D = width

h = floor height: (3m)

n = Number of stories

E = Rate of Front-Clearance to Height: (1.5)

α = Rate of Side-Clearance to Width: (0.2)

$$= \text{F.A.R.} = \frac{DBn}{(D + EnH)\ (B + \alpha B)} \quad \frac{Dn}{(D + EnH)\ (1 + \alpha)}$$

- Individual Houses (n = 1) V = 0.533
- Terrace Houses (n = 2) V = 0.784
- 4 Stories Apartment (n = 4) V = 1.026

By assuming the floor area for a person, S (M^2), the density of a residential area, P, is as follows:

$$P = 10{,}000 \times v/S$$

In a residential area the area reserved for the public facilities of various kinds is usually 50% of the area for residences. Therefore, the density of a residential area as a whole, B, is as follows:

$$P = \frac{10,000 \times v}{1.5 S}$$

In DKI Jakarta the average residential floor area per person is said to be about 12 M^2 according to the government policy. The desirable space is at least 20 M^2. For a residence of more than 2 stories, additional 2 M^2 of a building area is necessary for stair cases. Therefore, the density of a residential area by type of residences is as follows:

	12 M^2/Person	20 M^2/Person
◦ Individual Houses	296 Persons/HA	178 Persons/HA
◦ Terrace Houses	373 Persons/HA	238 Persons/HA
◦ 4 Stories Apartment	489 Persons/HA	311 Persons/HA

A preferable residential area of a mixture of individual houses and terrace houses with 16 M^2 of floor area per person will have the density of 271 persons/HA. For a residential area of terrace houses and medium height apartments in the CBD with the floor area of 12 M^2 per resident, the density can be as high as 430 persons/HA, but in any case the maximum density should be below 490 persons/HA.

In 1976 the residential area in DKI Jakarta was about 20,300 HA including Kampungs. The population of Kampungs was 2,400,000 and the rest was 3,100,000. Therefore, the average density in Kampungs is 418 persons/HA and that of residential areas outside of Kampung was 212 persons/HA. The population density of DKI Jakarta as a whole was 86 persons/HA.

Assuming the total residential area in the year, 2000 to be about 32,800 HA including 6,800 HA of the area of Kampungs, the residential area outside of Kampungs will be 26,000 HA.

The average annual growth rate of the Kampung population is assumed to be about 1.3%, and then, the Kampung population will reach 3,280,000. The population outside of Kampungs will be, therefore, 7,170,000.

So, the average Kampung density will be 483 persons/HA and the density outside of Kampungs will be 276 persons/HA in the year, 2000. So, the capacity of population absorption by residential areas will reach its limit in the year, 2000.

However, in reality, there will be a considerable number of the residential population in the area of other uses. Assuming that the density of residential population in industrial areas is 50 persons/HA and that in commercial areas is 100 persons/HA in the year, 2000, then, the total population in those areas will be 670,000. By taking those into account, the Kampung density would be reduced to 450 persons/HA and the density of the residential area outside of Kampungs would be reduced to 258 persons/HA.

2-5-2 Commercial and Administration Area

In 1971 the contents of work places classified into Sector III were as follows:

Electricity, gas and water Trade,. restaurant and hotel Financing and Insurance	33.3%
Transportation and communication	12.7%
Community, social and personal services	42.0%
Undefined	12.0%

In terms of their location, work places in Sector III are divided into two groups: ones located within commercial and administration areas; and those outside.

It is assumed that the number of work places outside of commercial and administration areas is 35% of the total work places in Sector III, and that it would be reduced to around 25% in the years, 2000, because of the increase of large scale organizations located in the CBD.

The distributions of work places within and outside of commercial and administration areas in each zone are done in proportion to the total floor area of commercial and administration facilities in each zone for the former group, and the total residential population for the latter group.

(1) Concentrated scheme

According to 'The Master Plan of DKI Jakarta, 1965-1985,' the number of work places per unit area will be about 160/HA in the year, 2000, and then, the total area of commercial and administration areas will amounts to 3,212 HA in the year, 2000, when the projected number of work places in Sector III is applied.

From the 'F.A.R. Regulation Map,' the average of the maximum F.A.R. in each zone in the CBD can be measured. The ratio between the actual F.A.R. in 2000, the F.A.R. of buildings constructed and the maximum F.A.R., is assumed as follows:

C.B.D.	0.60
Outside of C.B.D.	0.35

The B.A.R., Building Area Ratio or the ratio between the building area and the ground area, in commercial and administration areas is assumed as follows:

C.B.D.	0.85
Outside of C.B.D.	0.90

Then, the ratio between the actual floor area and the ground area by zone would be as shown in Table 2-18, and the total floor area in the commercial and administration area will be 2,961 HA in the year, 2,000. The unit floor area per work place will be 14.9 M^2 and this is considered to be a reasonable number.

This 'Concentric Scheme' of the CBD generally shares its basic concept with 'The Master Plan of DKI Jakarta, 1965-1985,' and it aims at the continuous enlargement of the present CBD. However, a rough estimate of the commuting population to the enlarged CBD is proved to exceed the capacity of the future road networks. This is why the 'Dispersed Scheme' of the commercial and administration facilities has to be studied.

(2) Volume of commuting traffic and capacity of traffic networks

In the 'Concentrated Scheme' previously mentioned, the number of work places in Sector III in the CBD is estimated to be 1,085,000 and the employed population in Sector III to be 277,000. In the same scheme the number of work places in Sector III in DKI Jakarta as a whole is 2,656,000, and so, those outside of the CBD amount 1,571,000.

The employed population in Sector III in DKI Jakarta is 2,183,000, and so, the commuting population into DKI Jakarta is:

2,656,000 - 2,183,000 = 473,000

And the commuting population into the CBD from outside of DKI Jakarta is:

473 x 1,085/2,656 = 193,000

The number of employed population in DKI Jakarta, and at the same time, outside of the CBD is:

2,183,000 - 277,000 = 1,906,000

In this employed population, the number of people who commute into the CBD is:

1,906,000 x 1,085,000/2,656,000 = 779,000

As a result, the total of commuting from the outside of the CBD into the CBD is:

193,000 + 779,000 = 972,000

Assuming that during the peak hour, from 8:00 AM to 9:00 AM, 50% of the total commuting would occur, the number of commuting population is 486,000.

The capacity of commuting into and from the CBD is checked by setting 17 nodal points shown in Table 2-24, and it is estimated to be 560,000 cars/day. In addition to it, the commuting by the Intra Urban Highway is estimated to be 152,000 cars/day.

Besides that, amount, the capacity of the numb r of narrow streets is taken into account, 5%. Then, the total capacity of the future road network crossing the boundary of the CBD would be 747,000 cars/day in total in the year, 2000.

According to the survey, the capacity during peak hours reaches 8% of a day, and also, that the number of passengers carried by a vehicle during peak hours is 13 persons/vehicle.

Therefore, the total capacity of the future road networks would be:

$$747{,}000 \text{ cars/day} \times 0.08 \times 13 = 777{,}000 \text{ persons/hour}$$

Those carried by the railway would be about 28,000 persons/hour by our estimation.

Then, the total capacity of commuting into and from the CBD would reach 805,000 persons/hour, and that of one way would be 50% of it, 402,500 persons/hour.

'Dispersed Scheme'

By the studies mentioned above, it has become necessary to allow only the amount of work places which generate the traffic not exceeding the capacity of the future traffic networks. In other words, the balance between the development of the CBD and the traffic facilities planned has to be kept. Then, the amount of work places which has to be removed is:

$$\frac{\text{Capacity of Traffic Networks}}{\text{Commuting Population}} = \frac{402.5}{486.0} = 0.8$$

In dispersing the commercial and administration areas along the Ring Road alignment, those areas of the south of Pondok Indah and Pasar Minggu are suitable as mentioned in '2-3-3 Land Use along the Ring Road.' In the 'Dispersed Scheme' the floor area reduced from the CBD and its surroundings is distributed into sub-centers.

The total ground area of the commercial and administration land use in the 'Dispersed Scheme' is about 10% smaller than that in the 'Concentrated Scheme' due to the lower F.A.R. on the periphery than in the CBD.

Fig. 2-24
MAXIMUM FLOOR
AREA RATIO OF
C.B.D., JAKARTA

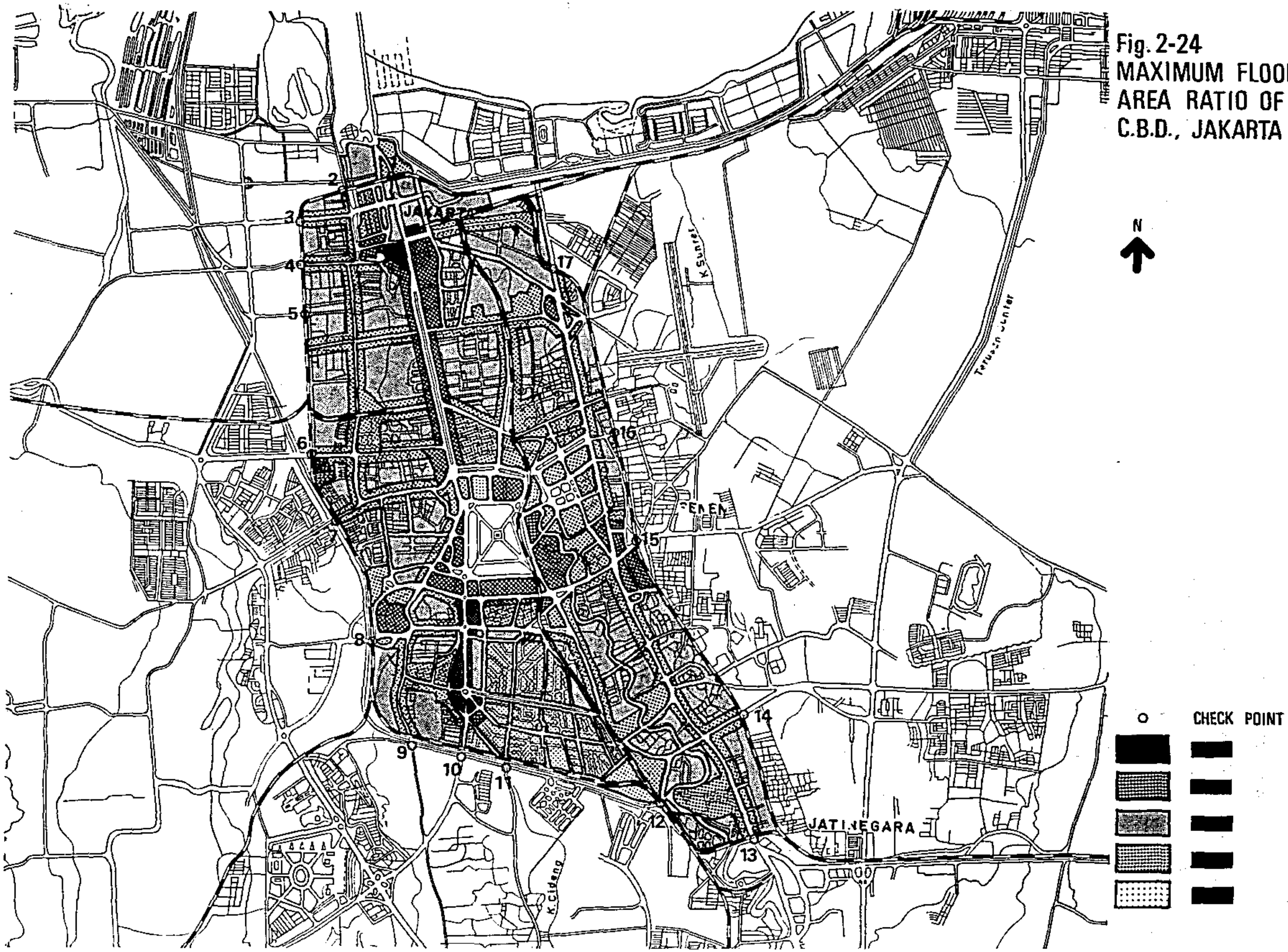


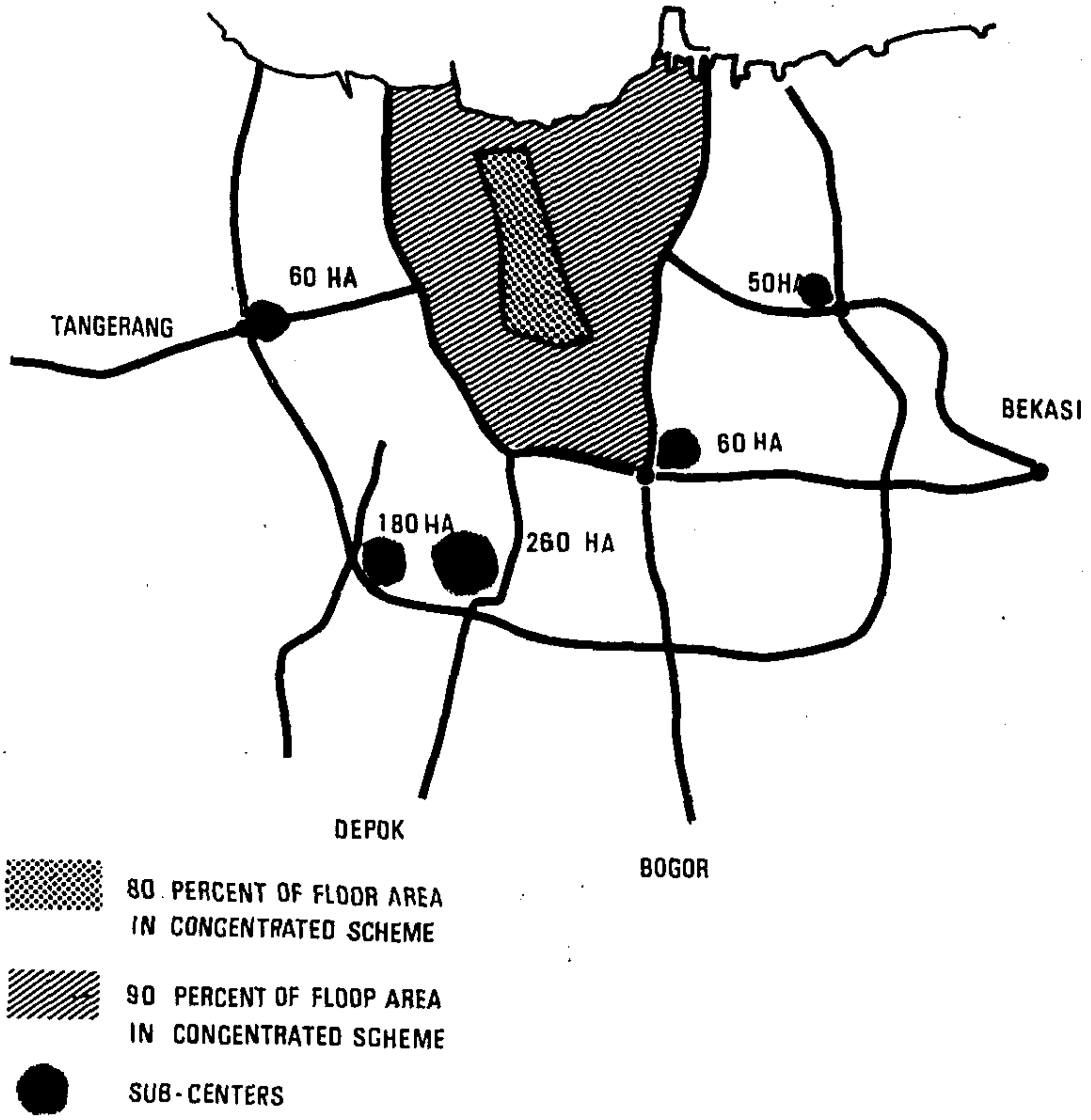
Table 2-19 EMPLOYMENT AND WORK PLACES IN C.B.D., 2000

	Commercial & Administration Area, (Ha)	Average Floor Area Ratio, (%)	Floor Area, (Ha)	Work Places, (x 1,000)	Number of Employee (x 1,000)
1	331	164	543	364.4	27.1
2	177	141	250	167.8	24.0
4	203	149	302	202.7	64.0
5	75	167	125	83.9	21.5
6	38	63	24	16.1	19.7
12	207	148	306	205.4	84.4
31	48	140	67	45.0	36.6
C.B.D. Total	1,079	150	1,617	1,085.3	277.3

Note: The percentages of the area within C.B.D. in the following zones are:

Zone No.	Percentage
5	50%
6	30%
12	70%
31	30%

Fig.2-25
COMMECIAL AND/OR ADMINISTRATION DISTRICTS IN DISPERSED SCHEME



2-5-3 Industrial Area

Because of the wind direction in DKI Jakarta, it should be avoided to locate large factories with obnoxious effects on the environment on the northern coast. In 'The Master Plan of DKI Jakarta, 1965-1985' the industrial area is largely concentrated on Progadung Area and it would be better to be dispersed. Industries which should be close enough to their market would be better to be located along the Ring Road alignment, preferably outside, and those which should be close to the sources of materials should be located in the local area.

According to 'The Master Plan of DKI Jakarta, 1965-1985,' the number of work places classified into Sector II per unit area is 160/HA. When the projected total number of work places is applied, the industrial area amounts to 6,950 HA.

2-5-4 Others

(1) Institutional area (administration excluded)
The area for institutional facilities, namely schools, hospitals, etc., was 570 HA in 1973, and this was 1,146 M^2 for a person. Assuming that it will be in proportion to the population of DKI Jakarta, 1,205 HA will be necessary in 2000.

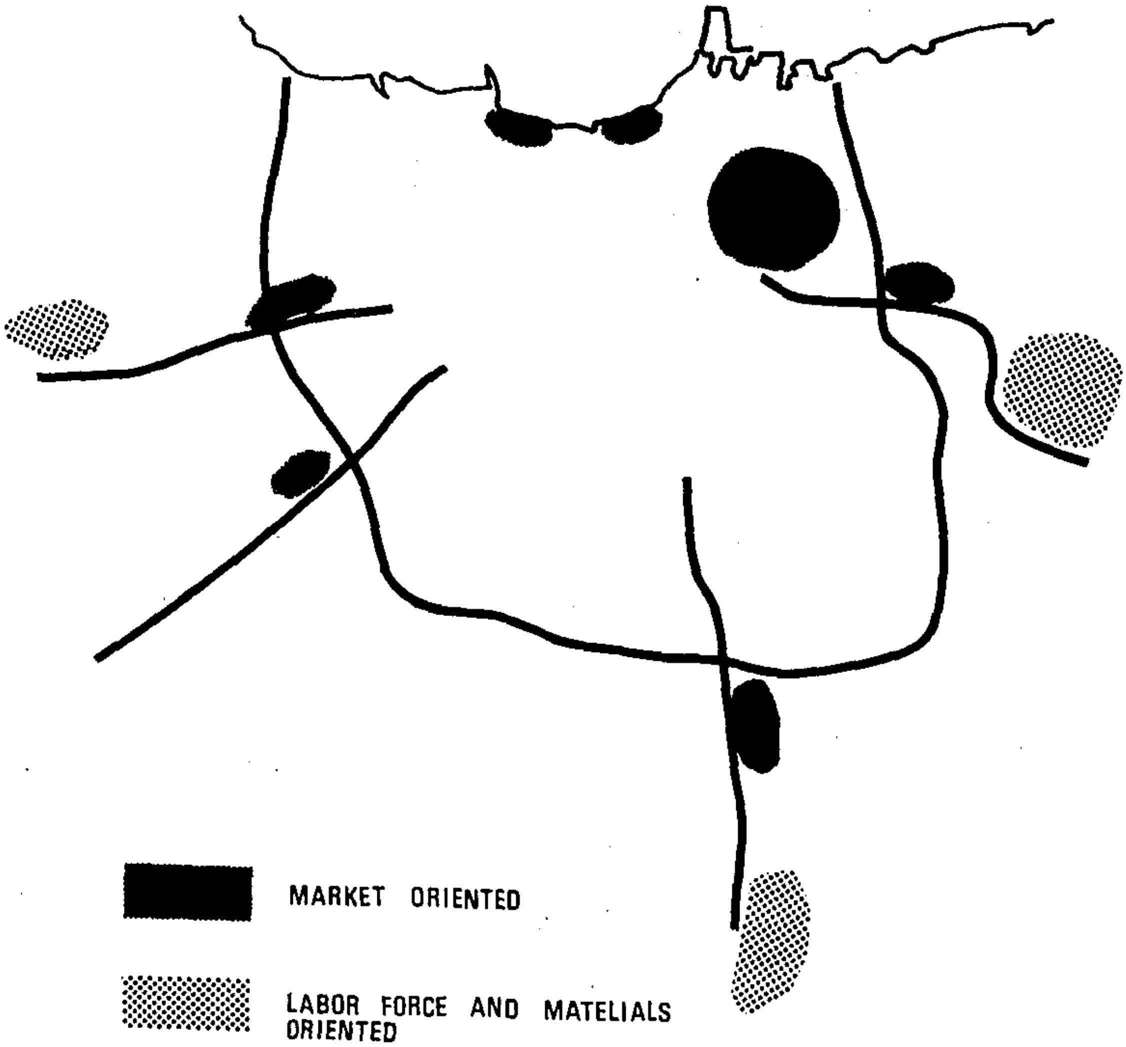
(2) Agricultural area
According to the 'JMATS' report, the area reserved for the agricultural area will be transformed to residential areas, and also, the number of work places in Sector I per unit agricultural area will increase in future.

Assuming that the total agricultural area would be reduced to 7,663 HA in 2000, the number of work places in Sector I per unit area, 2.1 / HA can be obtained by applying our projection of work places in Sector I.

(3) Open spaces
The land uses which fall onto this category are:

- Area reserved for infrastructure;
- Park area; and
- Green

Fig. 2-26
MANUFACTURING INDUSTRY LOCATIONS



The total amount of Open Spaces in 1973 was 12,300 HA which was about 18.7% of DKI Jakarta, and this would increase slightly in the year, 2000 to 13,780 HA, 21%.

Assuming that the area for infrastructures will occupy 10% of the total area of DKI Jakarta, the recreational areas, namely Parks and/or Green, would be 11%, 7,218 HA. This is about 7 M^2 per resident.

2-5-5 Land Use Framework

From the present land use and our land use plan in 2000, the land use situation at the intermediate points, 1985 and 1990, can be obtained, Table 2-20.

Residential, Commercial and Administration, and Industrial Area are figured out by applying the intermediate number of work places per unit area. Institutional area is in proportion to the total population. And other statistics are by straight line projections.

Table 2-20 D.K.I. JAKARTA LAND USE

	1971	1973	1976	1985	1990	2000 (Concentrated)	2000 (Dispersed)
Total Residential Population, (x 1,000)	4,631	5,052	5,640	7,720	8,730	10,510	10,510
Non-agricultural Population (%)	96.4	96.9	97.5	98.7	99.0	99.5	99.5
Non-agricultural Population (x 1,000)	4,464	4,895	5,489	7,620	8,643	10,459	10,459
Residential Area, (Ha)	17,031	18,323	20,330	26,458	28,906	32,810	32,810
Average Density in Residential Area, (Person/Ha)	262	267	270	288	299	319	319
Kampung Area, (Ha)	5,500	5,600	5,743	6,100	6,300	6,800	6,800
Kampung Population, (x 1,000)	2,200	2,300	2,401	2,700	2,900	3,284	3,284
Kampung Density, (Persons/Ha)	400	411	418	443	460	483	483
Residential Area excluding Kampung, (Ha)	11,531	12,723	14,587	20,358	22,606	26,010	26,010
Total Residential Popluation excluding Kampung Population (x 1,000)	2,264	2,595	3,088	4,920	5,743	7,173	7,173
Density in residential area outside of Kampung (Persons/Ha)	196	203	212	237	254	276	276
Total Employed Population in Sector II, (x 1,000)	206	240	303	555	721	1,112	1,112
Employed Population in Industrial Area (x 1,000)	124	146	187	360	480	778	778
Industrial Area, (Ha)	867	1,032	1,355	2,813	3,902	6,950	6,950
Second Industry Employee per Ha.	143	141	138	128	123	112	112
Total Employed Population in Section III	996	1,103	1,278	1,841	2,134	2,656	2,656
Employed Population in Commercial and Administration Area, (x 1,000)	647	725	852	1,285	1,528	1,992	1,992
Commercial and Administration Area, (Ha)	1,256	1,395	1,598	2,270	2,616	3,212	3,509
Tertial Industry Employee per Ha.	515	522	533	566	584	620	568
Institutional Area, (Ha)	524	570	646	885	1,001	1,205	1,205
Agricultural Population, (x 1,000)	42	40	38	29	25	16	16
Agricultural Area, (Ha)	33,737	32,000	29,223	20,267	15,940	7,663	7,663
Agricultural Population Per Ha.	1.24	1.25	1.30	1.43	1.57	2.09	2.09
Green, Utility, etc., (Ha)	12,205	12,302	12,468	12,927	13,255	13,780	13,483
Percentage to whole area	18.6	18.7	19.0	19.7	20.2	21.0	20.5
Total Area, (Ha)	65,620	65,620	65,620	65,620	65,620	65,620	65,620

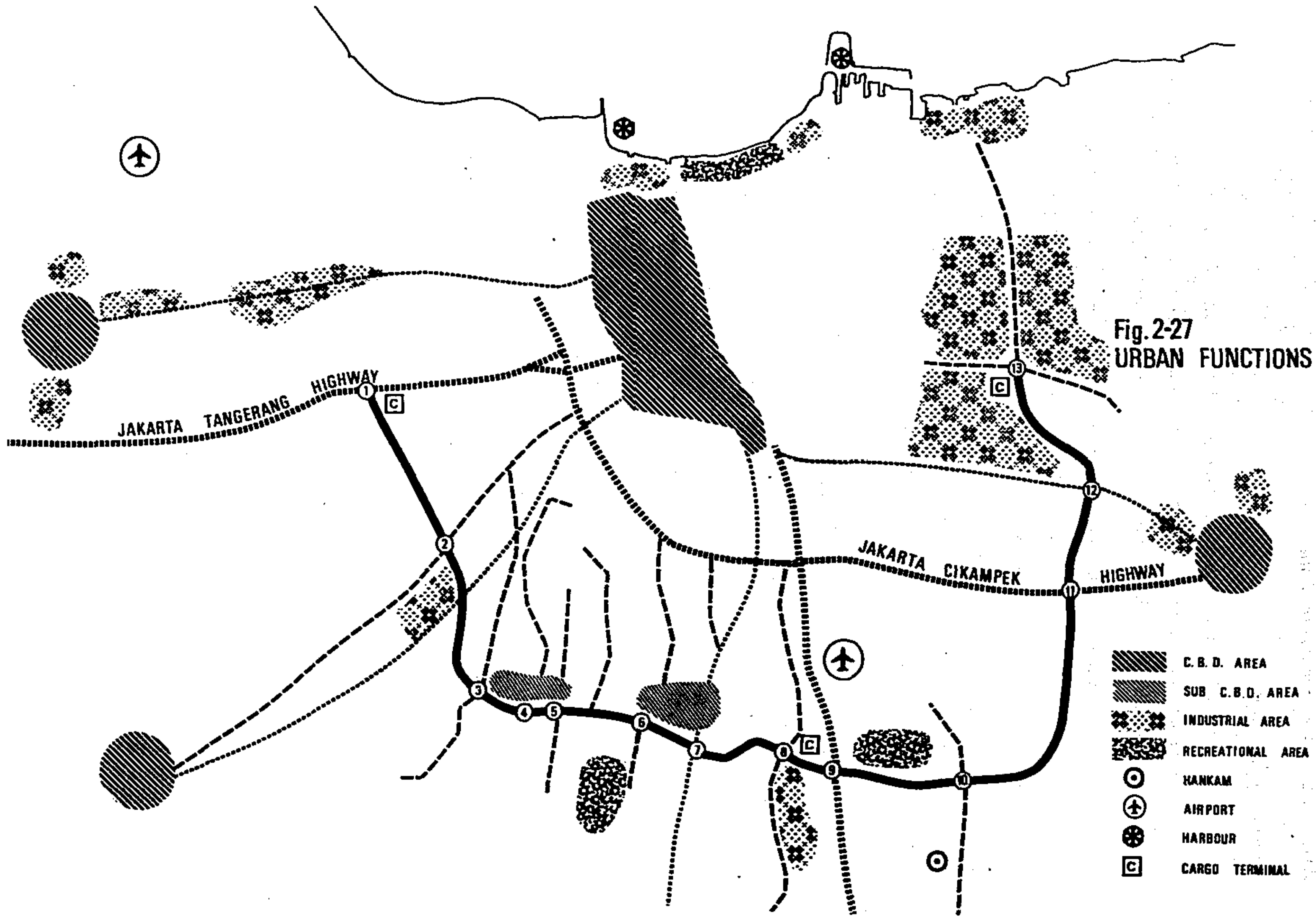


Fig. 2-27
URBAN FUNCTIONS

2.6 Forecasted Figures by Zone

2-6-1 Land Use

By reducing the area of the Seribu Island from the total of Kecamatans in DKI Jakarta, the total area of the fourty one zones dealt with in this report can be obtained.

On the 'Zoning Map' the area of each zone can be measured, and then, it is distributed into four major land uses referring to those maps as follows:

- Land Use Map, DKI Jakarta, 1973
- DKI Jakarta Land Use Plan, 2000, Dispersed Scheme
- DKI Jakarta Land Use Plan, 2000, Concentrated Scheme

2-6-2 Residential Population in Jakarta by Zone

a) Present residential population
The 'Kecamatan' population can be found in 'statistic Wilayah DKI Jakarta 1970-1976.' By adding up the populations of 'Kacamatans,' the population of each zone can be obtained.

In case of boundary line cuts across a 'Kecamatan,' the population of the smaller administrative unit, 'Kelurahan,' was used instead.

b) Future residential population
By projecting the population development in the past while taking the area of residential land uses and its density into account, the residential population in the year, 2000, are figured out.

The density in residential areas is kept lower than 500 person/HA.

2-6-3 Residential Population in BoTaBek Area by Zone

Approximately, the population of 8,590,000 is assumed in the 'BoTaBek' area in the year, 2000. Here, the distribution of the increased portion of it is going to be studied.

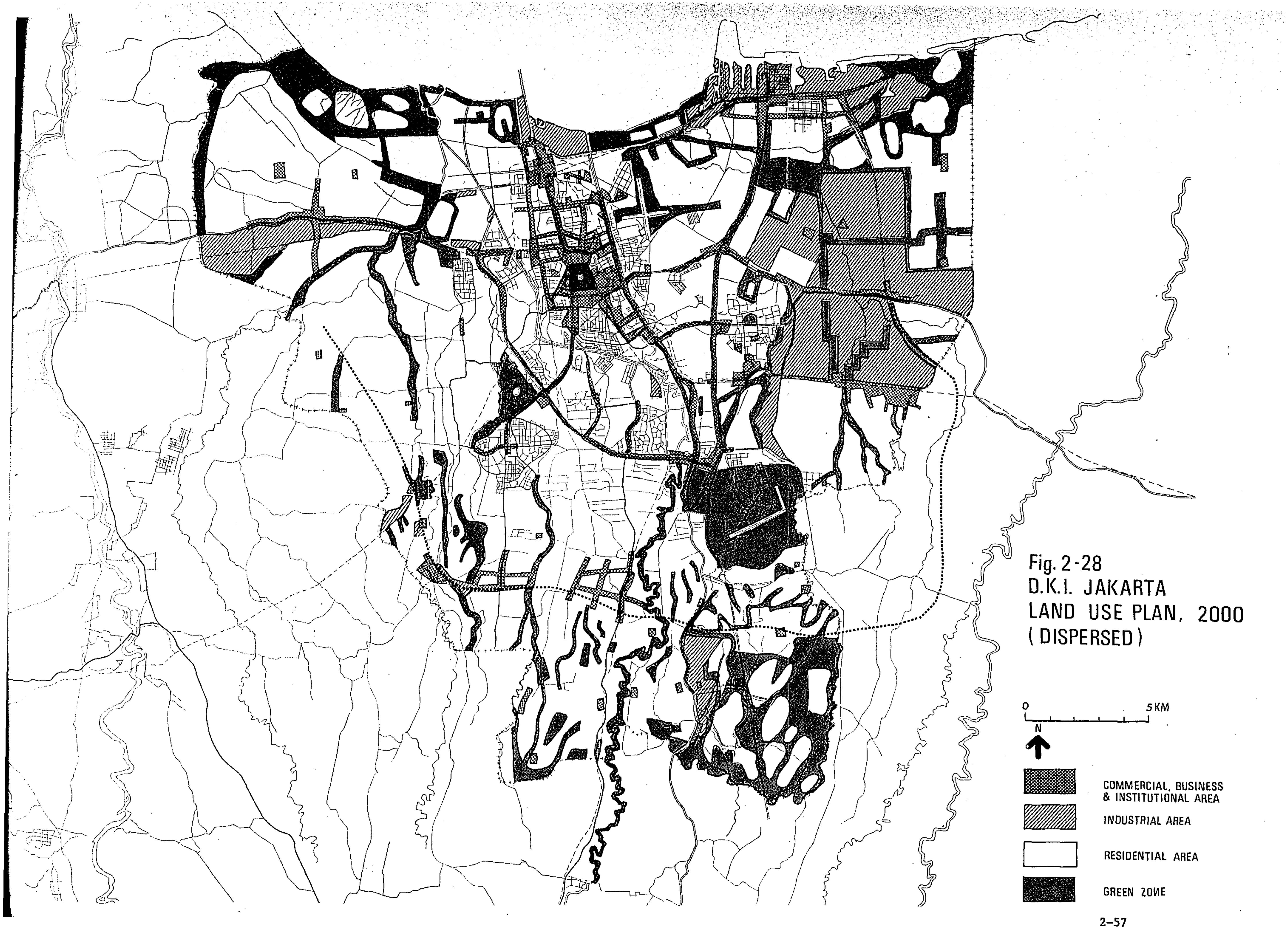


Fig. 2-28
D.K.I. JAKARTA
LAND USE PLAN, 2000
(DISPERSED)

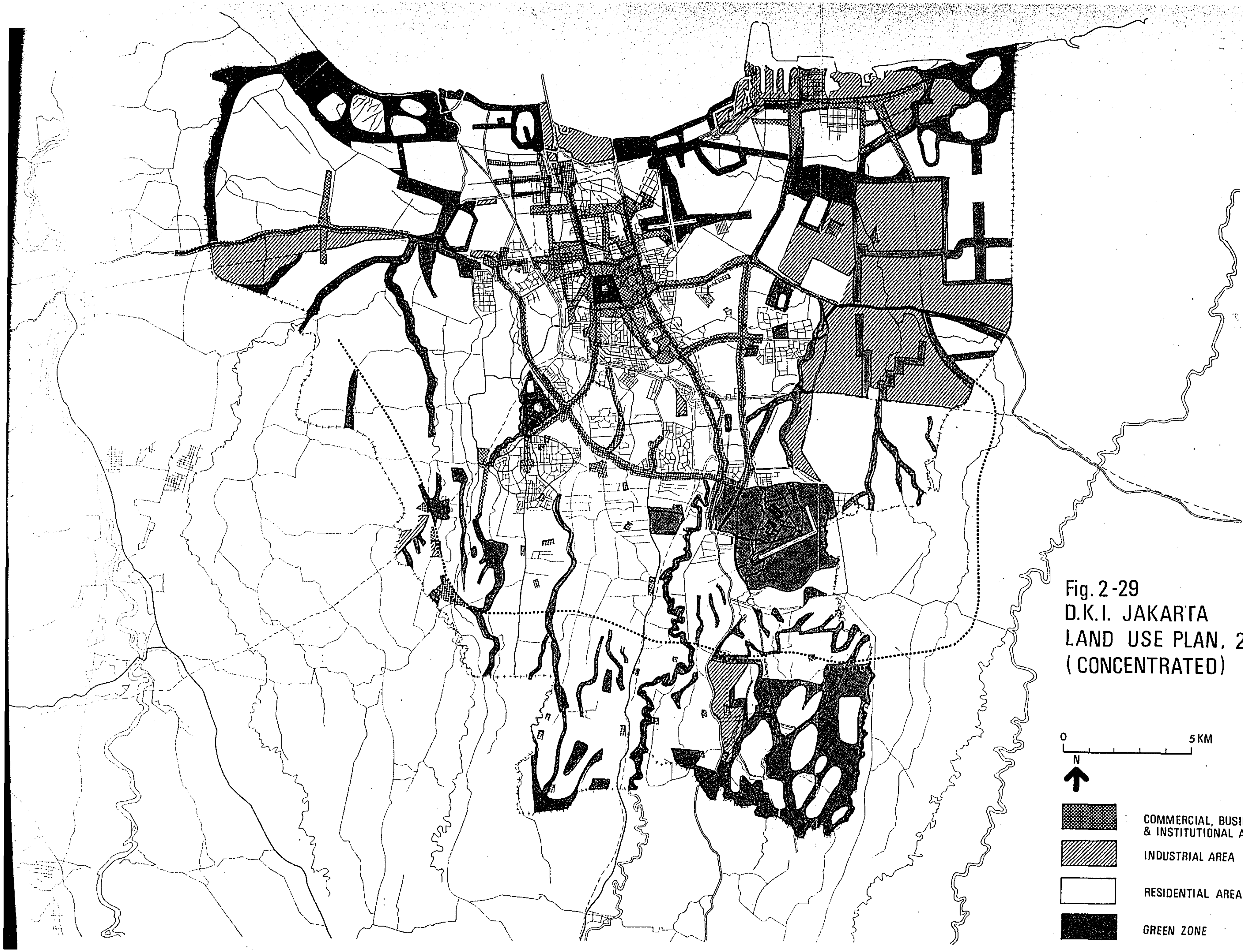


Fig. 2-29
D.K.I. JAKARTA
LAND USE PLAN, 2000
(CONCENTRATED)

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N

COMMERCIAL, BUSINESS & INSTITUTIONAL AREA
INDUSTRIAL AREA
RESIDENTIAL AREA
GREEN ZONE

Table 2-21 Land Use in D.K.I Jakarta

Zone	Area	Land Use	1973	2000 (Concen-trated)	2000 (Dis-persed)
1	787.7	Resid. Comm. Ind. Others	376.5 189.7 9.5 212.0	253 331 0 203.7	265
2	590.6	"	211.4 101.0 85.6 192.6	220 177 73 120.6	142
3	1443.7	"	980.4 46.9 39.0 377.4	963 183 10 287.7	165
4	1082.5	"	649.6 156.7 9.7 266.5	610 203 0	162
5	1049.9	"	656.3 81.0 9.4 303.2	400 149 0 500.9	127
Pus-at		"	2874.2 575.3 153.2 1351.9	2446 1043 83 1382.6	861
6	2362.4	"	718.5 67.1 167.8 1409	900 126 242 1094.4	113
7	2362.8 (2493.6)	"	893.1 10.0 96.8 1362.9	1100 84 335 843.8	76
8	2821.7	"	445.8 30.9 110 2235	640 165 605 1411.7	165
9	1443.7	"	23.1 0 11.5 1409.1	300 24 428 691.7	24
10	2756.1	"	55.5 00 0 2700	840 64 620 1232.1	64

Zone	Area	Land Use	1973	2000 (Concen-trated)	2000 (Dis-persed)
11	2001.5	Resid. Comm. Ind. Others	68.1 0 0 1933.4	500 6 0 1495.5	6
Uta-ra	13748.2	"	2204.1 108.0 386.1 11050	4280 469 2230 6769.2	448
12	2099.9	"	1383.8 187.9 44.1 484.1	1240 295 78 486.9	224
13	721.8	"	467.7 20.5 6.5 227.1	480 51 0 190.8	48
14	1049.9	"	192.2 4.8 3.1 849.8	620 24 10 405.9	24
15	656.2	"	188.3 1.8 0.7 465.4	520 32 0 104.2	32
16	1903.0	"	262.6 24.3 0 1616.1	1600 28 0 275	28
17	2428.0	"	372 2.8 0 2053.2	1100 24 835	24
18	2165.5	"	534.9 11.2 0 1619.4	1550 37 0 578.5	97
19	2099.9	"	558.6 5.0 2.1 1534.2	1200 40 0 859.9	40
Band	13124.2	"	3960.1 258.3 56.5 8849.3	8310 531 923 3860.2	517

Zone	Area	Land Use	1973	2000 (Concen-trated)	2000 (Dis-persed)
20	1837.4	Resid. Comm. Ind. Others	1346.8 86.1 49.6 354.9	1060 187 45 545.4	165
21	2362.4	"	876.5 52.5 66.2 1367.2	1800 75 60 427.4	75
22	2099.9	"	1178.0 103.1 8.4 810.4	1195 136 10 758.9	226
23	1181.2	"	513.8 23.7 13.0 630.7	850 35 25 271.2	35
24	525.0	"	160.1 3.9 0 361	420 5 0 100	45
25	721.8	"	98.9 4.0 0 618.9	560 5 0 156.5	185
26	787.5	"	105.5 13.8 1.6 666.6	700 5 0 82.5	45
27	2165.5	"	233.9 11.2 2.2 1918.2	1800 27 0 338.5	27
28	918.7	"	209.5 17.3 2.8 689.1	800 13 0 105.7	13
30	1312.4	"	302.0 0 0 1010.4	1005 29 65 213.4	29
Sel-atan	14568.0	"	5199.5 321.1 148.4 8899	10645 596 205 3122	1018

Zone	Area	Land Use	1973	2000 (Concen-trated)	2000 (Dis-persed)
31	1968.6	Resid. Comm. Ind. Others	1112.2 44.1 92.5 719.8	1185 161 138 484.6	145
32	1640.5	"	810.5 52.7 32.8 744.5	650 203 30 757.5	263
33	2362.4	"	134.7 9.0 2.1 2216.6	400 10 20 1932.4	10
34	459.3	"	131.6 2.0 11.3 314.4	300 8 10 10	8
35	656.2	"	123.9 4.3 3.1 524.9	450 5 0 201.2	5
36	1246.8	"	137.5 1.6 2.4 1105.3	540 15 0 691.8	15
37	1771.8	"	243.3 6.0 78.1 144.4	780 39 245 707.8	39
38	2524.8	"	271.0 7.1 0.8 2345.9	655 31 0 1938.8	31
39	2165.5	"	470 2.4 0 1693.1	1530 57 215 343.5	57
40	2231.1	"	420.0 4.0 65.2 1741.9	170 21 1675 365.1	21

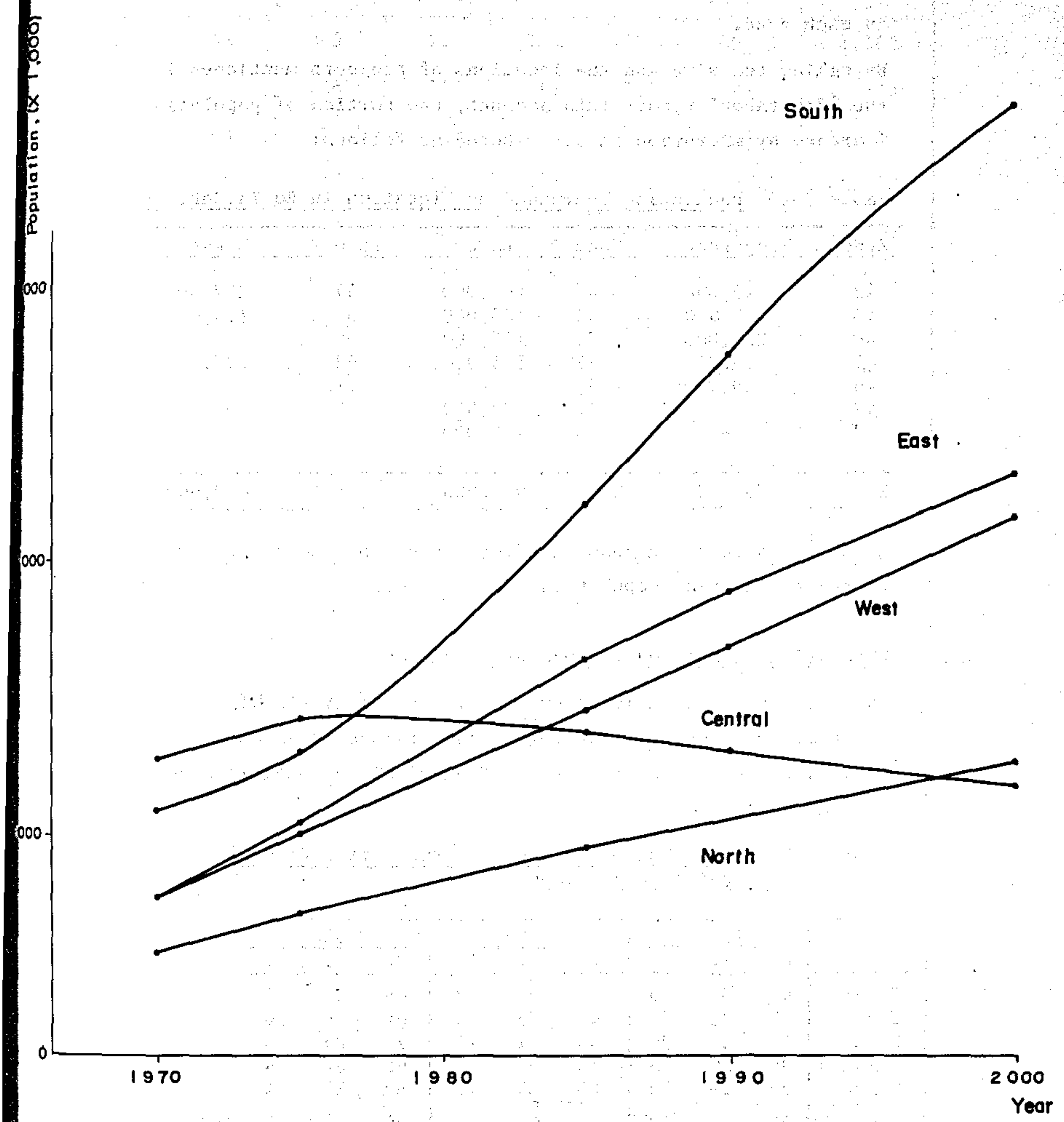
Zone	Area	Land Use	1973	2000 (Concen-trated)	2000 (Dis-persed)
41	1968.6	Resid. Comm. Ind. Others	231.0 0 0 1737.6	450 21 1175 322.6	71
Ti-mur	19095.6	"	4085.7 133.2 288.3 14588.4	7130 571 3508 7886.6	665
DKI Ja-kar-ta	65490 (65621)	"	18323.6 1395.9 1032.5 44738	32810 3212 6949 22519	3509

Table 2-22

Residential Population of D.K.I Jakarta by Zone (x1,000)

Zone No.	1970	1971	1973	1975	1976	1985	1990	2000
1	162.8	168.7	175.8	171.9	169.4	150	140	124
2	166	168.9	173.9	183.4	184.4	168	145	110
3	367.3	380.2	418.0	444.7	453.6	478	320	293
4	317.3	304.4	313.2	332.4	334.5	335	320	293
5	264.0	247.5	259.8	287.2	273.9	257	239	196
Central Jakarta	1278.2	1269.7	1340.7	1419.6	1414.5	1388	1318	1185
6	187.4	174.9	192.4	212.2	213.2	265	283	300
7	137.4	151.8	169.4	188.3	190.5	260	287	320
8	233.9	243.3	263.4	255.0	294.4	334	332	320
9	7.0	7.4	8.5	10.0	12.6	47	70	110
10	10.2	10.5	12.0	13.7	14.3	45	75	135
11	8.8	4.7	5.3	6.2	6.1	25	40	75
North Jakarta	584.7	592.6	651.0	715.4	731.1	976	1087	7260
12	509.0	534.3	586.3	622.7	630.0	670	645	600
13	114.8	127.9	143.9	160.6	161.5	198	206	215
14	12.0	15.6	18.0	21.5	22.5	75	118	190
15	24.0	31.2	35.9	41.0	48.7	94	125	170
16	14.3	18.6	21.4	23.2	28.0	85	143	250
17	20.8	24.3	28.0	31.6	37.2	90	138	220
18	37.4	46.5	47.9	55.7	64.0	140	200	320
19	37.3	46.4	47.8	55.6	68.7	125	150	180
West Jakarta	769.6	844.8	129.2	1011.9	1060.6	1477	1725	2145
20	455.1	464.0	486.8	492.9	495.0	508	509	510
21	161.5	166.5	191.2	216.8	235.6	520	640	800
22	227.4	227.6	248.8	267.8	274.3	400	460	540
23	120.3	114.5	132.1	151.0	158.1	270	320	386
24	12.1	12.9	14.6	15.4	16.5	40	68	125
25	8.7	1.3	11.5	11.6	18.0	52	95	165
26	18.8	20.1	22.7	26.0	28.4	65	95	160
27	30.0	32.1	36.2	42.4	46.5	98	155	290
28	16.4	11.5	13.3	16.9	18.3	60	100	185
29	16.5	15.7	18.1	28.6	21.9	65	97	130
30	29.7	28.2	32.6	36.9	39.9	120	200	330
South Jakarta	1091.5	1102.4	1206.9	1298.3	1347.5	2196	2731	3615
31	290.7	312.7	350.7	387.3	396.0	522	555	580
32	250.7	262.7	293.7	333.8	345.8	378	360	320
33	45.2	49.3	57.1	65.8	75.2	145	165	180
34	16.1	17.1	19.5	22.5	24.7	72	86	110
35	12.6	13.4	15.4	17.6	18.0	44	67	110
36	13.1	12.3	13.9	15.3	17.4	50	75	105
37	37.0	38.9	44.0	51.6	54.8	97	120	160
38	18.3	19.2	21.8	23.9	26.1	65	90	120
39	36.7	37.9	41.9	47.0	50.0	125	210	440
40	35.9	36.5	41.9	38.2	45.2	52	55	60
41	21.4	21.7	25.0	25.0	34.0	80	100	120
East Jakarta	777.7	821.7	924.9	1031.5	1087.2	630	1883	2305
Total	4501.7	4631.2	5052.7	5476.7	5640.9	7667	8752	10510

Fig. 2-30 POPULATION PROJECTION IN WILAYAHS



The population added after 1975 can be divided into the natural increase and migration. It is assumed that the natural increase occurs proportionally to the residential population, and the migration depends on the specific location of new developments in each zone.

By taking the size and the locations of projects mentioned in the 'Jabotabek' report into account, the portion of population increase by migration is distributed as follows:

Table 2-23 Population Increased by Migration in Bo.Ta.Bek. Area

Zone #	Tangerang	Zone #	Bogor	Zone #	Bekasi
42	210,000	49	400,000	57	237,500
43	240,000	50	100,000	58	175,000
44	225,000	51	145,000	59	-
45	60,000	52	145,000	60	227,500
46	30,000	53	-	61	-
47	-	54	80,000	62	-
48	-	55	120,000		
		56	-		
Total	765,000	Total	990,000	Total	640,000

Then, the natural increase is distributed into zones proportionally to the residential population of each zone.

2-6-4 Population Classified by Shelter Conditions

The present classification by zone is in 'Statistic Wilayah DKI Jakarta, 1976' and that of future is obtained by adjusting the projection in '2.2.2 Classified Population' by specific condition in each zone.

Table 2-25 Distribution Forecast of Population Classified by Shelter Conditions

(%)

	1976			1985			2000		
	P.	S.	T.	P.	S.	T.	P.	S.	T.
Pusat	41	34	25	56	32	12	69	26	5
Utara	21	28	51	42	33	25	64	26	10
Barat	34	30	36	54	31	15	70	25	5
Selatan	36	36	28	56	33	11	65	31	4
Timur	39	29	32	63	25	12	82	14	4
DKI	35	32	33	56	30	14	70	25	5

P: Permanent S: Semi Permanent T: Temporary

Table 2-24

Residential Population of Bo. Ta. Bek. Area by Zone

Unit: x 1,000

		1975	1976	1985	1990	2000	
Tangerang	42	205.2	212	304	372	509.3	12,563
	43	126.4	132	216	288	424.4	13,375
	44	123.8	129	210	275	405.6	18,563
	45	158.7	159	198	235	291.5	21,750
	46	172.3	173	200	230	281.3	16,875
	47	211.9	212	238	262	309.1	29,813
	48	156.8	158	174	195	228.7	21,689
	Total	1,155.1	1,175	1,540	1,857	2,449.9	134,627
Bogor	49	536.6	550	760	900	1,209.0	24,000
	50	58.9	62	102	128	188.8	6,563
	51	112.8	115	175	216	315.1	11,125
	52	131.9	132	201	245	343.9	10,938
	53	37.3	38	40	45	56.2	6,000
	54	550.5	558	670	748	910.0	130,500
	55	320.3	326	414	472	602.9	47,750
	56	274.7	277	314	324	414.2	91,813
	Total	2,023.0	2,058	2,676	3,078	4,040.1	328,689
Bekasi	57	134.7	139	235	304	456.6	8,688
	58	75.0	77	144	196	297.0	8,375
	59	40.5	41	46	50	65.9	13,688
	60	239.2	246	366	450	616.7	27,813
	61	228.4	229	269	302	371.6	40,875
	62	179.6	181	210	238	292.2	47,813
	Total	897.4	913	1,270	1,540	2,100	147,252
Bo. Ta. Bek.		(4,074	4,146	5,434	6,516	8,590)	610,568

Fig.2-31 POPULATION PROJECTION IN BOTABEK AREA

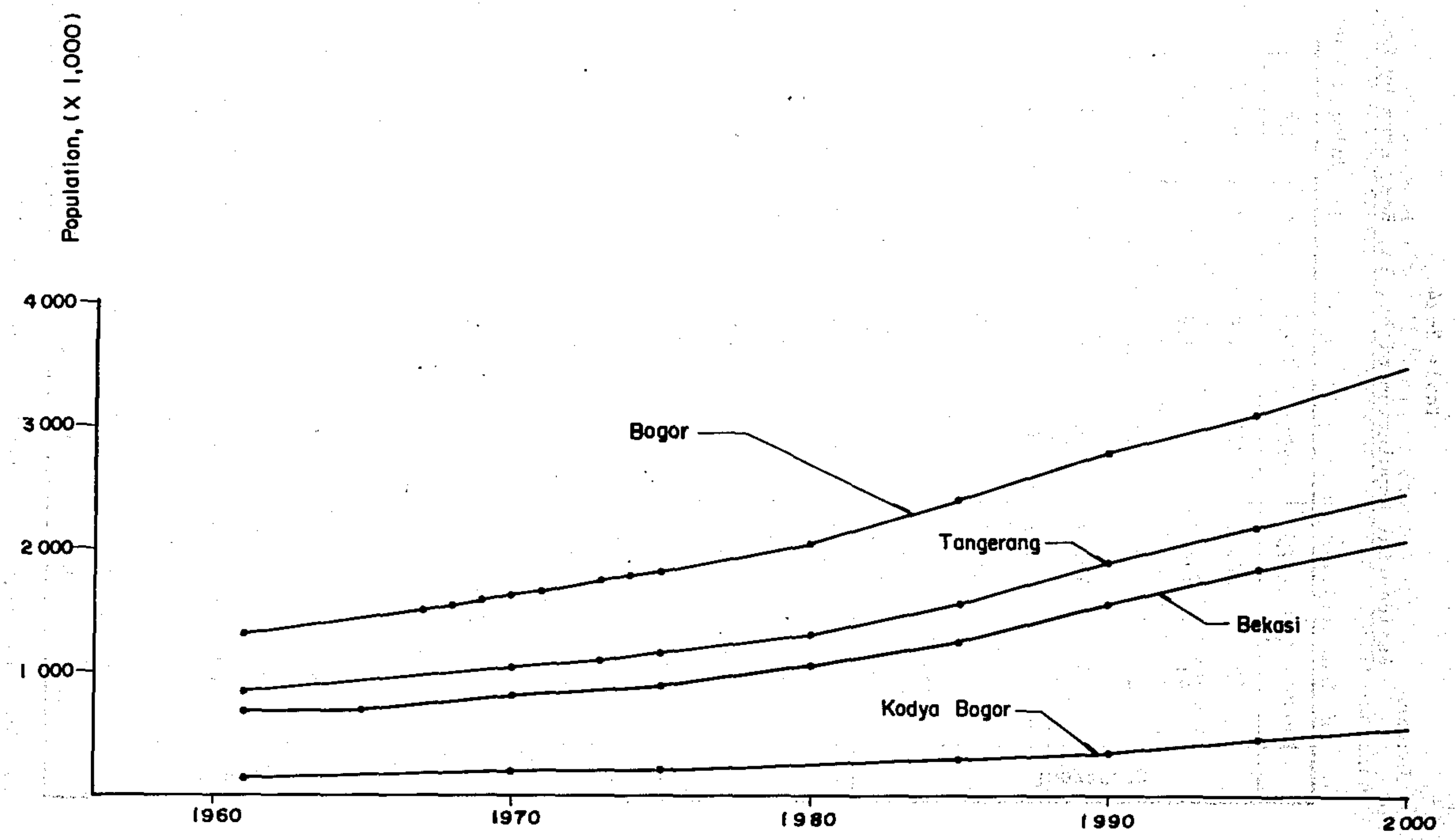


Table 2-26

Projection of Population Classified by Shelter Conditions

Unit: x 1,000

	Zone No.	1976 Perma-nent	1976 Semi Perma-nent	1976 Tem-porary	1985 Perma-nent	1985 Semi Perma-nent	1985 Tem-porary	2000 Perma-nent	2000 Semi Perma-nent	2000 Tem-porary
Pusat	1	121.6	32.2	15.6	107.3	31.1	11.7	104.2	16.1	3.7
	2	93.2	57.4	33.9	117.5	35.5	15.0	85.8	19.8	4.4
	3	145.8	191.4	116.5	228.7	191.0	58.3	295.7	138.6	27.7
	4	162.6	97.1	73.6	206.2	88.8	39.9	219.8	61.5	11.7
	5	88.2	90.1	95.6	114.3	97.7	45.0	119.6	64.7	11.8
		611.4	468.2	335.2	774.0	444.2	69.9	825.0	300.7	59.3
Utara	6	54.2	59.5	99.5	160.8	67.6	36.6	229.4	45.0	25.6
	7	35.8	49.6	105.1	82.1	99.8	78.1	172.8	112.0	35.2
	8	56.5	93.0	144.8	120.5	116.0	97.6	185.6	96.0	38.4
	9	2.2	4.3	6.0	18.7	16.1	12.2	77.0	26.4	6.6
	10	3.2	3.6	7.5	14.3	16.1	14.6	66.2	51.3	17.6
	11	1.5	1.7	2.8	10.5	9.7	4.9	54.0	18.8	2.3
		153.4	211.7	365.7	406.7	325.3	244.0	785.0	349.5	125.6
Barat	12	262.4	194.8	172.7	394.6	188.1	87.2	438.0	132.0	30.0
	13	56.1	61.9	43.4	97.9	76.2	23.9	150.5	55.9	8.6
	14	6.2	5.2	11.1	42.5	17.2	15.4	146.3	32.3	11.4
	15	13.4	11.3	24.0	62.4	17.6	14.0	137.7	27.2	5.1
	16	7.7	6.5	13.8	49.7	20.3	15.0	187.5	50.0	12.5
	17	7.4	10.8	19.0	47.1	26.2	16.7	147.4	61.6	11.0
	18	10.5	20.3	33.2	53.0	59.7	27.3	185.6	112.0	22.4
	19	11.3	21.8	35.7	48.3	54.6	22.1	106.2	64.8	9.0
		375.0	332.6	352.9	795.4	459.9	221.7	1,499.2	535.8	110.0
Selatan	20	177.0	173.6	144.4	332.0	139.4	36.6	377.4	122.4	10.2
	21	60.4	94.5	80.7	267.8	188.6	63.7	536.0	240.0	24.0
	22	132.9	103.9	37.6	277.9	101.9	20.2	459.0	70.2	10.8
	23	42.0	49.8	66.2	118.6	116.4	35.0	190.0	178.6	11.4
	24	3.5	4.9	8.1	17.8	12.9	9.2	61.3	51.3	12.5
	25	2.8	3.8	6.4	24.0	16.7	9.4	95.7	62.7	6.6
	26	6.0	8.4	14.0	30.2	21.7	13.1	91.2	60.8	8.0
	27	9.9	13.7	22.9	44.6	33.6	19.8	159.5	118.9	11.6
	28	8.9	6.9	2.5	38.6	18.8	2.6	140.6	38.9	5.6
	29	5.8	6.9	9.2	25.5	30.6	8.9	53.3	70.2	6.5
	30	10.6	12.6	16.7	53.0	43.5	23.5	154.8	138.2	37.1
		459.8	479.0	408.7	1,230.2	724.1	241.8	2,318.7	1,152.1	144.2
Timur	31	194.5	103.0	98.5	388.0	88.2	45.8	504.6	69.6	5.8
	32	131.9	104.0	110.0	263.8	83.8	30.4	281.6	35.2	3.2
	33	31.6	18.8	24.8	112.6	22.9	9.5	156.6	19.8	3.6
	34	7.5	5.8	11.4	43.9	16.0	12.1	97.9	9.9	2.2
	35	5.9	4.4	7.8	29.4	8.8	5.8	99.0	9.9	1.1
	36	3.9	3.9	9.6	24.1	11.6	14.2	69.3	21.0	14.7
	37	12.2	12.3	30.3	47.5	20.5	29.1	102.4	28.8	28.8
	38	5.8	5.9	14.4	28.7	19.2	17.1	49.8	43.2	27.0
	39	18.3	16.0	15.7	97.8	17.2	10.0	409.2	26.4	4.4
	40	8.5	19.8	16.9	21.3	21.9	8.7	35.4	19.8	4.8
	41	6.4	14.9	12.7	35.1	32.1	12.9	80.4	37.2	2.4
		426.5	308.8	352.1	1,092.2	342.2	195.6	1,886.2	320.8	98.0
D.K.I. Jakarta		2,026.1	1,800.3	1,814.6	4,298.4	2,295.7	1,072.9	7,314.0	2,658.9	537.1

Table 2-27

D.K.I. Jakarta Population Classified by Density in 1985 (x 1,000)

Zone No.	a	b	c	k
1	3.1	23.8	20.6	102.5
2	5.5	27.3	76.4	58.8
3	13.7	54.5	149.7	260.1
4	10.7	53.4	149.6	121.3
5	5.8	29.3	81.9	140.0
6	61.7	76.8	15.1	111.4
7	105.5	37.7	7.5	109.3
8	5.8	14.9	38.9	294.4
9	12.3	23.5	11.2	-
10	31.5	11.2	2.3	-
11	17.5	6.3	1.2	-
12	224.0	80.0	16.0	350.0
13	45.2	16.1	3.2	133.5
14	52.5	18.7	3.8	-
15	47.4	18.0	6.5	22.1
16	59.5	21.3	4.2	-
17	63.0	22.5	4.5	-
18	62.0	22.1	4.4	51.5
19	87.5	31.2	6.3	-
20	9.8	49.0	137.1	312.1
21	45.5	180.6	135.2	158.7
22	85.8	145.8	60.1	108.3
23	13.4	33.9	88.2	134.5
24	28.0	10.0	2.0	-
25	35.0	12.5	2.5	-
26	36.7	13.1	2.6	12.6
27	4.1	1.6	0.2	92.1
28	42.0	15.0	3.0	-
29	45.5	16.3	3.2	-
30	84.0	30.0	6.0	-

Zone No.	a	b	c	k
31	17.7	89.5	250.6	164.0
32	10.0	50.1	140.4	174.5
33	5.9	23.7	83.1	26.3
34	10.8	36.0	25.2	-
35	21.2	7.6	1.5	13.7
36	35.0	12.5	2.5	-
37	67.9	24.2	4.9	-
38	45.5	16.3	3.2	-
39	36.8	13.1	2.6	72.5
40	36.4	13.0	2.6	-
41	55.9	20.0	4.1	-
Average Distribution	22.0	18.4	20.4	39.2

a: less 250 persons/Ha
b: 250 ∿ 400 persons/Ha
c: over 400 persons/Ha
k: Kampung

Table 2-28

D.K.I. Jakarta Population Classified by Density in 2000 (x 1,000)

Zone No.	a	b	c	k	Zone No.	a	b	c	k
1	1.2	9.0	7.8	102.3	31	9.0	45.2	126.7	93.2
2	2.3	11.6	32.5	59.1	32	11.9	59.4	166.3	79.2
3	17.2	43.4	113.1	260.6	33	113.6	40.6	8.1	14.1
4	8.0	40.1	112.2	121.0	34	12.3	53.9	41.6	-
5	3.4	22.1	18.7	140.0	35	70.9	25.3	5.1	7.6
6	100.5	35.9	7.2	132.5	36	63.2	22.6	4.5	-
7	107.7	38.4	7.7	131.0	37	91.8	32.8	6.6	-
8	11.8	4.2	0.8	264.7	38	71.4	25.5	5.1	-
9	17.6	51.7	34.1	-	39	231.1	99.1	66.2	33.2
10	82.3	23.4	5.9	-	40	13.8	27.6	13.8	-
11	51.0	18.2	3.6	-	41	74.2	29.4	14.0	-
12	25.7	38.5	89.7	416.1	Average Distribution	27.4	19.9	19.3	33.4
13	17.9	23.7	5.8	158.9					
14	71.1	89.3	18.2	-					
15	45.7	67.6	21.9	29.7					
16	166.3	59.4	11.9	-					
17	146.3	52.3	10.5	-					
18	160.4	57.3	11.5	68.4					
19	119.7	42.8	8.6	-					
20	7.6	32.5	89.8	369.9					
21	33.3	128.0	350.8	263.8					
22	17.5	87.3	244.5	179.9					
23	16.6	71.9	55.3	224.8					
24	67.8	28.1	16.5	-					
25	23.0	72.9	49.8	12.7					
26	94.7	33.8	6.8	16.7					
27	161.8	57.8	11.5	97.3					
28	125.7	44.9	9.0	-					
29	73.0	30.9	19.6	-					
30	113.1	146.9	34.7	-					

a: less 250 persons/Ha
b: 250 ∿ 400 persons/Ha
c: over 400 persons/Ha
k: Kampung

Table 2-29 Employment Situation in Wilayah

	ITEM		1971	1976	1985	1990	2000
1)	Central Jakarta						
	Population (x1,000)		1258	1415	1388	1318	1185
	Rate of Employment(%)		27.5	28.1	29.2	29.8	31
	Employed (x1,000)		346.1	397.6	405.3	392.8	367.4
	Distribution by Sector (%)	Sector I	0.3	0.15	0	0	0
		II	14.1	15.3	20.5	23.8	29.5
		III	85.6	84.5	79.5	76.2	70.5
	Number of Employed by Sector	Sector I	1.0	0.6	0	0	0
		II	48.9	48.7	67.0	78.8	108.4
		III	296.2	348.3	338.3	314.0	259.0
2)	North Jakarta						
	Population (x1,000)		586	731	976	1087	1260
	Rate of Employment(%)		29.0	29.3	30.0	30.0	31
	Employed (x1,000)		170.1	214.2	292.8	329.4	390.6
	Distribution by Sector (%)	Sector I	6.8	4.5	2.5	1.7	0.6
		II	13.7	16.8	22.2	25.1	29.0
		III	79.4	78.7	75.3	73.1	70.4
	Number of Employed by Sector	Sector I	11.6	9.6	7.3	5.6	2.3
		II	23.4	32.8	58.3	74.3	113.3
		III	135.2	171.8	227.2	249.5	275
3)	West Jakarta						
	Population (x1,000)		820	1060	1477	1725	2145
	Rate of Employment(%)		25.5	26.4	28.2	29.1	31
	Employed (x1,000)		208.8	279.8	416.5	502.0	665.0
	Distribution by Sector (%)	Sector I	6.8	4.5	2.1	1.4	0.6
		II	21.5	28.8	32.8	33.4	35.0
		III	71.8	66.7	65.1	65.1	64.4
	Number of Employed by Sector	Sector I	14.1	12.6	8.7	7.0	4.0
		II	44.8	67.7	118.8	153.7	232.8
		III	149.9	199.5	289.0	341.3	428.2
4)	South Jakarta						
	Population (x1,000)		1063	1348	2196	2739	3615
	Rate of Employment(%)		25.4	26.3	28.0	29.0	31
	Employed (x1,000)		269.5	354.5	614.9	794.3	1120.7
	Distribution by Sector (%)	Sector I	4.1	2.9	1.5	1.1	0.6
		II	19.1	26.4	30.9	31.0	33.5
		III	76.8	70.7	67.6	67.9	65.9
	Number of Employed by Sector	Sector I	11.1	10.3	9.2	8.7	6.3
		II	51.5	88.2	178.3	236.4	375.4
		III	206.8	256	427.4	549.2	739.0
5)	East Jakarta						
	Population (x1,000)		807	1087	1630	1883	2305
	Rate of Employment(%)		22.9	24.3	26.8	28.2	31
	Employed (x1,000)		184.5	264.1	436.8	531.0	714.6
	Distribution by Sector (%)	Sector I	2.3	1.7	0.9	0.7	0.5
		II	16.6	26.5	30.3	30.6	32.0
		III	81.1	71.8	68.8	68.7	67.5
	Number of Employed by Sector	Sector I	4.3	4.5	3.9	3.7	3.5
		II	30.7	54.6	108.7	144.9	228.7
		III	149.9	205.0	324.2	382.4	482.4

Table 2-31 Employment in D.K.I Jakarta, 1985 (x1,000)

	Employed	Sector I	Sector II	Sector III
1	43.8	0	7.2	36.6
2	49.1	0	8.1	41.0
3	139.6	0	23.1	116.5
4	97.8	0	16.2	81.6
5	75.0	0	12.4	52.6
Central JKT	405.3	0	67.0	338.3
6	79.5	0.7	16.1	62.7
7	78.0	0.3	15.9	81.8
8	100.2	5.5	19.3	75.4
9	14.1	0.1	2.9	11.1
10	13.5	0.3	2.7	10.5
11	7.5	0.4	1.4	5.7
North JKT	292.8	7.3	58.3	227.2
12	188.9	1.1	54.7	133.1
13	55.8	0.3	16.2	39.3
14	21.1	0.4	6.0	14.7
15	26.5	0.8	7.5	18.2
16	24.0	0.5	6.8	16.7
17	25.4	2.4	6.7	16.3
18	39.5	1.5	11.1	26.9
19	35.2	1.7	9.8	23.7
West JKT	416.5	8.7	118.8	289.0
20	142.2	1.0	41.6	99.6
21	145.6	2.4	42.2	101.0
22	112.0	2.5	32.2	77.3
23	75.6	0.5	22.1	53.0
24	11.2	0.2	3.2	7.8
25	14.2	0.3	4.0	9.7
26	18.2	0.3	5.3	12.6
27	27.4	1.0	7.8	18.6
28	16.8	0.3	4.9	11.6
29	18.2	0.2	5.3	12.9
30	33.6	0.5	9.7	23.4
South JKT	614.9	9.2	178.3	427.4
31	139.9	0.1	35.1	104.7
32	101.3	1.1	25.2	75
33	38.9	0.3	9.7	28.9
34	19.3	0.2	4.8	14.3
35	11.8	0.2	2.9	8.7
36	13.4	0.3	3.3	9.8
37	26.0	0.3	6.5	19.2
38	17.4	0.6	4.2	12.6
39	33.5	0.1	8.4	25.0
40	13.9	0.3	3.4	10.2
41	21.4	0.4	5.3	15.7
East JKT	436.8	3.9	108.7	324.2

Table 2-30 Employment in D.K.I Jakarta, 1976 (x1,000)

	Employed	Sector I	Sector II	Sector III
1	47.6	0	5.8	41.8
2	51.8	0	6.4	45.4
3	127.5	0.6	15.6	111.3
4	94.0	0	11.5	82.5
5	97.0	0	9.4	67.6
Central JKT	397.6	0.6	48.7	348.3
6	62.5	1.0	9.9	51.6
7	55.8	0.3	8.9	46.6
8	86.3	8.0	12.6	65.7
9	3.7	0.1	0.6	3.0
10	4.2	0.2	0.6	3.4
11	1.8	0	0.3	1.5
North JKT	214.2	9.6	32.8	171.8
12	166.2	2.0	41.6	122.6
13	42.6	0.5	10.7	31.4
14	5.9	0.6	1.3	4.0
15	12.8	1.4	2.9	8.5
16	7.4	0.8	1.7	4.9
17	9.8	3.8	1.5	4.5
18	16.9	1.7	3.9	11.3
19	18.1	1.8	4.1	12.2
West JKT	279.8	12.6	67.7	199.5
20	130.2	1.6	33.0	95.6
21	62.0	3.5	15.0	43.5
22	72.2	2.9	17.8	51.5
23	41.6	0.4	10.6	30.6
24	4.3	0.2	1.1	3.0
25	3.4	0.2	0.8	2.4
26	7.5	0.4	1.8	5.3
27	12.2	0.7	2.9	8.6
28	4.8	0.2	1.2	3.4
29	5.8	0.1	1.5	4.2
30	10.5	0.1	1.5	4.2
South JKT	354.5	10.3	88.2	256
31	96.2	0.3	20.2	75.7
32	84.0	1.9	17.3	64.8
33	18.3	0.1	3.8	14.4
34	6.0	0.4	1.2	4.4
35	4.4	0.2	0.9	3.3
36	4.2	0.1	0.9	3.2
37	13.3	0.3	2.7	11.3
38	6.3	0.2	1.3	4.8
39	12.1	0.1	2.5	9.5
40	11.0	0.5	2.2	8.3
41	8.3	0.4	1.7	6.2
East JKT	264.1	4.5	54.6	205.0

Table 2- 33 Employment in D.K.I Jakarta, 2000 (x1,000)

	Employed	Sector I	Sector II	Sector III
1	38.4	0	11.3	27.1
2	34.1	0	10.1	24.0
3	143.2	0	42.3	100.9
4	90.8	0	26.8	64.0
5	60.8	0	17.9	42.9
	367.4	0	108.4	259.0
6	93.0	0.2	27.1	65.7
7	99.2	0.2	28.9	70.1
8	99.2	0.5	28.8	69.9
9	34.1	0.1	9.9	24.1
10	41.9	0.5	12.1	29.3
11	23.3	0.8	6.6	15.9
	390.6	2.3	113.3	275
12	186.1	0	65.5	120.6
13	66.7	0.1	23.5	43.1
14	58.9	0.2	20.7	38.0
15	32.7	0.1	18.5	34.1
16	77.5	0.3	27.2	50.0
17	68.2	0.6	23.8	43.8
18	99.3	1.1	34.6	63.6
19	55.8	1.6	19.7	35.1
	665.0	4.0	232.8	428.2
20	158.1	0	53.3	104.8
21	248.0	0	83.5	164.5
22	167.4	1.1	56.4	110.9
23	117.8	0.8	39.4	77.6
24	38.8	0.3	13.0	25.5
25	51.2	0.5	17.1	33.6
26	49.6	0.2	16.6	32.8
27	89.9	1.5	29.8	58.6
28	57.4	0.5	19.2	37.7
29	40.3	0.4	13.4	26.5
30	102.3	1.0	34.1	67.2
	1120.7	6.3	375.4	731.0
31	179.8	0	57.8	122.0
32	99.2	0	31.9	67.3
33	55.8	0.9	19.7	37.2
34	34.1	0	11.0	23.1
35	34.1	0.1	10.9	23.1
36	32.6	0.5	10.3	21.8
37	49.6	0.5	15.8	33.3
38	37.2	1.3	11.5	24.4
39	136.4	0.2	43.8	92.4
40	18.6	0.1	5.9	12.6
41	37.2	0.1	11.9	25.2
	714.6	3.5	228.7	482.4

Table 2-32 Employment in D.K.I. Jakarta, 1990 (x1,000)

	Employed	Sector I	Sector II	Sector III
1	41.7	0	8.4	33.3
2	43.2	0	8.7	34.5
3	141.3	0	28.3	113
4	95.4	0	19.1	76.3
5	71.2	0	14.3	56.9
Central JKT	392.8	0	78.8	314.0
6	85.8	0.5	19.6	65.7
7	87.0	0.2	19.9	66.9
8	100.6	3.9	22.2	74.5
9	21.2	0.1	4.8	16.3
10	22.7	0.4	5.1	17.2
11	12.1	0.5	2.9	9.7
North JKT	329.4	5.6	74.3	249.5
12	187.7	0.5	58.1	129.1
13	59.9	0.2	18.5	41.2
14	34.3	0.4	10.5	23.4
15	36.4	0.6	11.1	24.7
16	41.6	0.4	12.8	28.4
17	40.2	2.0	11.9	26.3
18	58.2	1.3	17.7	39.2
19	43.7	1.6	13.1	29.0
West JKT	502.0	7.0	153.7	341.3
20	147.6	0.8	44.2	102.6
21	185.6	1.6	55.4	128.6
22	133.4	2.0	39.5	91.9
23	92.8	0.6	27.7	64.5
24	19.7	0.3	5.8	13.6
25	27.5	0.4	8.2	18.9
26	27.5	0.3	8.2	19.0
27	44.9	1.3	13.1	30.5
28	29.0	0.4	8.6	19.9
29	28.1	0.3	8.4	19.4
30	58.0	0.7	17.2	40.1
South JKT	794.3	8.7	236.4	549.2
31	156.5	0.1	43.0	113.4
32	101.5	0.7	27.7	73.1
33	46.5	0.5	12.6	33.4
34	24.3	0.2	6.6	17.5
35	18.9	0.1	5.2	13.6
36	21.1	0.3	5.7	15.1
37	33.8	0.3	9.2	24.3
38	25.4	0.8	6.8	17.8
39	59.2	0.2	16.2	42.8
40	15.5	0.2	4.2	11.1
41	28.2	0.3	7.7	20.2
East JKT	531.0	3.7	144.9	382.4

2-6-5 Population Classified by Density

The classification is done according to the criteria as follows:

a. Less than 250 persons/HA

b. From 250 persons/HA to 400 persons/HA

c. More than 400 persons/HA

k. Kampung population, 446 persons/HA in 1985 and 483 persons/HA in 2000.

By reducing the Kampung population from the total, the average density in residential areas in each zone can be obtained, and then, the distribution of the classified population according to the above criteria is decided.

2-6-6 Employment by Zone

The present ratio among the employment in Sector I, Sector II and Sector III can be obtained for each of the five Wilayahs in DKI Jakarta.

The total of the employed population in each zone is in proportion to the total population of each zone. The employment in Sector I in each zone is in proportion to the area of agricultural land use. The remaining is divided into the employed populations in Sector II and III according to the ratio between residential population.

2-6-7 Work Places by Zone

1) Sector I

Assuming no commuting in Sector I, the population employed in Sector I is considered to be the same as the one in work places in Section I.

2) Sector II

As mentioned in '2.4.3 Work Places,' work places in Sector II can be divided into: work places in industrial areas, (A); and those outside, (B). The ratio between the two is assumed to be 65:35 in 1971 and 75:25 in 2000.

(A) in 1975 is distributed among zones proportionally to the number of manufacturing factories and that in 2000 to the total area of the industrial land use. (B) is distributed proportionally to the total area of the residential land use.

3) Sector III

As mentioned before, work places in Sector III can be divided into: work places in commercial and administration areas, (A); and those outside, (B). The ratio between the two is assumed to be 65:35 in 1971 and 75:25 in 2000.

(A) is assumed to be proportional to the total floor area of commercial and administration facilities.

The total floor area of commercial and administration facilities in 1973 in each zone is obtained from the area of commercial and administrative land use multiplied by the F.A.R. in the CBD and by assuming 200% of F.A.R. in the rest.

That in 2000 is figured out from the maximum F.A.R., the ratio between the actual F.A.R. in 2000 and the maximum F.A.R., and B.A.R. as mentioned in '2-5-2 Commercial and Administration Area.'

(B) is distributed proportionally to the residential population in each zone.

Table 2-34 Population, Work Places and Employment, D.K.I. Jakarta

Zone No.	1976 Residential Population	1976 Population Employed	1976 Number of work places by Sector: Sector I	1976 Sector II	1976 Sector III	1985 Residential Population	1985 Population Employed	1985 Number of work places by Sector: Sector I	1985 Sector II	1985 Sector III	1990 Residential Population	1990 Population Employed	1990 Number of work places by Sector: Sector I	1990 Sector II	1990 Sector III	2000 Residential Population	2000 Population Employed	2000 Number of work places by Sector: Sector I	2000 Sector II	2000 Sector III Concentrated	2000 Sector III Dispersed
1	169.4	47.6	-	11.5	170.0	150.0	43.8	-	8.6	254.0	140.0	41.4	-	7.0	298.0	124.0	38.4	-	3.9	373.8	300.6
2	184.4	51.8	-	8.6	94.0	168.0	49.1	-	9.8	128.0	145.0	43.2	-	10.4	145.0	110.0	34.1	-	11.7	173.7	141.4
3	453.6	127.5	0.6	6.6	68.0	478.0	139.6	-	10.1	85.0	474.0	141.3	-	11.9	93.0	462.0	143.2	-	15.8	106.9	99.2
4	334.5	94.0	-	11.8	142.0	535.0	97.8	-	11.0	179.0	320.0	35.4	-	10.5	194.0	273.0	90.8	-	9.6	223.5	182.0
5	273.9	97.0	-	8.3	68.0	257.0	75.0	-	7.4	93.0	239.0	71.2	-	6.9	105.0	196.0	60.8	-	5.9	124.4	109.4
	415.8	397.6	0.6	46.8	542.0	1,388.0	405.3	-	46.9	737.0	1,318.0	392.8	-	46.7	835.0	1,850.0	367.4	-	46.9	1,005.3	832.6
6	213.2	62.5	1.0	17.9	41.0	265.0	99.5	0.7	22.8	55.0	283.0	85.8	0.5	27.0	61.0	300.0	93.0	0.2	36.6	72.4	66.9
7	190.5	55.8	0.3	10.8	21.0	260.0	78.0	0.3	22.6	35.0	287.0	87.0	0.2	30.2	42.0	520.0	39.2	0.2	47.7	55.8	52.4
8	294.4	86.3	8.0	10.1	37.0	334.0	100.2	5.5	31.6	59.0	332.0	100.6	3.9	48.7	70.0	320.0	99.2	0.5	38.0	30.2	30.2
9	12.6	3.7	0.1	2.0	0.7	47.0	14.1	0.1	18.6	0.9	40.0	21.2	0.1	29.0	10.0	110.0	34.1	0.1	51.4	17.1	17.0
10	14.3	4.2	0.2	3.0	4.0	45.0	13.5	0.3	26.8	16.0	75.0	22.7	0.4	40.3	24.0	135.0	41.9	0.5	73.7	35.6	35.6
11	6.1	1.8	-	0.2	1.2	25.0	7.5	0.4	0.3	3.6	40.0	13.1	0.5	1.4	5.0	75.0	23.3	0.8	2.4	7.4	7.4
	731.1	214.2	9.6	44.0	204.6	1,501.0	292.8	7.3	123.3	163.5	1,087.0	329.4	5.6	146.6	212.0	1,260.0	390.6	2.3	491.4	275.6	269.5
12	630.0	166.2	2.0	36.3	180.2	640.0	188.9	1.1	23.9	227.0	645.0	187.7	0.5	29.3	248.0	600.0	186.7	-	27.7	282.1	222.4
13	161.5	42.6	0.5	7.5	20.0	198.0	55.8	0.3	6.7	27.0	206.0	59.9	0.2	6.6	30.0	215.0	66.7	0.1	6.8	35.3	33.9
14	22.5	5.9	0.6	2.0	5.0	75.0	21.1	0.4	3.6	11.0	118.0	34.3	0.4	4.7	15.0	190.0	58.9	0.2	7.1	22.3	22.2
15	48.7	12.8	1.4	1.9	5.0	94.0	26.5	0.8	2.9	13.0	125.0	36.4	0.6	3.7	16.0	170.0	52.7	0.1	5.4	24.3	24.3
16	28.0	7.4	0.8	0.8	12.0	85.0	24.0	0.5	3.2	18.0	143.0	41.6	0.4	4.6	21.0	250.0	77.5	0.3	4.9	36.7	27.6
17	37.2	9.8	3.8	5.8	5.0	90.0	25.4	2.4	38.1	13.0	138.0	40.2	2.0	56.3	18.0	220.0	68.2	0.6	100.5	24.1	24.1
18	64.0	16.9	1.7	6.5	11.0	140.0	39.5	1.5	3.7	21.0	200.0	58.2	1.3	12.1	26.0	320.0	99.3	1.1	17.5	36.0	61.3
19	68.7	18.1	1.8	6.2	8.0	125.0	35.2	1.7	7.7	16.0	180.0	43.7	1.6	3.1	20.0	180.0	55.8	1.6	12.2	2-.5	28.4
	060.6	279.8	12.6	26.0	246.2	1,497.0	416.5	8.7	101.5	119.0	1,725.0	502.0	7.0	127.0	334.0	2,145.0	665.0	4.0	185.1	196.4	444.2
20	495.0	130.2	1.6	10.6	71.0	508.0	142.2	1.0	22.2	88.0	509.0	147.6	0.8	21.7	36.0	510.0	158.1	-	32.1	109.8	102.2
21	235.6	62.0	3.5	7.6	38.0	520.0	145.6	2.4	17.1	57.0	640.0	185.6	1.6	21.7	66.0	800.0	248.0	-	18.2	82.3	82.3
22	274.3	72.2	2.9	11.2	53.0	400.0	112.0	2.5	10.5	73.0	460.0	133.4	2.0	12.8	80.0	540.0	167.4	1.1	14.9	91.8	129.9
23	158.1	91.6	0.4	0.6	20.0	270.0	75.6	0.5	11.6	28.0	320.0	92.8	0.6	12.5	32.0	380.0	117.8	0.8	4.0	38.9	38.9
24	16.5	4.3	0.2	0.4	3.3	40.0	11.2	0.2	1.4	6.1	68.0	19.7	0.3	2.3	7.5	125.0	38.8	0.3	4.0	10.1	27.0
25	13.0	3.4	0.2	0.4	3.3	50.0	14.0	0.3	2.0	7.0	95.0	27.5	0.4	3.0	3.0	165.0	51.2	0.5	5.2	12.6	88.8
26	28.4	7.5	0.4	0.7	7.1	65.0	18.2	0.3	2.1	3.0	95.0	27.5	0.3	3.0	10.0	160.0	46.9	0.2	5.1	12.3	29.2
27	46.5	12.2	0.7	1.2	9.0	98.0	27.4	1.0	3.9	17.0	155.0	44.9	1.3	5.5	22.0	290.0	89.9	1.5	9.2	29.7	29.7
28	18.3	4.8	0.2	0.6	8.0	60.0	16.8	0.3	2.4	12.0	100.0	29.0	0.4	3.5	14.0	185.0	57.4	0.5	5.9	17.2	17.2
29	21.9	5.8	0.1	0.6	8.0	65.0	18.2	0.2	1.7	22.0	97.0	28.1	0.3	2.4	29.0	130.0	40.3	0.4	4.1	43.4	81.5
30	39.9	10.5	0.1	3.1	6.0	120.0	33.6	0.5	15.0	16.0	200.0	58.0	0.7	22.3	23.0	530.0	102.3	1.0	38.7	33.2	33.1
	347.5	354.5	10.3	37.0	232.7	2,196.0	614.9	9.2	90.2	335.1	2,739.0	794.3	8.7	114.2	388.5	3,615.0	,120.7	6.3	141.4	431.3	353.3
31	396.0	96.2	0.3	17.9	54.0	522.0	139.9	0.1	21.9	85.0	555.0	156.5	0.1	25.3	101.0	580.0	179.8	-	33.9	129.7	120.5
32	345.8	84.0	1.9	15.7	49.0	378.0	101.3	1.1	13.7	71.0	360.0	101.5	0.7	13.6	84.0	320.0	99.2	-	13.6	106.1	131.7
33	75.2	18.3	0.1	1.9	8.2	145.0	38.9	0.3	3.8	11.0	165.0	96.5	0.5	5.1	13.0	180.0	55.8	0.3	4.9	15.5	15.6
34	24.7	6.0	0.4	2.6	3.0	72.0	19.3	0.2	3.0	5.9	86.0	24.3	0.2	3.6	7.0	110.0	34.1	-	4.6	10.3	10.3
35	18.0	4.4	0.2	0.6	3.3	44.0	11.8	0.2	1.6	7.0	67.0	18.9	0.1	2.2	8.0	110.0	34.1	0.1	3.5	3.1	3.1
36	17.4	4.2	0.1	0.7	2.7	50.0	13.4	0.3	1.6	6.0	75.0	21.1	0.3	2.1	8.0	105.0	32.6	0.5	3.3	13.0	13.0
37	54.8	13.3	0.3	3.4	8.0	97.0	26.0	0.3	16.5	15.0	120.0	33.8	0.3	21.3	20.0	160.0	49.6	0.5	32.5	26.7	26.6
38	26.1	6.3	0.2	0.6	6.0	65.0	17.4	0.6	1.7	12.0	90.0	25.4	0.8	2.3	15.0	120.0	37.2	1.3	3.8	20.7	20.7
39	50.0	12.1	0.1	4.6	8.0	125.0	33.5	0.1	14.9	22.0	210.0	59.2	0.2	21.2	29.0	440.0	136.4	0.2	35.7	52.0	52.0
40	45.2	11.0	0.5	25.8	5.3	52.0	13.9	0.3	71.4	8.0	55.0	15.5	0.2	38.0	10.0	60.0	18.6	0.1	170.7	12.7	12.7
41	34.0	8.3	0.4	5.8	3.5	80.0	21.4	0.4	44.0	9.0	100.0	28.2	0.3	65.8	11.0	120.0	37.2	0.1	122.2	16.5	37.7
	087.2	246.7	4.5	85.6	149.0	1,630.0	436.8	3.9	134.1	51.9	1,883.0	531.0	3.7	260.5	306.0	2,305.0	714.6	3.5	431.7	412.4	449.9
	640.9	1,492.2	57.6	305.8	1,275.0	8,192.0	,166.3	29.1	556.3	1,841.0	8,752.0	2549.5	25.0	721.5	2,134.0	2,305.0	,258.3	16.1	,112.1	2,656.0	2656.0

2-7 Regulations and Guidance for Land Use

In relation to the future land use planning in the periphery of Jakarta, a multi-nuclues type of city shall be proposed for urban planning.

In its implementation, however, adequate regulations and guidance on the basis of the established criteria are of primary importance so that all the activities should properly be arranged in line wit with the principle when planning as a multi-nuclues city.

The following are outlines of establishing such criteria in preparation for adequate regulations and guidance:

(1) Classification of land use

More detailed classification will be needed such as:

a. Industrial areas
   - a-1. Areas for heavy industry
   - a-2. Areas for light or ordinary industries

b. Commercial areas

c. Business areas

d. Residential areas
   - d-1. Residential areas for exclusive use
   - d-2. Ordinary residential areas

One thing important other than such classification is that the areas permitting or not permitting "location" shall clearly be designated in each area. Particular consideration shall be given to the areas where multi-use of the land be permitted.

(2) Regulations for implementation

a. It can be proposed that any plans of buildings or other facilities shall be subject to the "permission" or the "permission for land use" rather than the mere "acknowledgement of application" for buildings or other facilities.

b. When the buildings or other facilities planned and applied may obstruct the future urban planning, they shall not, in principle, be permitted unless they are;
   - i) temporary buildings or facilities, or
   - ii) subject to the restrictions with respect to their use and scale.

c. High rised buildings may adapt to the future development, however, regulations shall be applied to the volumetric occupancy as well as structural and formative respects. Such regulations shall include;

   i) Setback or obliquity of the buildings designed to get wider view, more sunlight and efficiency of ventilation.

   ii) Non-occupied areas providing the space for public works or emergency refuge.

(3) Others

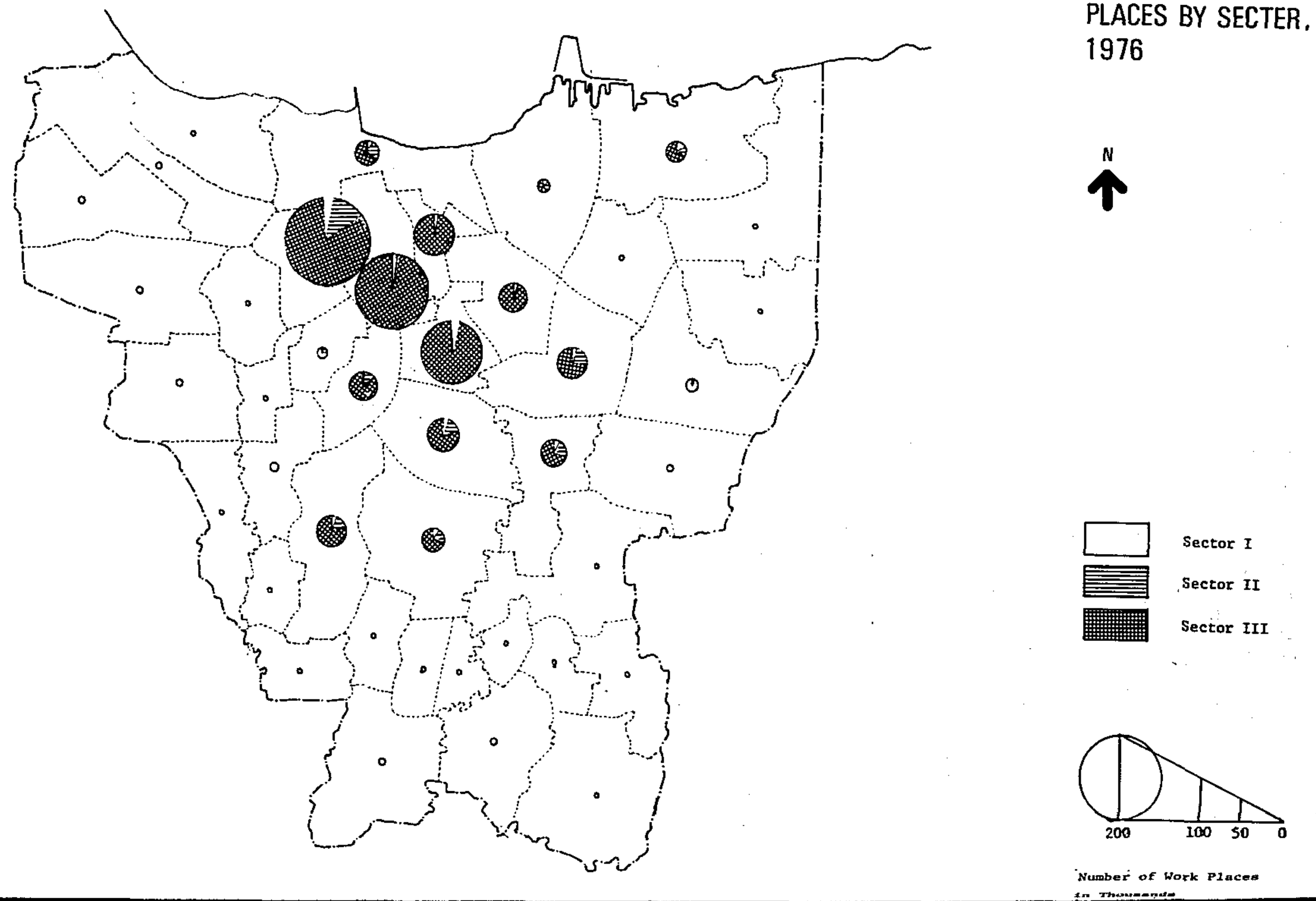
a. Release from the regulations in the case of agreement by all those holding titles to an estate (Excepted regulations).

b. Area development with the right of expropriation of land.

c. Establishment of financing system to the area development program for business, industrial and housing complex.

By establishing the criteria and taking legal steps, as referred to the above, adequate regulations and guidance can be attained.

Fig. 2-32
NUMBER OF WORK PLACES BY SECTER, 1976



CHAPTER 3 TECHINICAL STUDY AND ANALYSIS

3-1 Geological Analysis

3-1-1 Geological Conditions of Study Area

(1) Geological situation

The surrounding of Jakarta is basically formed of sedimentary rocks of the tertiary era, overlayed with volcaniclastic materials of the quarternary diluvial epoch. Along the river sides, alluvial layers are accumulated, and tertiary rocks are not outcropped. The volcaniclastic materials are of clay, sandy soil, gravels and these mixtures, and in the study area the surface layer is considerably stratified and it is composed mainly of clayey soil. This clayey soil weathered under the high temperature and humidity environment over extensive depth, part of it forming purplish-red to brown lateritic clay with very high water content. Where weathering has not progressed, the volcaniclastic materials are mainly of black and gray cohesive soils and they are hardened.

(2) Geomechanics

From the results of the soil surveys, the physical properties of the lateritic cohesive soil which greatly affects the proposed project are as listed in Table 3-1, and the CBR value and N value together with the locations where samples were obtained, are shown in Fig. 3-1.

Table 3-1 Results of Physical Tests of Volcanic Cohesive Soils

Soil Classification	Unified soil classification:		CH-MH (cohesive soil)
	AASHO soil classification:		A-7
Specific gravity	GS		2.4 ∿ 3.0
Natural moisture content	Wn	%	23 ∿ 123
Liquid limit	LL	%	50 ∿ 110
Plastic limit	PL	%	35 ∿ 70
Plasticity index	I_p		15 ∿ 65
Unit weight	γt	g/cm^3	1.5 ∿ 2.0
Maximum dry density	γd max	g/cm^3	1.3 ∿ 1.6
Optimum moisture content	Wopt	%	2.0 ∿ 40.0
Field CBR		%	1.5 ∿ 13.0
Undisturbed soaked CBR		%	1.0 ∿ 8.0
Modified soaked CBR		%	2.3 ∿ 9.8
Water absorption swelling	γe	%	0.004 ∿ 0.095
Cohesion	Cu	Kg/cm^2	0.07 ∿ 0.68
Angle of shearing resistance	ϕu	(°)	6.5 ∿ 22.5
Consolidation index	Cc		0.47 ∿ 0.99

3-1-2 Geomechanics and Earthwork Plan

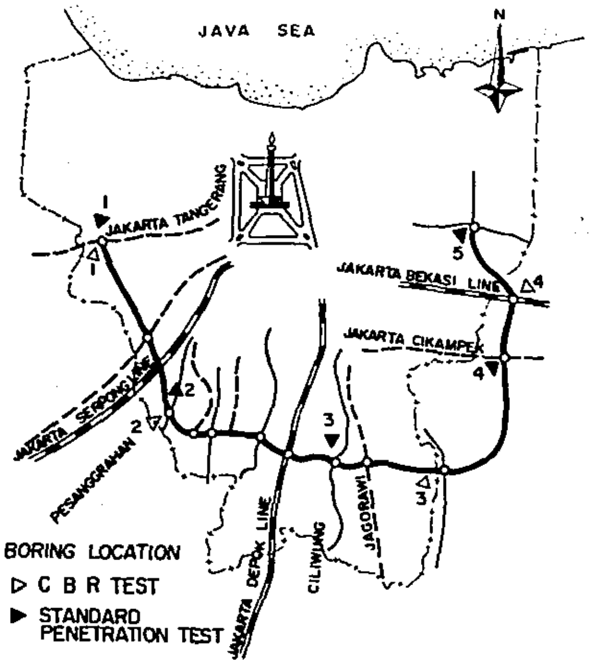
(1) Embankment

The project road will traverse through the diluvial upland covered with the lateritic soil and the paddy field of the alluvial plain accumulated soft soil layers. As embankment materials, the volcanic clay is low in bearing strength when disturbed and ample care has to be taken during compaction in the process of construction. Also, the low laying area of sedimentary layer dissetted up by minor rivers are estimated to be of soft soil with poor bearing strength so that embankment works on this soil has to be conducted slowly.

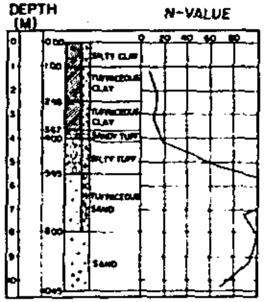
Fig. 3 — 1

SUMMARY OF SOIL SURVEY TEST RESULTS

Boring No. ▽	Specific Gravity Gs	M. I. T. Classification				Atterberg Limits			Classifi-cation	Maximum Dry Density γ_d g/cm^3	C. B. R.
		Gravel %	Sand %	Silt %	Clay %	L.L. %	P.L. %	P.I. %	Unified		
1.	2.657	—	7	22	71	93.20	39.91	53.29	CH	1.305	5.30
2.	2.611	—	8	30	62	91.60	39.20	62.40	CH	1.305	7.80
3.	2.592	—	—	34	66	95.50	43.05	52.45	CH	1.310	4.47
4.	2.543	—	—	42	58	93.90	36.92	56.98	CH	1.192	4.50



▼ BORE HOLE NO. 1



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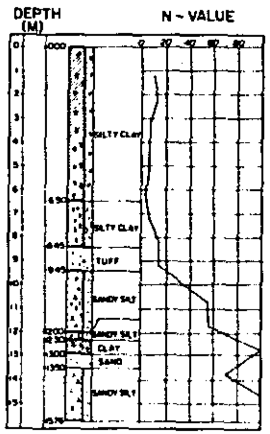

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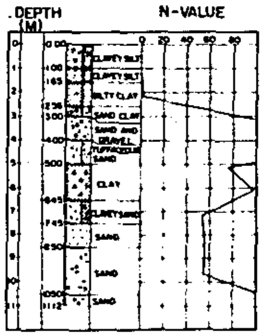

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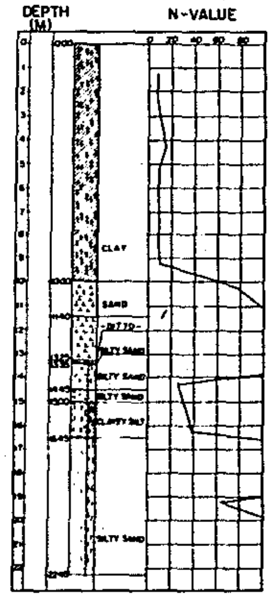

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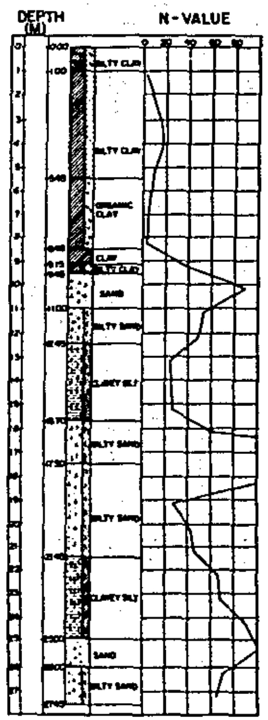


The soft and weak soil layer in the project area is for a 3 km stretch on the west route and for a 6 km stretch on the east route. From the data of various soil studies, the extent of settlement according to the height of embankment are estimated as shown in Table 3-2.

Table 3-2 Settlement against Height of Embankment

(in m)

Depth of Soft Soil			
Embankment height	3 m	4 m	6 m
0 ∿ 3 m	-	0.3	0.5
3 ∿ 5 m	0.3	0.5	0.8
5 ∿ 8 m	0.5	0.8	1.2

At the preliminary design stage, the methods of embankment works at the soft soil zone are proposed as follows:

(a) For the stretch along the west route where the soft soil layer is comparatively shallow, the stretch may be removed of the soft soil and replaced with better quality soil, in order to prevent the deformation of the road surface of the law embankment and to reduce settlement of embankment or structures of the replaced soil so that long term stability may be obtained.

(b) Where the soft soil layer is deep and/or the embankment is high, preloading method may be adopted, as for the Jagorawi Highway, whereby consolidation settlement is applied to the soft soil layer, and subsequently the excess top layer is removed to finish the embankment to predetermined height in order to contain the settlement within allowable limit. Sand for a depth of 1 m is layed on the roadbed and the water that is emitted from the foundation and the embankment is removed from the sides of the embankment. The consolidation time for a soft soil layer of about 60 cm in height is estimated to be about 6 to 7 months.

(2) Gradient of slope

Gradient of slope should be designed safely enough respectively the kind and situation of soil and the height of earthwork. The clay and clayey soil in the project area classified in the unified classification as CH, MH is rich in cohesiveness so that for an embankment of about 6 m in height a slope of 1.5:1~1.8:1 and for a cut portion of 10 m in height a slope of 0.8:1~1.2:1 are considered standard stable values.

The Indonesian standard of slope gradient (4:1 for embankment, and 3:1 for cut) is much more gradual than these stable gradient values. However, from the topography and vertical profile of the Ring Road, if the Indonesian standard is adopted for the high cuts and embankments for the hilly areas and river basin regions, the land requirement will be very great and the earthwork volume will largely increase. Therefore, for the study area, with due consideration to the rainfall characteristics, geology, and underground water situation, the following values are adopted as the gradients for the slopes classified by height of the cut or embankment.

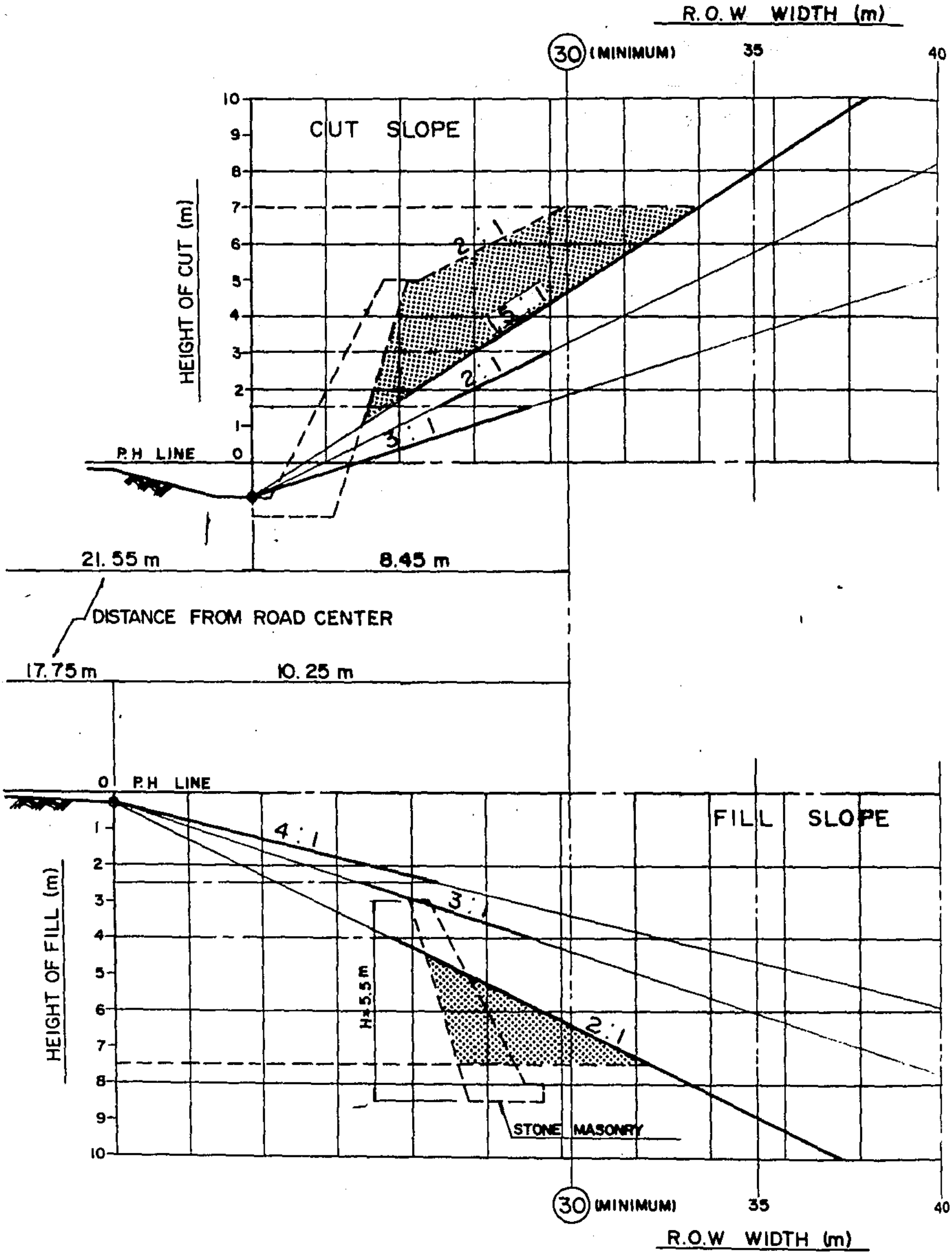
Table 3-3 Gradient of Slope

Height (m)	Embankment	Cut
0 ∿ 2.5	4 : 1	3 : 1
2.5 ∿ 4	3 : 1	2 : 1
4 or more	2 : 1	1.5 : 1
Indonesian criteria	4 : 1	3 : 1

Deciding the gradient of slope as above, more than 70% of the alignment of the project road have come to be the minimum width of the criteria.

In Fig. 3-1-2 is shown the relation between the gradient of slope for embankment and cut and the necessary width of right-of-way.

Fig. 3-1-2 RELATION BETWEEN GRADIENT OF SLOPE AND R.O.W WIDTH.



3-1-3 Foundation of Structures

(1) Survey

To determine the type of foundation for structures, rotary boring survey with standard penetration test was performed for the locations where major bridges are proposed. The boring was performed to a planned depth, but was terminated where the N value of over 50 continued for more than 5 m. Penetration test was performed at 1 m interval. Generally it was noted that at the plain near the coast the bearing stratum is quite deep and tends to become shollower for the gradual slope region further inland. The results of the survey are as shown in the previous Fig. 3-1 and the location where N value of over 50 continued for over 5m as shown in Table 3-4 together with the depth reached.

Table 3-4 Depth of Bearing Stratum

No.	Location of boring	Depth of stratum (m)
1	Junction with Jakarta-Tangerang Hwy	5
2	Proposed pier site of Pesanggrahan River Bridge	11
3	Proposed pier site of Cilliwung River Bridge	3
4	Junction with Jakarta-Cikampek Hwy	17
5	Junction with Jl. Jakarta-Bekasi	22

Note: The bearing strata were of hardened sandy soil.

(2) Determination of foundation works

Other than some exception, the bearing stratum in the study area is generally at about 5 ∿ 20 m below the existing surface, and the pile foundation work is proposed.

As the piles, considering the length of pile, quality of materials, driving capability, moment of inertia, etc., in RC pile and the steel pipe are determined.

The comparative studies of various types of piles are made as shown in Table 3-5. Through examination, following determination for the foundation is done.

Depth of the bearing stratum	Type
0 m ∿ 5 m	Spread foundation
5 m ∿ 12 m	RC Pile, 400 mm
12 m ∿ 22 m	Steel Pipe, ϕ600 mm

Additional checking of foundation types, at the stage of the detailed engineering with soil surveys should be needed to decide to proper foundation type.

Table 3-5 COMPARATIVE EVALUATION OF DIFFERENT TYPES OF PILES

(1)

Depth of Bearing Stratum			0 - 5 m	5 - 12 m	12 - 22 m				
					Material Quality	Availability of Material	Reliability in Construction	Fabrication Problems	Overall (1)
Evaluation	Spread Foundation		A	-	-	-	-	-	-
	Pile Foundation	R.C. Pile	B	A	A	A	C	A	B
		P.C. Pile	B	B	B	A	A	C	B
		Steel Pile	B	B	A	B	A	A	A
		Cast-in-Placed C-Pile	B	B	B	A	C	A	B
Remarks			Spread foundation is the most economical of all foundation types and it is so easy for the construction.	R.C. pile can be driven without joint and the most economical of all kind of foundation piles.	P.C. pile requires high strength concrete and maintenance of quality control is difficult.	R.C., P.C. and cast in place concrete are locally available except for reinforcement but steel pile has to be acquired from abroad.	R.C. pile is liable to cracks and damage of pile head and cast in place concrete pile is liable to interference of disturbed foundation at the pile head.	P.C. has to be fabricated at factories to be newly established and even if fabricated at stie, the problem of control of manufacturing remains.	Although there is a problem of availability, steel pile is considered most favorable

(2)

	Kind of Pile	Moment of Inertia	Economy	Overall (2)
Steel Pile	H-Pile	B	B	B
	Steel Pipe-Pile	A	A	A

(3) Of the steel pipe pile, both the $\phi 400$ - $\phi 600$ class may be driven with medium capacity driver, but considering the saving in work period with larger diameter piles, the $\phi 600$ pipe pile is considered for this study.

3-2 Material Surveys

3-2-1 Survey of Quarries

The study team made an extensive survey of the quarries over a wide area in the periphery for the 46 km proposed Ring Road, fully taking into consideration the available geological map for the study area, and the data from construction works of Jagorawi Highway which is an interurban highway within the study area.

The surveys made studies on the existing situation of quarrying, the production capacity and the quality of materials. The studied locations are as shown in Fig. 3-2 and the results summarized in Table 3-6. The use of aggregates for the Jagorawi Highway construction are as follows:

(a) Use of aggregates are in accordance with the ASHO standards.

(b) Coarse aggregates are of gravels excavated from the riverbed of Citeureup River at Kedungmanggu and crushed at the site office.

(c) Fine aggregates are purchased from suppliers in Bogor.

3-2-2 Aggregates Procurement and Implementation Plan

Since there is no aggregate supply source near the project area, and the materials excavated at cut portions do not contain suitable pavement materials, and also as the construction period for the project coincides with the construction period of other projects, it is anticipated that the procurement of aggregates will have a great bearing on the implementation of the project.

Basically, since the quarry site of the basalt hill at G. Putric which is 20 km from the project site, has aggregates of good quality at large quantity, this quarry should be made the main source of aggregates supply for the project, with a crushing plant established near the Ring Road, and with a production plan made with careful study of the balance between the estimated volume of aggregates demand and the construction schedule.

Fig.3-2 QUARRY SITES STUDIED

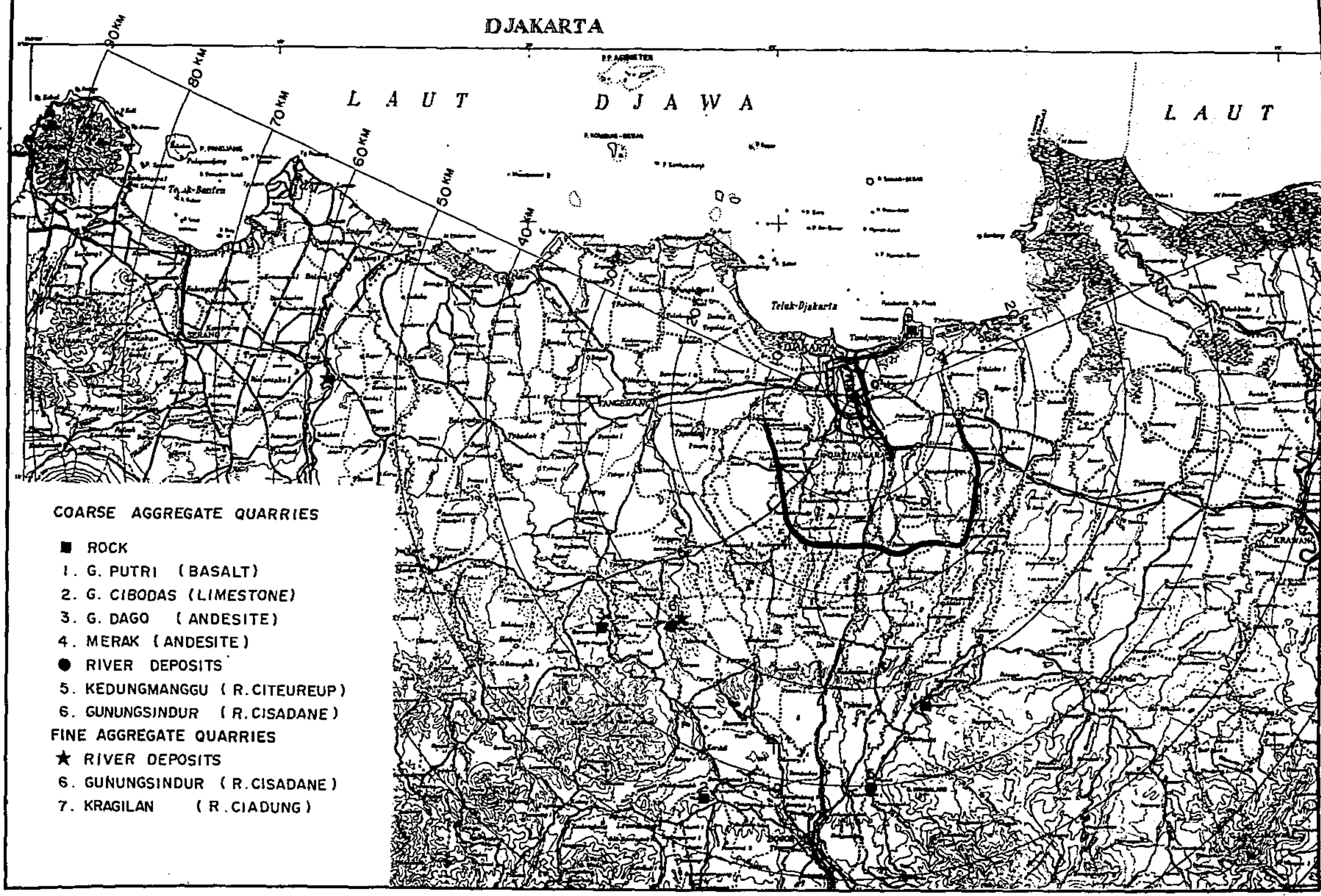
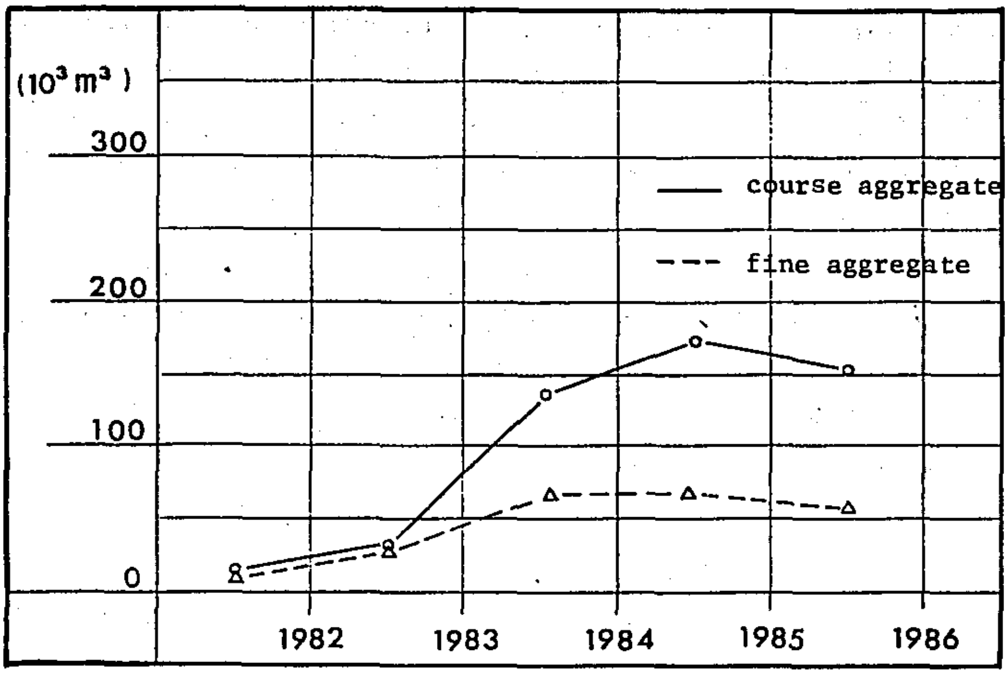


Table 3-6 Summary of Survey of Quarries

No.	Quarry	Type of material	Remarks
1	G. Putri	Basalt hill	Quality is fine and hard and there is no problem in material quantity or quality. Mass production is possible with adequate mechanical power. Location is also near the construction site, and is a very highly favored source of aggregates.
2	G. Cibodas	Limestone hill	Small scale excavation is now being carried out for production of limestone to be burnt to produced lime, but quality is not uniform. Results of abrasion test show that abrasion loss is near the limit for concrete aggregates. Also, there will be problems in production control in case of mass production.
3	G. Dago	Andesite hill	Top soil is shallow, and little weathering has occured and the quality is large. As there is no bridge across Ci Sadane, the transport distance from quarry to construction site is very long.
4	Merak	Andesite and its clastic rocks	This is a well known quarry of the region although it is over 100 km from Jakarta. The quality of the coarse aggregate for concrete is good. But due to the presence of platty joint, care has to be taken in crushing to avoid plate shape aggregates. Mass production is not possible.
5	Kedung-manggu	Riverbed sediments	This is the quarry site for Jagovawi Highway, where production by crushing of river pebbles is carried out at two or three sites of the Citeureup River. The riverbed pebbles are of andesite of about 25∿50 mm in diameter. The pebble layer is about 2∿3 m in depth and most of the locations are already exhausted of supply.
6	Gunung-sindur	Riverbed sediments	Manual excavation is carried out at Ci Sadane River for sand and gravel and the aggregate layer is about 2∿3m.
7	Kargilau	Riverbed sediments	This is the sediment of Ciadjung River at about 60 km west of Jakarta, and small scale excavation is made for sand. Quantity is hopeful.

Fig. 3-3 Chart of Estimated Aggregates Demand by Year



3-3 River and Hydrological Analysis

3-3-1 Site Surveys

The site surveys are carried out to obtain data for the planning of the bridges of project road, and the design criteria for drainage facilities, and also for the design of the minimum embankment height at river basins and the design of the profile of the highway.

The site surveys were carried out by the study team for a two-month period from March, 1977, making careful studies of the precipitation data of the study area, the basic plan of flood control canals in Jakarta and other existing hydrological data, and also performing detailed field reconnaissance for the areas where the project road are liable to be affected by water.

(1) Rainfall characteristics

The project area is situated at northwest Java, of latitude 6°11' south and longitude 106°50' east and the climate shows the typical characteristics of Southeast Asian monsoon zone. The rainfall characteristics shows a distinctive dry season and wet season at half-year interval, due to the effects of tropical seasonal wind. The average annual precipitation at the flat area of the urban area of Jakarta facing the Java sea is about 1,800 mm, whereas at the mountain area towards the upstream of Ciliwung River the figure is more than double to 4,000 mm.

The study area of the project road is located between the flat area and the mountain area and rainfall data for the past 30 years were recorded at over 2,000 mm. 80% of the rainfalls in the 6-month period from November to April of the following year, and rainfall is particularly scarce for July and August which record about 60 mm. Nevertheless, the extreme dry season found in East Java or the Sundura Islands is not experienced here.

The daily characteristics of rainfall is such that the rain comes in the late afternoon or the evening at great intensity for one to two hours in the form of squall to a limited locality. From the rainfall data of the past 100 years from 1864 to 1961, the maximum precipation in 24 hours was recorded at 266 mm and the maximum hourly precipitation was 106 mm.

(2) The existing situation of the main rivers

As seen from Fig. 3-4, the major rivers of the study area, such as Pesanggrahan and Ciliwung, flow from the southern hill area towards the Java Sea at distances of 2 ∿ 5 km from one another. The gradient of flow near the river mouth is generally very gradual and the rivers meander along the way so that the river courses are not very stable. At the flat area of the river basin, inundation through floods extends over wide area, and early steps for river improvement, embankment provision and canal construction for flood control purpose are necessary.

The Ciliwung River towards the east of Jakarta-Depok railway line has a width of about 30 m near the project road, a width of over 100 m upstream and a river basin area of 310 km^2, is the largest river of the region.

Scouring is observed at the bridge piers of most existing bridges of the rivers, so that in the planning of river crossing, ample consideration has to be given to the location of the bridges and the span of the structure. The results of surveys of the major rivers are as summarized in Table 3-7.

3-3-2 Calculation of Discharge from the Study Area

The volume of discharge of the major rivers extending about 10 km to the south of the planned East-west flood control canal was calculated from the basic plan for the flood control canal of Jakarta prepared in 1973 and other available hydrological data, in order to obtain basic data for the planning of road profile, bridges and drainage structures.

(1) Calculation assumptions

(a) Peak discharge volume

The peak discharge volumes of the rivers were calculated by the rational formula. That is, assuming that the rainfall to an area is at an uniform intensity of YT (mm/hr) for a

Fig. 3-4 MAP OF MAJOR RIVERS

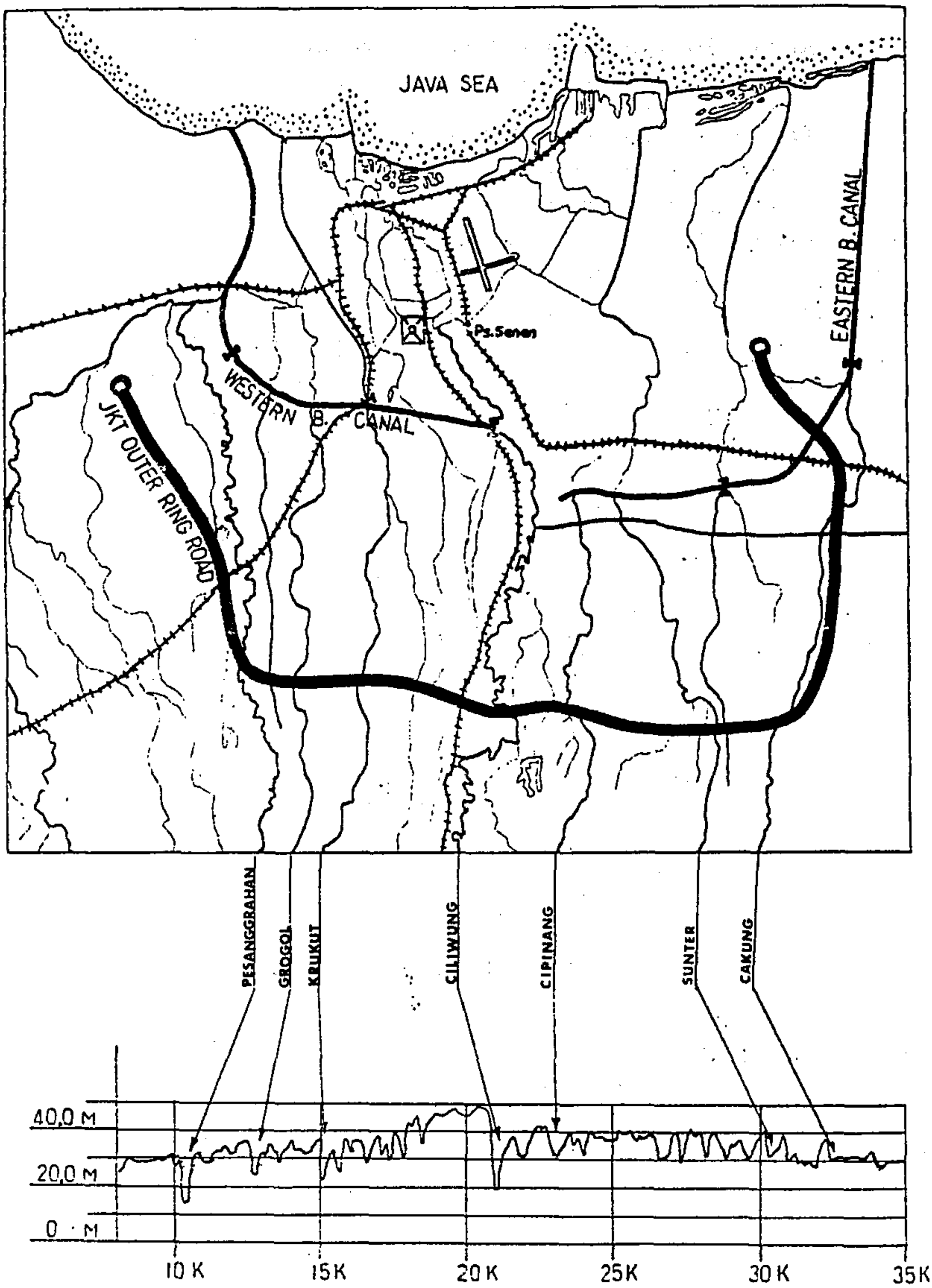


Table 3-7 Main Drainage and Bridge Survey Data

Name of River	Station	Nearest Village	Discription of Site			
			Width of River	Width of Flood	Stream	Existing Structure
K.Pesanggrahan	10 + 500	Pondok Pinang	10 m	60 - 70	Silty water Meandering flow	at 3 km up stream 20 m span R C Bridge
K. Krukut	15 + 150	-	5 m	7	Silty water Swift flow	at 2.2 km up stream 6.2 m span R C Bridge
Ciliwung	21 + 50	Tanjung Barat	30 m	35	Silty water Swift flow Meandering flow	Note: Navigation of banboo's raft.
K. Sunter	28 + 750	Pantar Jati	10 m	15	Silty water Swift flow Meandering flow	at 1.0 km up stream 10 m span R C Bridge
Saluran Induk Tarum Barat	38 + 600	Kampung Dua	15 m	-	Silty water	at 0.5 km up stream RC Bridge span 30 m
S. Cakung	30 + 750	Buaran	10 m	15	Silty water	at 0.2 km down stream 6 m span steel beam Bridge

duration of T hours, and the arrival time required for the water that falls on the uppermost end of the river to the river basin end (the location of the project road) via the earth surface and the river course is Tc hour, then using the maximum rainfall intensity of γ_{TC} at T = Tc hour, the peak discharge volume Qp is expressed in the following formula.

$$Qp = \frac{1}{3.6} \cdot f \cdot \gamma_{TC} \cdot A \ (m^3/sec)$$

where: f is discharge coefficient
A is river basin area

(b) Arrival time

The arrival time Tc is calculated with the formula established by Ir. J. H. Haspers taking into consideration the characteristics of rivers in Java.

$$Tc = 0.1\ L^{0.8} \cdot i^{-0.3}$$

where: L is length of river
i is gradient of river

(c) Maximum rainfall intensity for T hours

$$\gamma_T(mm/hr) \quad \frac{R_{24}}{24} \cdot \left(\frac{24}{T}\right)^{2/3}$$

where: T_{24} is maximum rainfall in 24 hours, using the 266 mm recorded for the mountain area from 1864 to 1961.

For major structures, the rainfall intensity probability is taken as 100 years.

(2) Discharge volume of major rivers

The areas of river basins of major rivers are as shown in Fig. 3-5, and, calculation in accordance with the above mentioned assumptions, the discharge volume of the major rivers and the control height of the project road are computed as shown in Table 3-8.

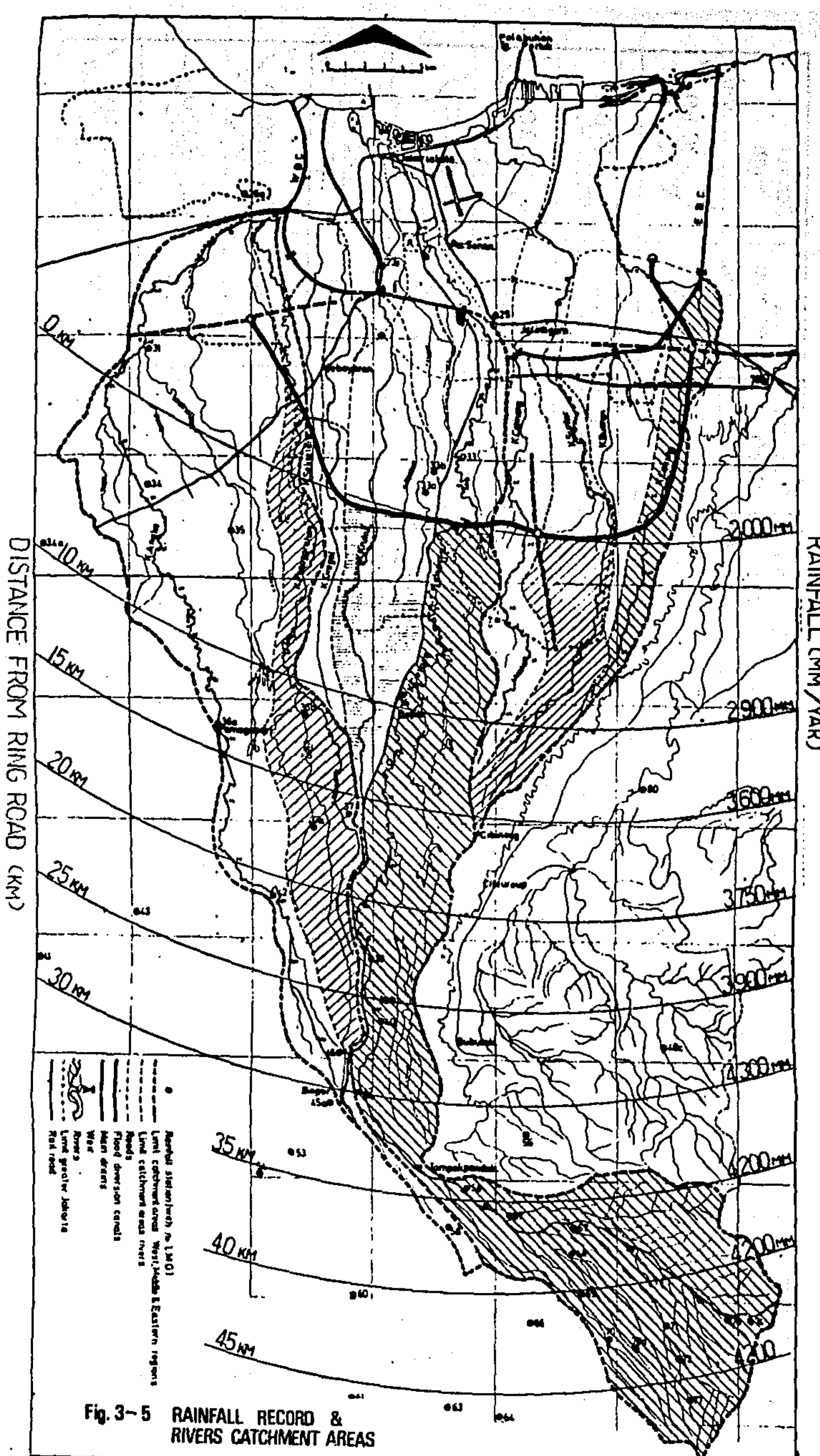


Fig. 3-5 RAINFALL RECORD & RIVERS CATCHMENT AREAS

Table 3-8 PEAK DISCHARGE OF MAIN RIVER

	Name of River	Catchment Area (Km²)	Length (Km)	Altitude (m) H1	Altitude (m) H2	Altitude (m) H	Slope (i%)	Concentr. Time (Hr)	Reduct. Coeff.	Peak Discharge (m^3/s)	Control High (m)
1	Pesanggrahan	89	61	205	14	191	3.13	15	0.70	260	(H.W.L) +20.80
2	Grogol	16	15	100	22	78	5.20	4	0.95	147	+27.00
3	Krukut	58	24	117	20	97	4.04	7	0.75	314	+28.00
4	Ciliwung	308	95	2908	19	2889	30.40	11	0.70	1116	+25.30
5	Cipinang	28	24	107	30	77	3.20	7	0.83	160	+36.50
6	Sunter	50	25	122	27	95	3.80	7	0.79	276	+30.60
7	Buaran	3	5	45	34	11	2.20	2	0.85	38	+30.50
8	Cakung	20	19	90	29	61	3.37	6	0.80	124	+31.90

3-3-3 Planning of Bridges and Road Crossing Drainage Structures

(1) Classification of structures

According to the discharge volumes calculated in the previous section, the size and type of structures adopted for the proposed Ring Road are classified as in Table 3-9. Basically, bridges are planned for rivers with peak discharge Qp (100) of over 50 m^3/sec and the span of the bridges is determined according to the cross section of the river and the planned control height.

Table 3-9 Classification of Structures

Qp (100 m^3/s	Structure	Size
0 ∿ 2.5	Pipe culvert	ϕ100
2.5 ∿ 5.0	Multi-pipe C.	2 ∿ ϕ100
5.0 ∿ 25.0	Box culvert	3.00 x 2.50
25.0 ∿ 50.0	Multi-Box C.	2 ∿ 3.00 x 2.50
50.0 ∿ 200.0	Bridge	Span 15 ∿ 20 m
200.0 ∿	Bridge	Span 30 m ∿

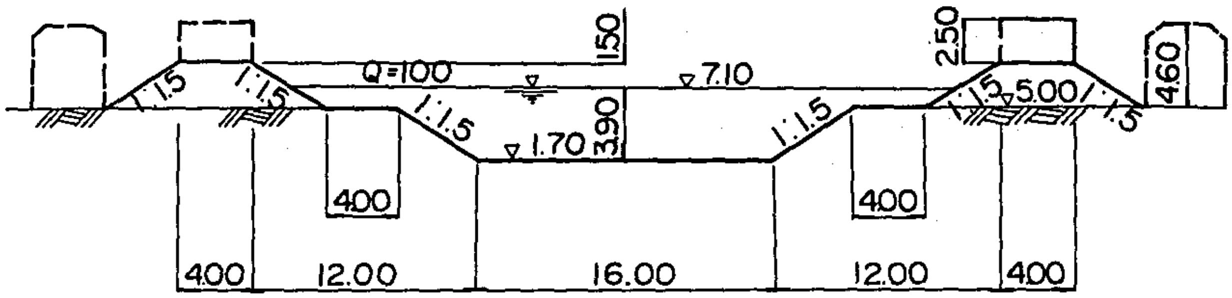
(2) Planned height of bridge

For river bridges, it is necessary to plan the required clearance from the lower part of the girder to the control height. The following are adopted as the minimum value for the clearance according to the planned discharge volume, thus controlling the planned profile of the project road.

Q (m^3/sec)	Clearance (m)
∿ 100	0.6
100 ∿ 500	0.8 ∿ 1.0
500 ∿ 1,500	1.0 ∿ 1.2

The Ring Road crosses the flood control canal planned by the Jakarta City near Sta. 43. The cross section of the planned canal as shown in the Masterplan for Drainage and Flood Control of Jakarta, 1973, is adopted for the control point for bridge plan.

Fig. 3-6 Cross Section of the Eastern Flood Control Canal



CHAPTER 4 DESIGN CRITERIA AND ALTERNATIVES

4-1 General

The Ring Road project for Jakarta, as shown in the landuse plan in Chapter 2, is part of a program of infrastructure improvement for the purpose of promoting development of various urban functions. The size of the Ring Road is about 14 km in average radius from the urban center, and extends for a distance of about 48 km, connecting the various radial roads at the periphery of Jakarta. The road will form the backbone of future Jakarta, and serve as a defining line for guiding the expansion of building up to prevent sprawling of the city.

In this chapter, a comparative analysis from different angles is made for the main road and the interchanges, which are planned at about 6 km interval, from the points of road maintenance situation and forecast traffic demand in order to obtain a suitable solution so that a policy may be established for the project road economically and technically and that an effective and feasible alternative may be determined.

The guidelines for determination of the route are as shown in Table 4-1 and the relevant items considered in the comparative study of the alternatives are shown in Fig. 4-2.

Fig. 4-1 Location and Size of Ring Road

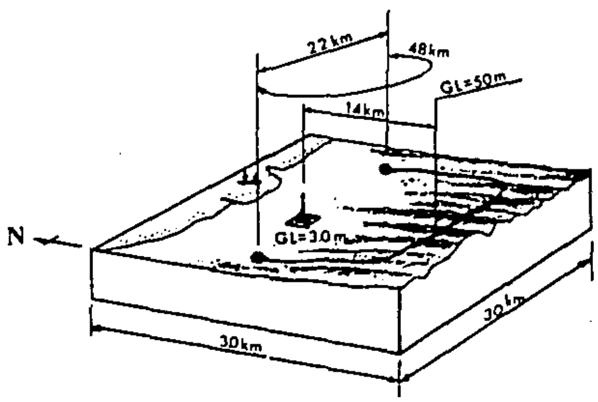
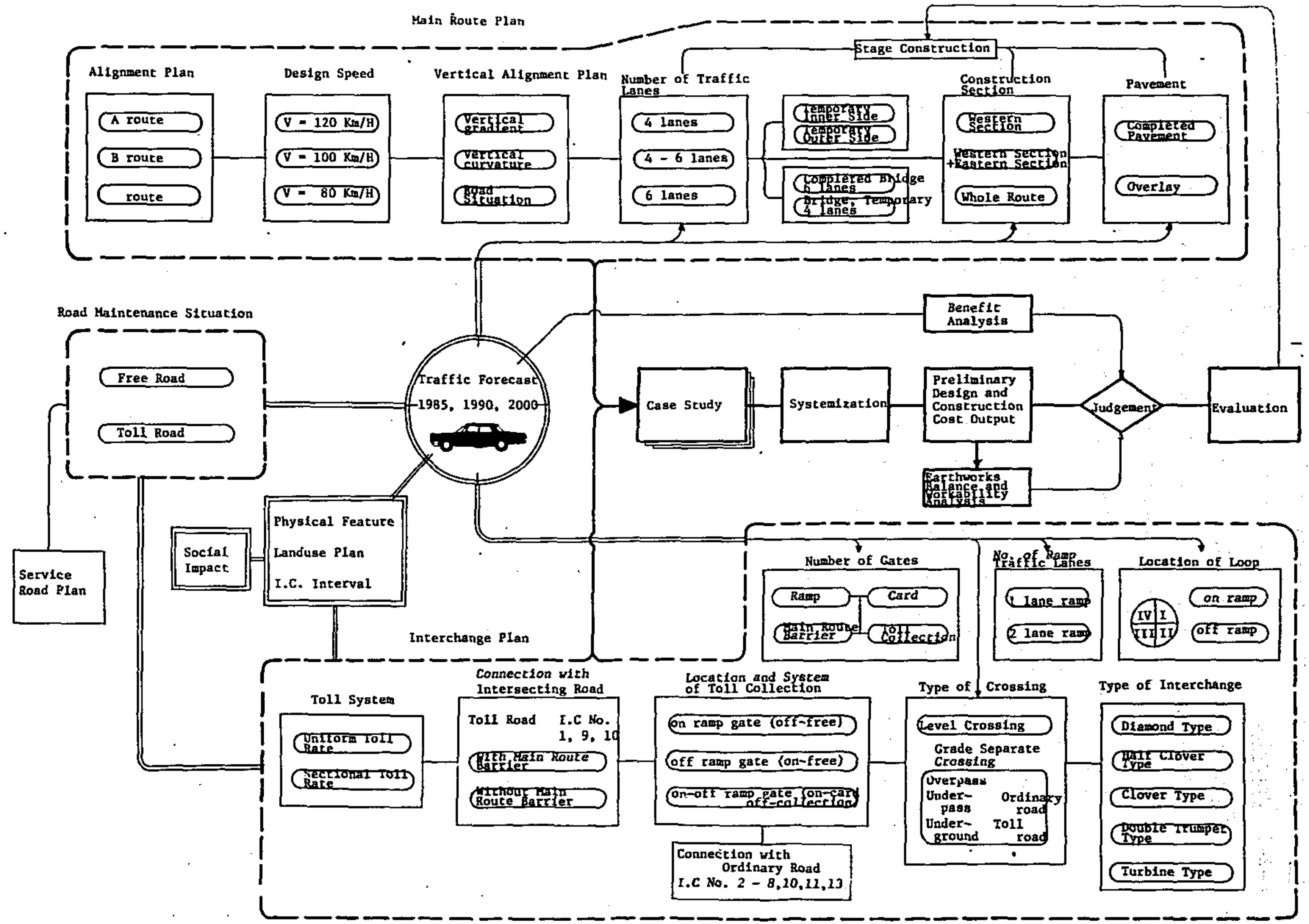


Table 4-1 Guidelines in Route Section

	Primary control	Secondary control
Objective	To secure a size of the Ring Road that conforms to the character and importance of the route, and to plan a safe and comfortable road.	
1. Natural condition		
a) Physical	Mountain range, rising, valley, sites of bridges at major rivers.	Large embankment, large cut, long and large slope, lakes, ponds, minor rivers.
b) Soil, geological	Large scale landslide belt, collapse belt	Weak ground belt sedimentary stratum, (ref. Fig.4- 13) talus cone belt, direction of fault.
c) Meteo-rological	Flood region (ref. Fig.4-12)	
2. Related public works	Relation between location of interchange and roads con-nected, location of inter-section with major radial roads and railway; town planning projects	Alignment near interchanges, number of crossings, land division project.
3. Environmental conditions		
a) Social invironment	School, hospital, mosque, heavy built-up areas	Village, factory, industrial estate.
b) Natural environment	Special environmental preservation zone, national park	Environmental preservation area (natural park) parks.
4. Others	Conditions stipulated by Bina Marga Cultural treasure, monuments, and other public facility buildings.	

Fig. 4-2 Relevant Factors for Establishment of Comparative Alternatives

Fig. 4 — 2
STUDY ITEMS ON ALTERNATIVES



4.2 Design Criteria for Main Route

4-2-1 General

The project road is to be connected to 3 urban toll roads (Jakarta-Tangerang Jagorawi, and Jakarta-Cikampek), either under construction or under plan.

The design criteria of these toll roads are mainly based on the "Expressway Geometric Structure Standard (draft), 1976" by the Bina Marga, Indonesia, the "Highway Geometric Structure Standard, 1970" of Indonesia and the "Highway Structure Ordinance" Japan. For the project road, alternative studies are made for the toll-road alternative and the toll-free-road alternative, and the road has to be planned in coordination with the above-mentioned three toll roads.

For this study, the design criteria adopted or newly established are explained in the following sections.

4-2-2 Geometric Structure Standard

(1) Design speed

For the toll-road alternative, the design speed is set for the two cases of 120 km/h and 100 km/h, and for the toll-free-road alternative, the 100 km/h design speed is adopted.

In the determination of the design speed considering the future important role of the road as an urban ring road, as high a speed as possible is adopted, because the physical features are favourable, and it is possible to construct the road at a high design speed and high capacity at a low construction cost.

For the free-road alternative, which will be a partially access control road, due to the in-and out-flow of traffic from the frontage roads in conformity to the function of the road it is not desirable for the speed to be higher than 100 km/h from the point of safety, and basically the design speed is set at 100 km/h for the whole route, and where unavoidable due to land use of physical conditions, the design speed is dropped to 80 km/h.

(2) Cross section width composition

For the two-direction four-lane section, the traffic lane is set at 3.75 m for both the toll and free road, providing 3.00 m for the left shoulder and 1.50 m for the right shoulder, in accordance with the stipulation of the Indonesian "Expressway Geometric Structure Standard (draft), 1976." The median is set at 113 m, the same as that for Jakarta-Cikampek and Jagorawi Highways. (Please see Fig. 4-3).

A 6-lane section is planned for the free road alternative from IC6(Sta 17 + 055) to IC9(Sta 24 + 570) and the cross section width composition is as shown in Fig. 4-3. In this section, the median is 5.50 m, which is of a lower standard than other urban expressways, but the section is short (7.5 km), and the width is in comformity with the minimum width of 5.50 m stipulated in the Indonesian "Expressway Geometric Structure Standard (draft), 1976."

(3) Minimum curve radius

Generally, it is desirable to adopt as large a curvature for the alignment within the limit of the physical feature, and for the project road, since most of the region around the road is flat plain, flatter curve radii are set than the minimum curve radius stipulated by the Indonesian geometric structures standard, and variations are made for the minimum radius to fit the requirements of a maximum superelevation of 8%.

(4) Cross fall

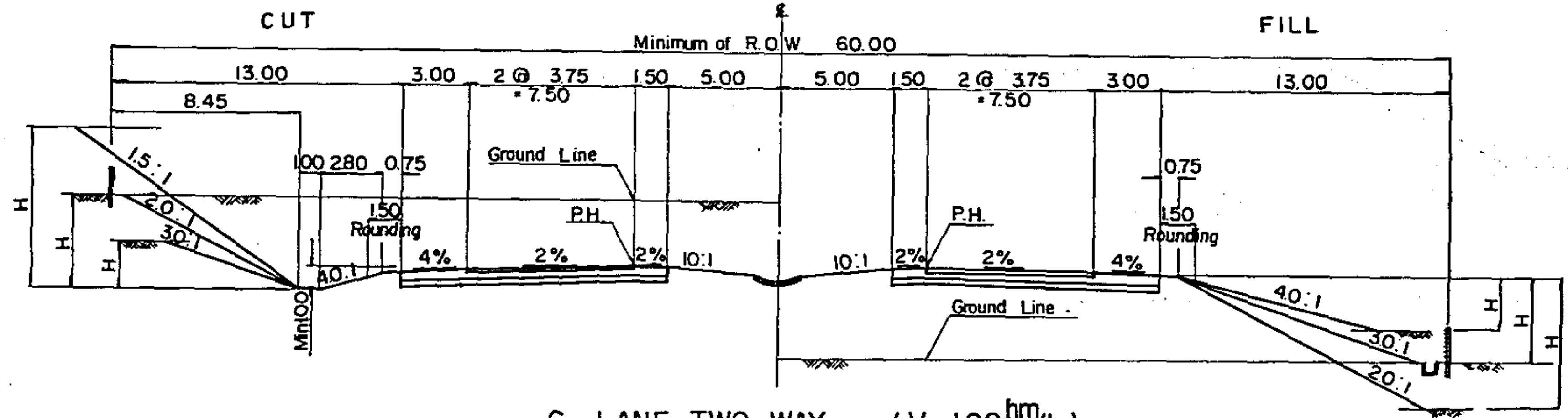
The crown height is determined from the both point of view of surface drainage and traffic safety. For the purpose of surface drainage the crown height should be higher and for the purpose of traffic safety the surface should be flat. From these two kinds of opposite purposes, the gradient of cross fall is determined considering the kinds of vehicles, rainfall, horizontal and vertical alignment and kinds of surface. For this Ring Road study the typical gradient of cross fall is decided 2% from the experimental equation of surface drainage.

(5) Traffic capacity

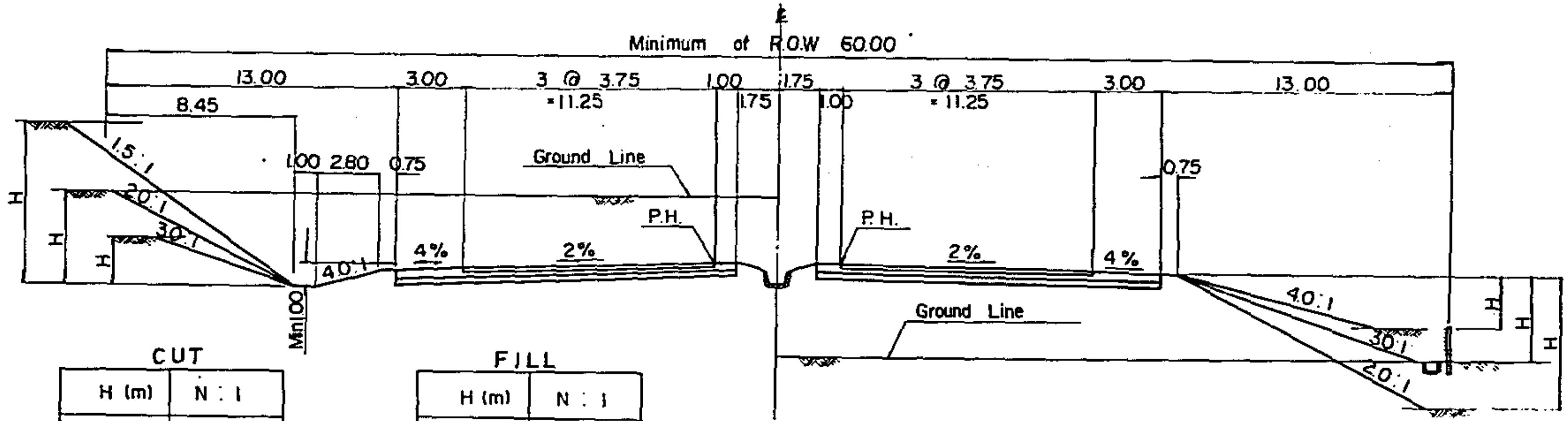
The traffic capacity is computed based on the Japanese "Highway Structure Ordinance," due to the fact that the various conditions of traffic in Indonesia, such as the type and size of vehicles are very similar to those in Japan. The method of computation of traffic capacity is as shown in Table 4-3.

Fig.4-3-1 TYPICAL CROSS SECTION SCALE 1 : 200

4 - LANE TWO WAY (V=120 km/h, 100 km/h)



6- LANE TWO WAY (V= 100 hm/h)



CUT

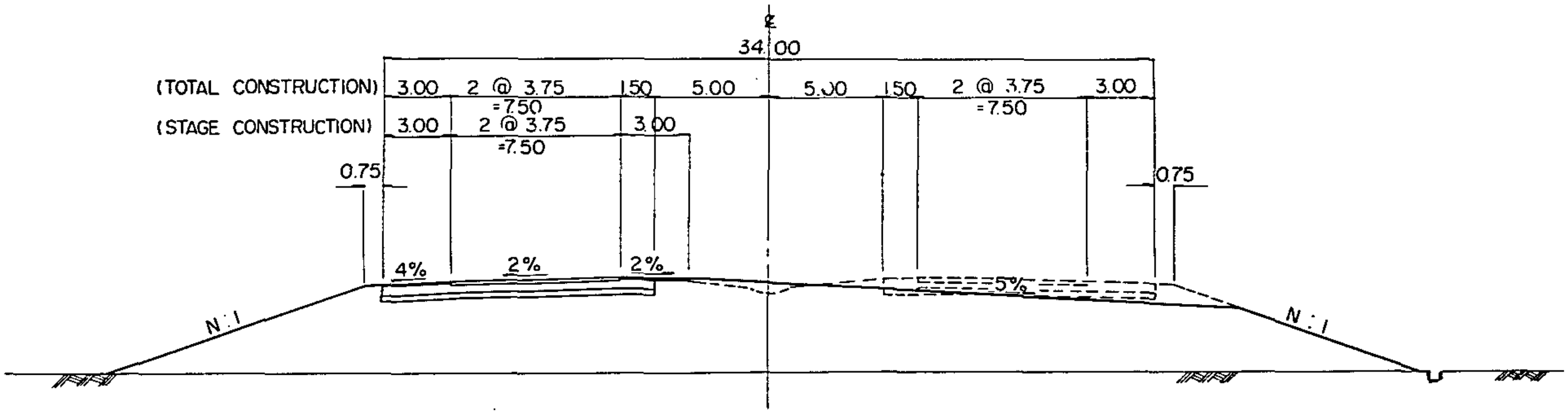
H (m)	N : 1
0≦H<2.5	3 : 1
2.5≦H<4.0	2 : 1
4.0≦H	1.5 : 1

FILL

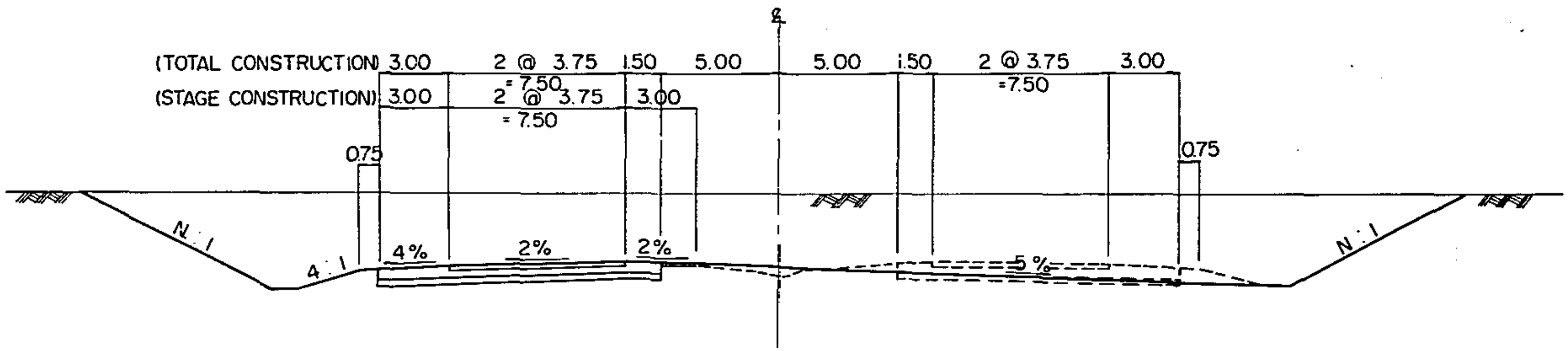
H (m)	N : 1
0≦H<2.5	4 : 1
2.5≦H<4	3 : 1
4≦H	2 : 1

Fig. 4-3-2 TYPICAL CROSS SECTION (STAGE CONSTRUCTION)
(2-LANE TWO WAY)

FILL SECTION



CUT SECTION



NOTES;

———— ; STAGE CONSTRUCTION

- - - - ; TOTAL

Table 4-2 HIGHWAY GEOMETRIC DESIGN STANDARDS

Item	Unit	Recommended Design Standard of this study			Bina Marga's Design Standard [1976], (1970)			Design Standard in Japan			Jakarta - Tangerang Highway			Jagorawi Highway	Jakarta-Cikampek Highway	Remarks
Terrain	-	Flat	Flat	Flat	[Sparcely Devel-loped] (Flat)	[Devel-oped] (Rolling)	(Moun-tainous)	-	-	-	-	-	-	-	-	
Design Speed	km/h	120	100	80	120	100	80	120	100	80	120	100	80	120	120	
Minimum R.O.W. width (excluding Frontage Road)	m	60	60	60	60	60	60	-	-	-	60	60	60	90	70	
Lane Width	m	3.75	3.75	3.75	3.75	3.75	3.75	3.75 (+3.5)	3.50	3.50	3.75 (2X)	3.75 (2X)	3.75 (2X)	3.75 (2X)	3.75 (2X)	
Shoulder Width (inside) (outside)	m	3.0	3.0	3.0	3.5	3.0	3.0	3.0	3.0	2.5	3.0	2.0	2.0	3.0	3.0	
Median Width	m	13.0	13.0	13.0	[5.5] (10.0)	[5.5] (10.0)	[5.5] (10.0)	4.5	4.5	3.0	10.0	4.0	-	13.0	13.0	
Crossfall of Pavement	%	2	2	2	2	2	2	2	2	2	2	2	2	2	2.5	
Crossfall of Shoulder	%	4	4	4	4	4	4	4	4	4	4	4	4	2 & 4	2 & 4	
Type of Pavement	-	Asphaltic concrete - - - hotmix														
Maximum Superelevation	%	(10 (6)	10 (6)	10	10	10	10	10	10	10	10	10	10	-	-	
Minimum Radius	m	630 (880)	410 (640)	250 (450)	560	350	210	710 (1000)	460 (700)	280 (400)	510 (880)	380 (640)	230 (450)	-	800	
Maximum Gradient	%	3	4	5	3	4	5	2	3	4	3	4	5	-	3	
Stopping Sight Distance	m	225	165	115	225	165	115	210	160	110	225	165	115	-	-	
Minimum Vertical Curve Length	m	Refer to Fig. 4-4, 4-5														
Minimum Radius for Curve not Requiring Transition Curve	m	2000 (4000)	1500 (3000)	1100 (2000)	2000	1500	1100	4000	3000	2000	2000 (4000)	1500 (3000)	1100	-	-	
Minimum Radius for Curves not Requiring Superelevation	m	7500	5000	3500	3000	2300	1600	7500	5000	3500	5700	4000	1600	-	-	
Superelevation Run-off rate	-	1/280	1/240	1/200	1/280	1/240	1/200	1/300	1/260	1/230	1/280	1/240	1/200	-	-	
Value of Superelevation	-	Refer to Fig. 4-6														

Note: The figures in parenthesis show the desirable values.

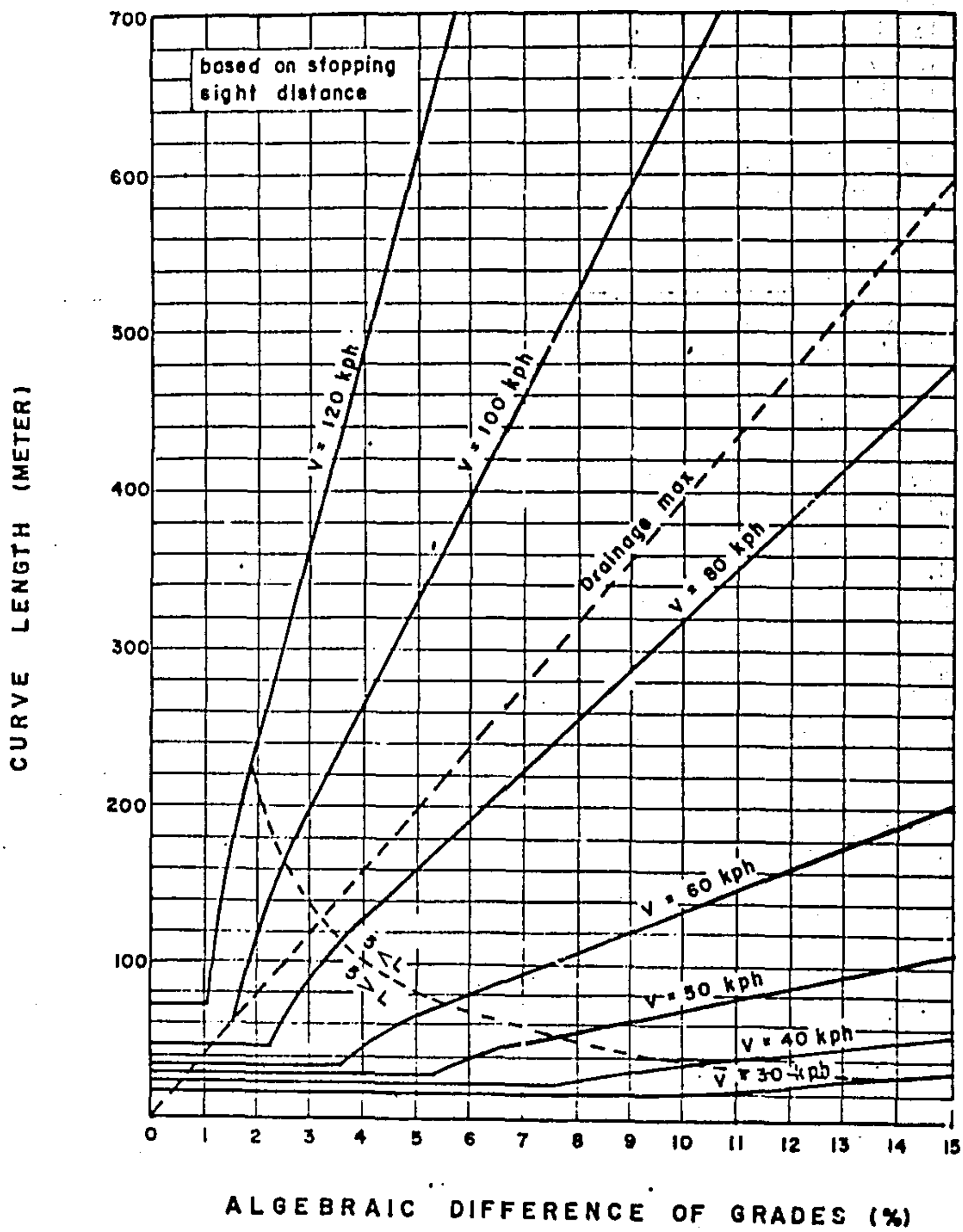


Fig. 4–4 LENGTH OF CREST VERTICAL CURVE

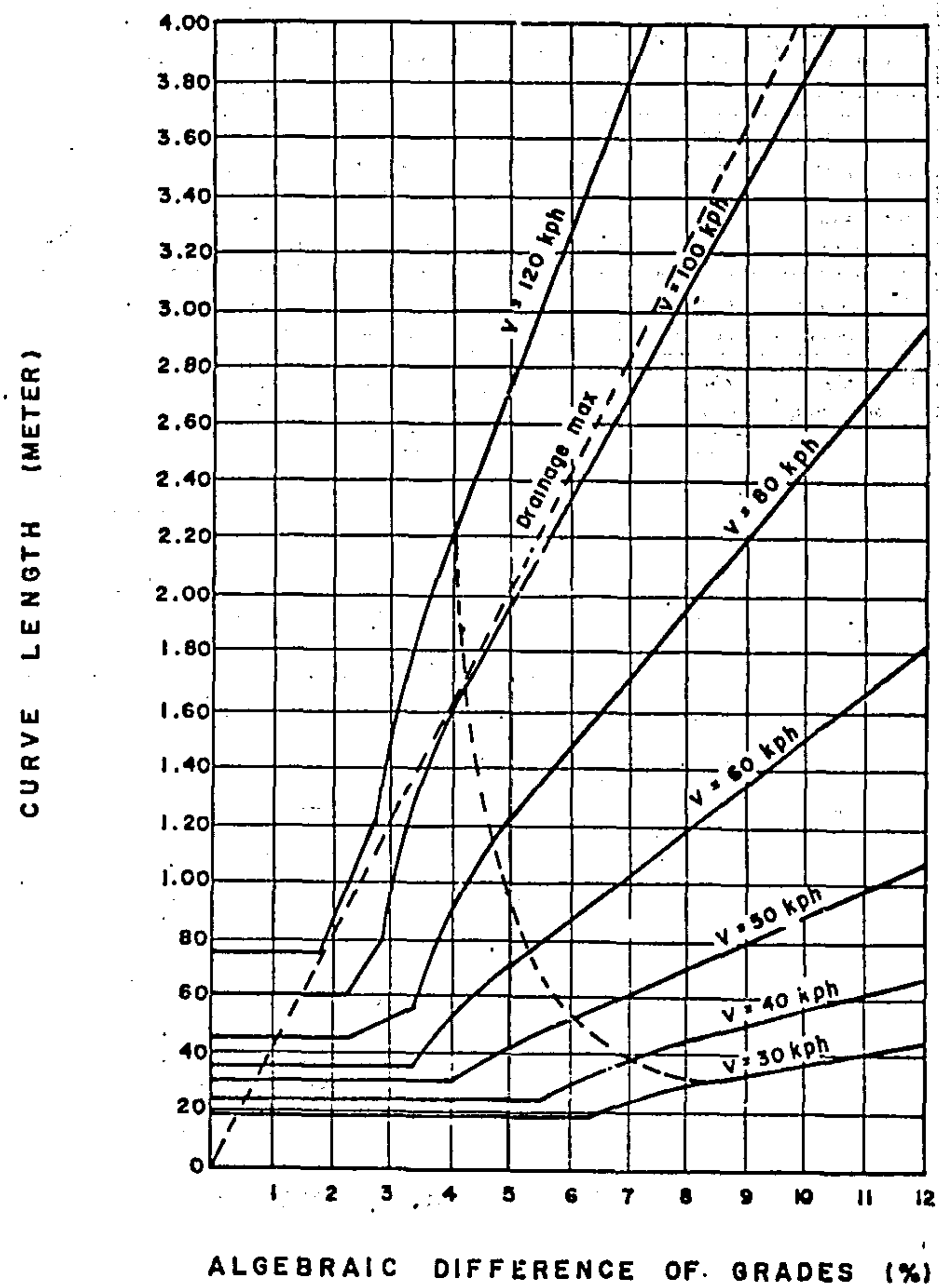
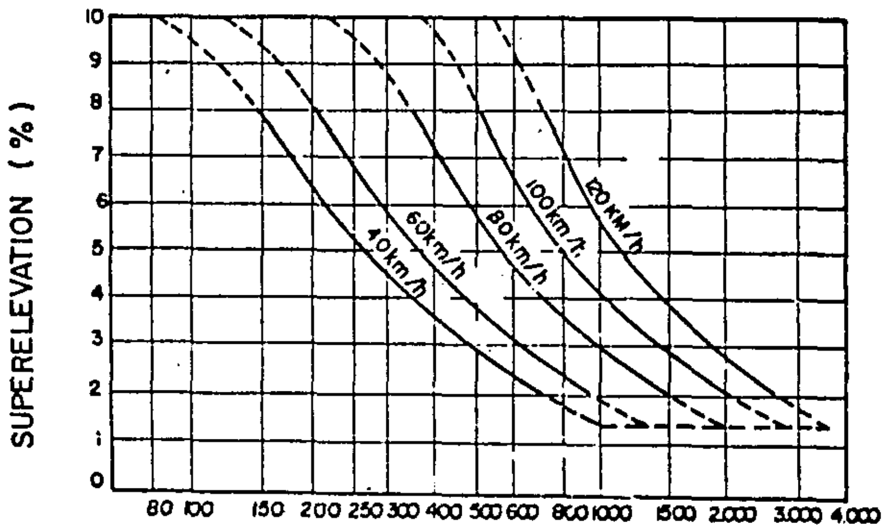


Fig. 4-5 LENGTH OF VERTICAL CURVE

DESIGN SPEED	. 120 KM/h	100KM/h	80KM/h	60KM/h	40KM/h	SUPER. EL
	570 ABOVE 610 UNDER	380 // 430 //	230 // 280 //	120 // 150 //	80 // 100 //	10 %
	610 ABOVE 670 UNDER	430 // 480 //	280 // 330 //	150 // 190 //	100 // 130 //	9 %
	670 ABOVE 760 UNDER	480 // 550 //	330 // 380 //	190 // 230 //	130 // 160 //	8 %
	760 ABOVE 880 UNDER	550 // 640 //	380 // 460	230 // 270 //	160 // 200 //	7 %
Radii	880 ABOVE 1,030 UNDER	640 // 760 //	450 // 540 //	270 // 330 //	200 // 240 //	6 %
	1,030 ABOVE 1,280 UNDER	760 // 930 //	540 // 670 //	330 // 420 //	240 // 310 //	5 %
	1,280 ABOVE 1,660 UNDER	930 // 1,210 //	670 // 870 //	420 // 560 //	310 // 410 //	4 %
	1,660 ABOVE 2,300 UNDER	1,210 // 1,700 //	870 // 1,240 //	560 // 800 //	410 // 590 //	3 %
	2,300 ABOVE (2,860 UNDER)	1,700 // (2,130) //	1,240 // (1,800) //	800 // (1,370) //	590 // (1,000) //	2 %



RECOMMENDED VALUES ARE AS SHOWN BELOW HEAVY LINE IN TABLE MENTIONED ABOVE

Fig. 4-6 SUPERELEVATION

Table 4-3 DESIGN TRAFFIC CAPACITY ANALYSIS

Item	Design Speed (km/h)	Lane Width (m)	Lateral Clearance		Heavy Vehicle		Coefficient of Adjustment					Basic Capacity (Veh./h)	Possible Capacity (Veh./h)	Design Level	Adjustment of Design Level	Design Capacity (Veh./h)	Peak Factor (%)	Rate of Direction (%)	Design Daily Volume (Veh./day) per lane	Remarks
			Left (m)	Right (m)	% of H.V.	Passenger car Equipment	Lane Width	Lateral Clearance	Heavy Veh.	Condition of Sight	Total									
					PT	ET	γL	γC	γT	γI		CB	C			CD	K	D	ADJ	
Multiple Lanes (per lane)																				
2-Lane, One Way	120 100	3.75	3.00	1.50	8.0	2.0	1.00	1.00	0.91	1.00	0.91	2500	2290	1	0.80	1820	8.0	60	19000	
3-Lane, One Way	100	3.75	3.00	1.00	8.0	2.0	1.00	0.98	0.91	1.00	0.89	2500	2230	1	0.80	1780	8.0	60	19000	

$$T = \frac{100}{100 - Pt + Et\ Pt}$$

Where γT; Coefficient of adjustment for heavy vehicles.

PT; Percentage of heavy vehicles.

ET; Passenger car equivalent of heavy vehicles.

$$C = CB \times L \times C \times I \times T$$

Where CB; Coefficient of adjustment for lane width.

γL; Coefficient of adjustment for lateral clearance.

γC; Coefficient of adjustment for condition of sight.

γT; Coefficient of adjustment for heavy vehicles.

$$ADJ\ (\text{Multiple Lanes}) = \frac{5000}{K.D.}\ CD$$

Where K; Peak factor (%)

D; Rate of direction (%)

CD; Design capacity (Veh/hour)

4-3 Design Criteria for Interchange

4-3-1 General

In determining the design criteria, the factors to be taken into consideration are the characteristics of the roads to be connected to, the design speed, traffic volume, and locality conditions. The interchange has to ensure smooth and safe connection between the two roads.

The characteristics of the connected roads are whether it is a toll road or a free road, and from the point of operation of the Ring Road, the factor to be considered is whether the Ring Road is to be operated as a toll road or a free road. The design criteria adopted or newly established under these conditions are described in subsequent sections.

4-3-2 Geometric Structure Standard

(1) Design speed of ramp

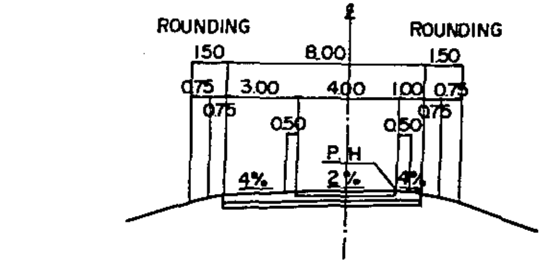
(a) Connection with inter-city toll roads
This will be a connection between two expressways, and the ramp will be considered by the drivers as part of the expressway, so that the ramp has to be planned as a converging or diverging section of the expressway. Therefore, generally it is desirable that the design speed of the ramp be the same as that of the main route and the minimum speed should be 1/2 that of the main route. The design speed for each ramp should therefore be determined within this range taking into consideration the traffic volume and the physical features.

The above principles are more easily conformed to in the case of a three-branch interchange. However, when applied to four-branch interchange, the interchange has to be the direct-connection type which involves enormous increase in construction cost. For this reason, the design speed is usually further reduced.

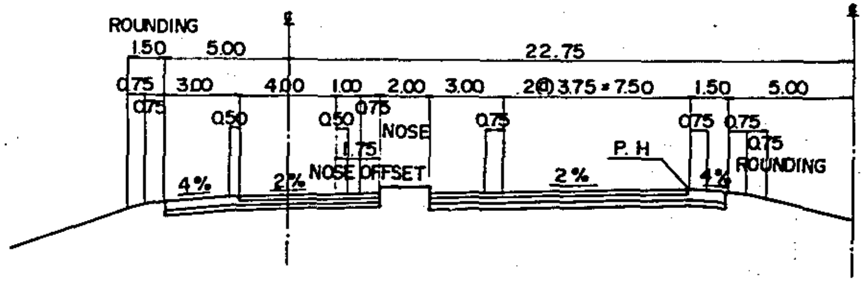
Fig. 4-7 TYPICAL CROSS SECTION OF INTERCHANGE

$V = 40 \, ^{km}/_{hr} \quad 60 \, ^{km}/_{hr}$

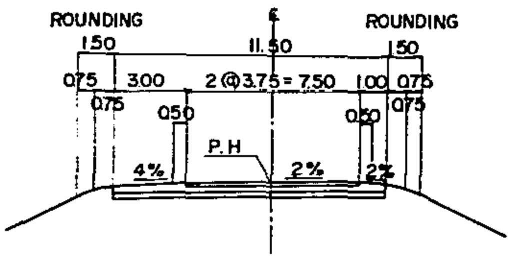
SCALE 1 : 200



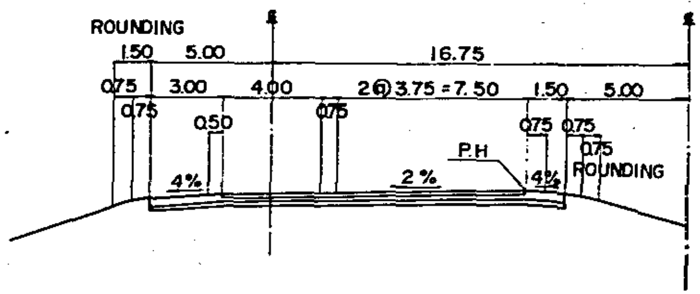
1 - LANE ONE WAY



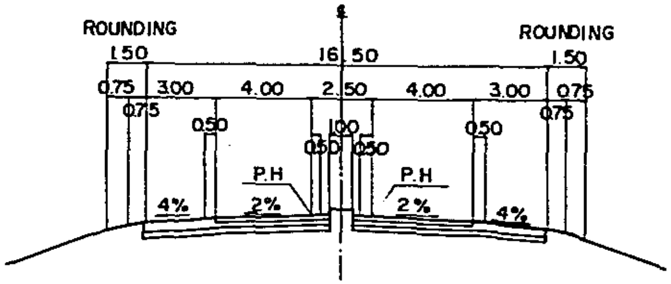
NOSE SECTION OF DECELERATION LANE



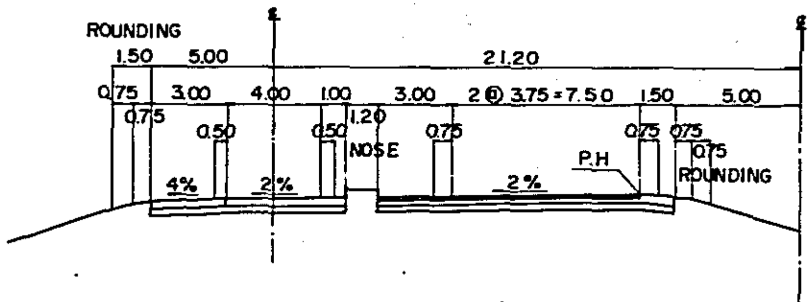
2 - LANE ONE WAY



SECTION OF END FOR TAPER



2 - LANE TWO WAY



NOSE SECTION OF ACCELERATION LANE

Thus taking all the above points into consideration, the design speed for the ramps of interchanges connecting intercity expressways, is set at 60 km/h or 1/2 that of the main route, but for the loop ramps, the exception of 40 km/h is adopted. In the case of the Ring Road being operated as a free-road, considering that vehicles have to stop at the toll gate installed in the interchange, the design speed is set at 40 km/h for all ramps.

(b) Connection with ordinary roads

Considering the design speed of the Ring Road (120 km/h), the design speed for ordinary roads (60 km/h), the traffic volume of the interchanges, and the necessity of installing toll gates, the design speed of ramps is set at 40 km/h. However, care is taken to ensure safety at the diverging point from the ramp to the main route for both the inflow and outflow traffic.

(2) Width composition

The width composition for ramps of single direction single lane type, two direction two lane type and also for the zone are in comformity with the standard adopted for the Jakarta-Tangerang Highway. For the single direction two lane ramps although the standard of 3.80 m per lane is stipulated in the Expressway Geometric Structure Standard of Bina Marga, the width of 37.5 m is adopted.

The width composition of the ramps is as shown in Fig. 4-7 and the items studies are summarized is Table 4-4.

4-3-4 Traffic Capacity

The traffic capacity is computed based on the Road Structure Ordinance of Japan, for the same reason as in the case of the main route.

The design traffic capacity for a single lane ramp, is 1,200 pcu/hr, since the curvature, gradient, and vertical curve of the ramps are of a lower standard when compared to the main route,

Table 4-4 INTERCHANGE GEOMETRIC DESIGN STANDARD FOR RAMP WAY

Item	Unit	Recommended Design Standard		BINA MARGA'S Design Standard		Design Standard in Japan		Remarks
Design Speed	Km/h	60	40	60	40	60	40	
Lane Width	m	4.0 1)	4.0 1)	4.5 2)	4.5 2)	3.5	3.5	
Shoulder Width of Left Side	m	3.0	3.0	3.0	3.0	2.5 3)	2.5 3)	
Median Width	m	-	2.5	-	-	2.5		
Crossfall of Pavement	%	2	2	3	3	2	2	
Crossfall of Shoulder	%	4	4	4	4	4	4	
Type of Pavement	-	Asphaltic Concrete (hot mix)						
Maximum Superelevation	%	10	10	10	10	10	10	
Minimum Radius	m	130	50	115	50	130	50	
Maximum Gradient	%	6	5	8	6	6	5	
Stopping Sight Distance	m	75	40	75	-	75	40	
Minimum Vertical Curve Length	m	Refer to Fig. 4-4, 4-5						
Minimum Radius for Curve not Requiring Transition Curve	m	500	300	-	-	500	300	
Superelevation Run-off	-	1/100	1/125	1/120	1/160	1/100	1/125	
Value of Superelevation on Curveture	-	Refer to Fig. 4-6						

Note; 1) 2 lane - One way Ramp: 2 x 3.75m
2) 2 lane - One way Ramp: 2 x 3.80m
3) 2 lane - One way Ramp: 0.75m

Table 4-5 INTERCHANGE GEOMETRIC DESIGN STANDARD FOR RAMP TERMINAL (THROUGH WAY SIDE)

Item	Unit	Design Speed of Through Way (Km/h)			Remarks
		120	100	80	
Minimum Horizontal Curve	m	2000	1500	1000	
Vertical Curve Length 1)	m	Two times of values shown in Fig - 4-4, 4-5			
Maximum Gradient	%	2	2	3	
Minimum Length of Deceleration Lane	m	170	150	130	
Diverging Angle of Nose	-	1/25	1/25	1/20	
Minimum Length of Acceleration Lane	m	270	240	210	
Minimum Length of Taper	m	70	60	50	
Radius of Nose	m	(Deceleration Side) 1.0 (Acceleration Side) 0.6			

Note; 1) Vertical curve length at ramp side will be used as shown in Fig. 4-4, 4-5 (V = 60 km/h) but consideration is given for the reduction in capacity due to heavy vehicles. (A heavy vehicle composition of 10% will reduce the design traffic capacity to 88%).

Since the capacity of the ramp is usually much smaller at the connecting point with the main route when compared to the capacity of the ramp itself, the practical traffic capacity of the ramp is determined by the capacity at the connecting point. The method of calculation for this connecting point is based on the formula in Highway Capacity Manual (U.S.A. 1975).

4-3-4 Toll Gate

In the planning and design of the toll gate, considerations have to be made regarding the road, topographical and other conditions as well as the system for the control and operation of the road. That is, in determining the type of interchange for a toll road, the system of toll collection has to be studied at the same time. The following items are studied based on the Design Manual, Vol. 4 of Japan Expressway Public Corporation.

(1) Toll system

The toll system for a toll road may be generally divided into uniform toll rate and sectional toll rate systems. Fig. 4-8 gives an illustrative example of the above two systems.

(2) The determination of the number of traffic lanes at a toll gate.

The number of traffic lanes to be provided at a toll gate is determined from the traffic volume (interval of arrival), the service time per vehicle, and also the service level provided (planned length of waiting queue).

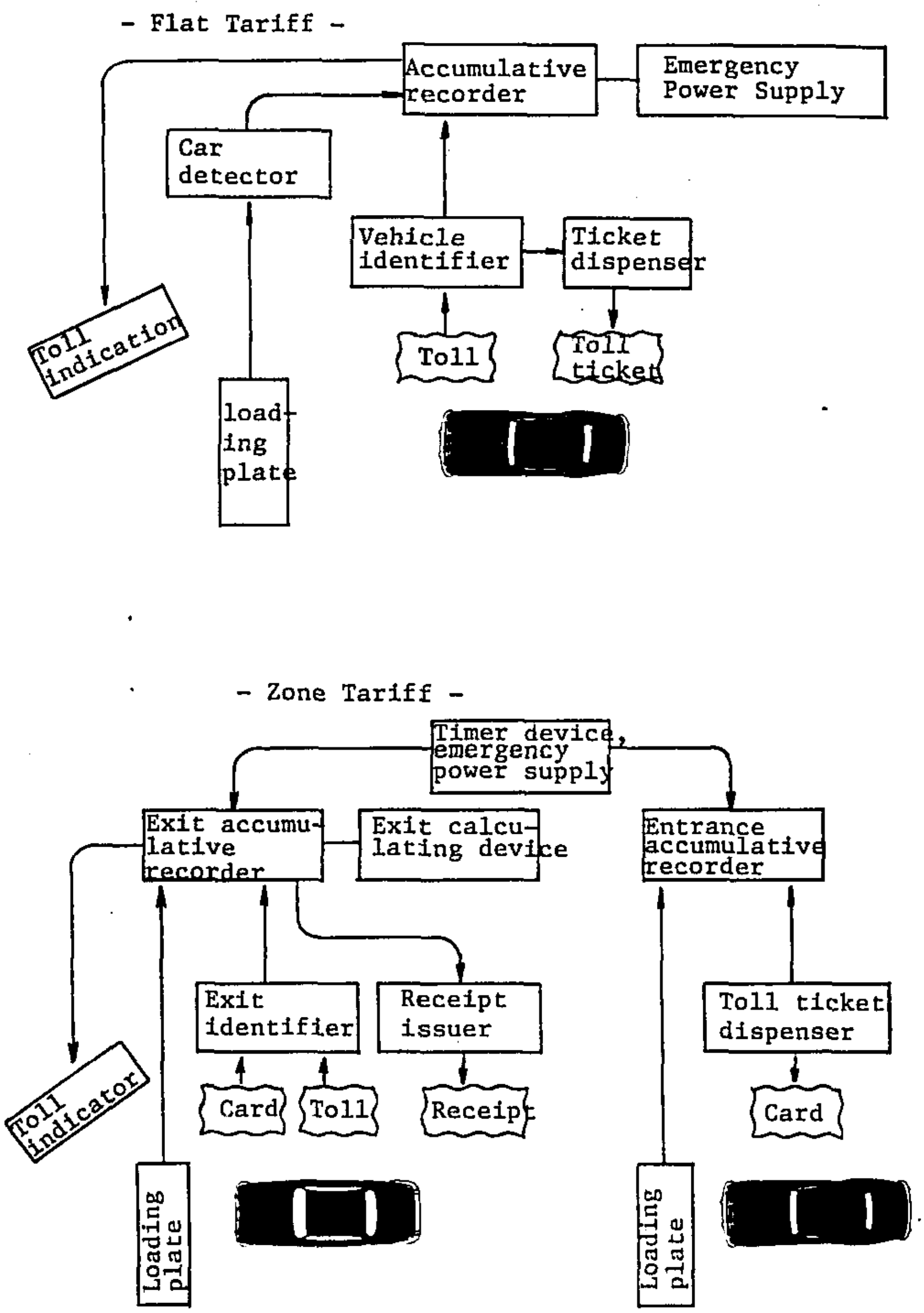
The above factors are decided according to the following standard.

(a) Basic hourly traffic volume

The basic traffic volume used is the design hourly traffic volume (DHV) which is calculated from the average daily traffic volume (ADT) by the following formula.

$$DHV = ADT \times K \times D$$

Fig.4−8 Example of Composition of Toll Collection System



In the above formula, the coefficient K (peak hour rate) is taken as 8% and D (single direction concentration of traffic) is taken as 60%.

(b) Service time per vehicle

The service time is assumed at 6 seconds for one entry and 14 seconds for one exit in the case of sectional toll rate and 8 seconds for all vehicles in the case of uniform toll rate, for the purpose of calculating the required traffic lane at toll gate.

(c) Service level

The service level is expressed in term of the length of the waiting queue and in principle there should be no vehicles waiting at a queue.

Based on the above assumptions, the calculation results are as shown in Table 4-6.

Table 4-6 Hourly Traffic Volume and Traffic Lanes
(Capacity of handling in one hour)

	Average service time(sec)		
No. of traffic lanes	6	8	14
1	300	225	128
2	852	638	364
3	1,422	1,065	609
4	1,922	1,492	852
5	2,580	1,935	1,105
6	3,168	2,376	1,356
7	3,780	2,835	1,617
8	4,368	3,272	1,872

(3) Criteria for planning and determination of toll plaza facilities.

(a) Target year for calculation of facilities

The toll plaza facilities to be provided in the year of opening are as follows:

Table 4-7 Installation Criteria of Facilities

Facility	Target year
Land for toll plaza	20 years after opening
Earthworks of toll plaza toll island, traffic lane pavement toll plaza building	10 years after opening
Toll booth and cash receiving machine	5 years after opening

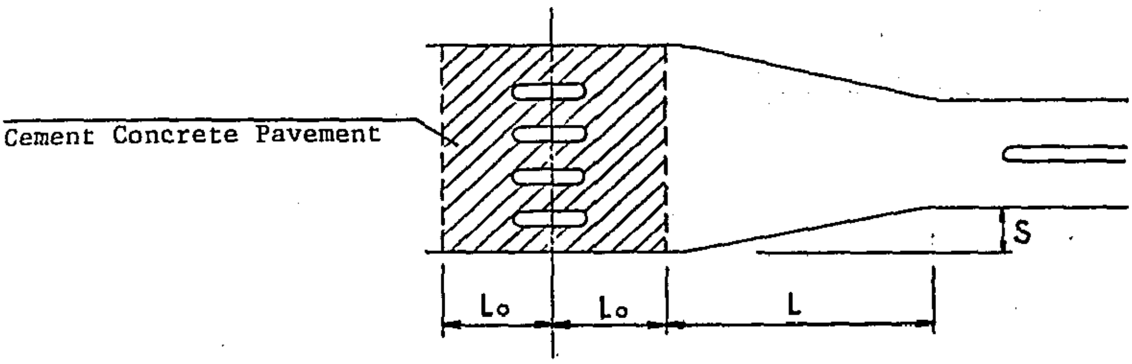
(b) Geometric structure standard of toll plaza

1) The width composition is as shown in Fig. 4-10.
2) Even if only one lane is required from calculation, two lanes will be provided with the left lanes serving as reserve lane.
3) The size of toll island will be 22.4 m in length, 2.2 m in width and 0.15 m in height.
4) The horizontal alignment at the portion where the toll plaza is to be provided will in principle conform with that for the main route and the minimum curvature radius at a interchange toll gate is 200 m.
5) The vertical curve of the portion where toll plaza is to be provided will be based on the criteria for the main route and that for the interchange toll gate will be more than 8,000 m in principle and more than 7,000 for exceptions.
6) The vertical gradient for a toll gate area is below 2% in principle or below 3% for exceptions. The range to be governed by this standard will be 100 m both sides of the gate in the case of toll gate on the main route and 50 m on both sides in the case of the interchange toll gate.
7) The standard cross fall at a toll gate is 1.5% and the maximum is 2.0%.
8) The toll gate portion will be 7 cement concrete pavement and the range is 50 m on both sides of a gate for

main route toll gate and 25 m on both sides of a gate for interchange toll gate.

9) The cement concrete portion will be of the same width as that required at the toll gate center line and the standard easement at both ends will be as shown in Fig. 4-9, but particular attention will be paid to the aesthetical effect. As shown in Fig. 4-9, the easement rate S.L. will below 1:3 and will be so planned as to enable smooth traffic flow.

Fig. 4-9 Easement at Toll Gate



10) At an interchange toll gate, the distance from the center line of the toll gate to the diverging point of the ramp should be over 75 m.

4-3-5 Interval of Interchange

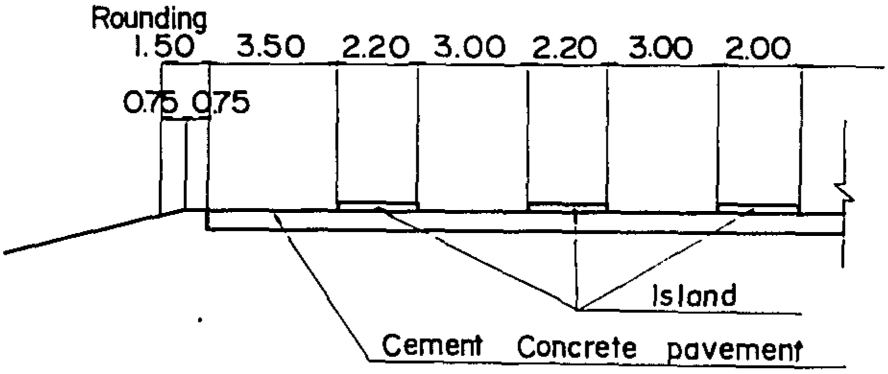
To determine the location of interchanges, the study for the interval of interchanges is done from the viewpoint of traffic safety. For this purpose, two points are examined. One is whether it is possible to allocate the necessary traffic signs to guide the traffic safely. The other is whether it is possible to treat the weaving traffic safety.

Generally, the necessary distance for the allocation of the traffic signs is longer than that for the weaving traffic. It is sufficient for the traffic safety if it is possible to get the necessary interval for the signs' allocation.

Fig.4-10

TYPICAL
CROSS SECTION OF TOLL PLAZA

S = 1 : 200 (Meter)



CLEARANCE OF TOLL LANE

S = 1 : 100 (Meter)

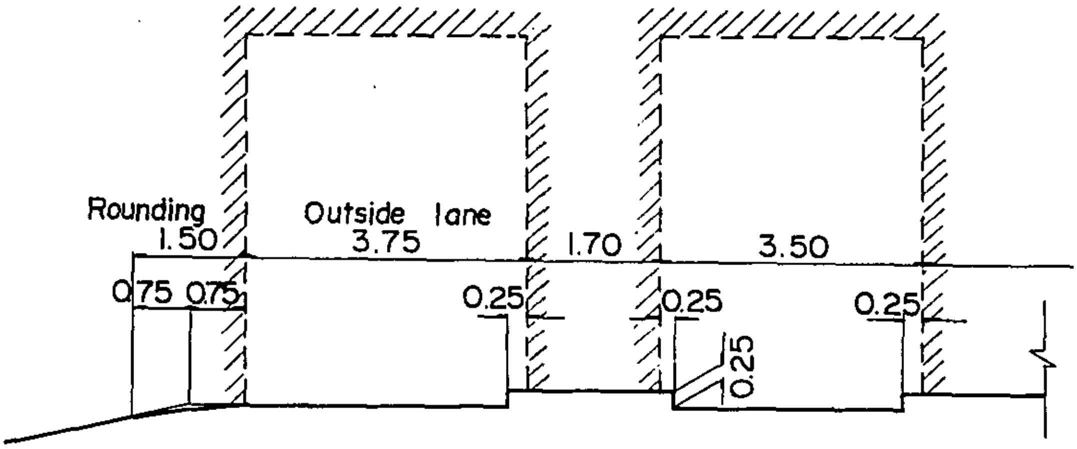
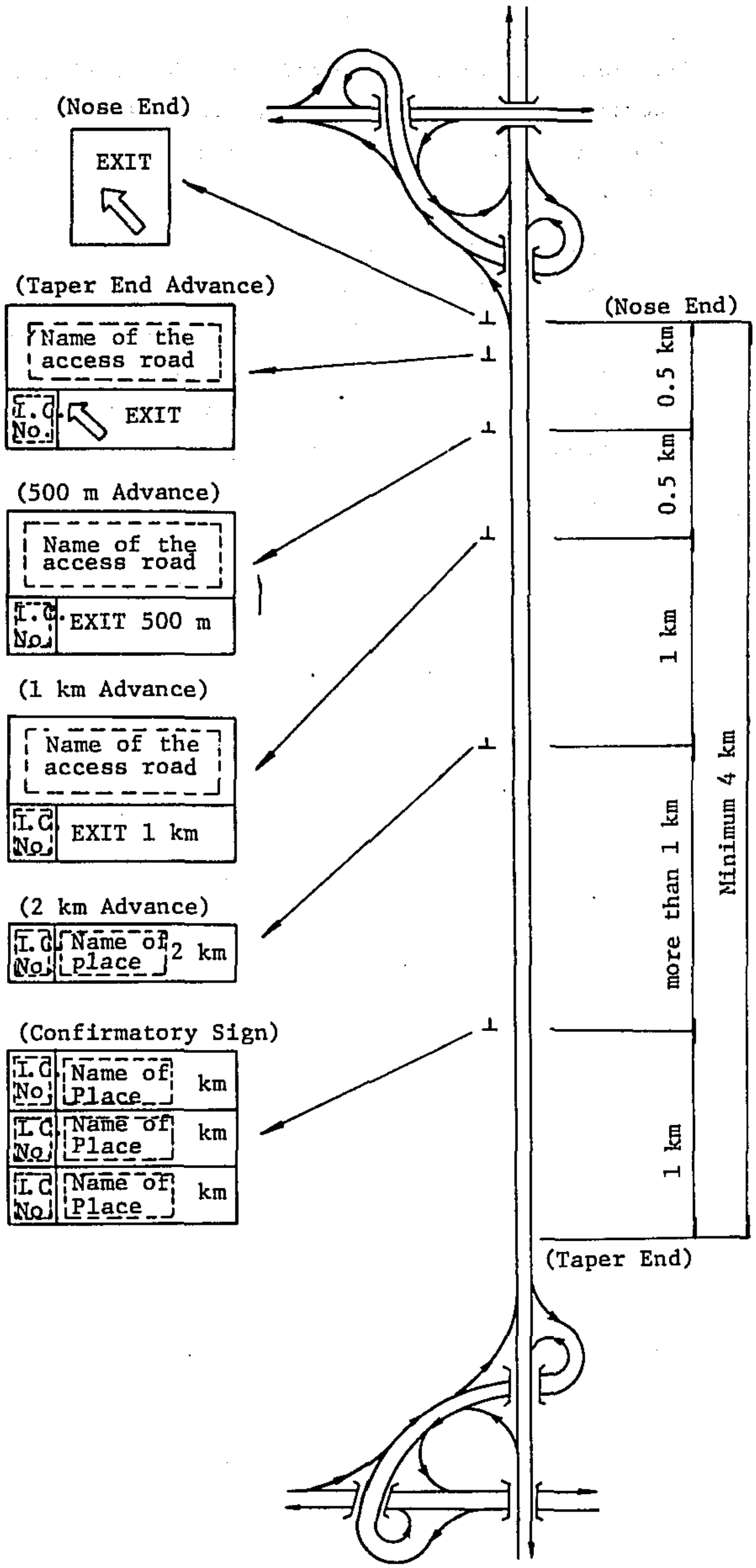


Fig. 4-11 ARRANGEMENT OF THE TRAFFIC SIGN



(1) Interval for the allocation of the traffic signs

Generally, on the expressway, the following traffic signs are allocated for the safety of in and out traffic for the interchange.

(a) Signs for confirmation

This sign makes the driver from an interchange to the throughway to confirm his running direction and distance. This is allocated at the 1 km point from the edge of acceleration taper and in case of the interval of interchanges being less than 5 km, this can be avoided.

(b) Preannouncing exit signs

This sign shows the interchange number, name, names of influenced towns and distance. Fundamentally this sign is composed of six signs as shown in Fig. 4-11.

In order to allocate these signs, the interval of interchanges is calculated as follows:

Interval of Interchange

= Necessary distance for allocation of Preannouncing Signs (2 km)

+ Necessary distance for allocation of Confirming Signs (1 km)

+ Necessary distance for sight of signs (1 km)

+ Average interval between the edge of taper or nose and the center of interchange (1 km)

(2) Weaving section length

According to Highway Capacity Manual (U.S.A.), length of a weaving section is shown and calculated in relation with the traffic volume in Fig. 4-12 and Fig. 4-13.

Fig. 4-12

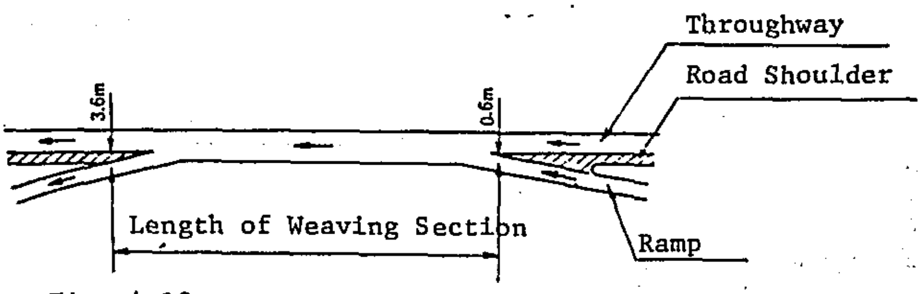


Fig. 4-13

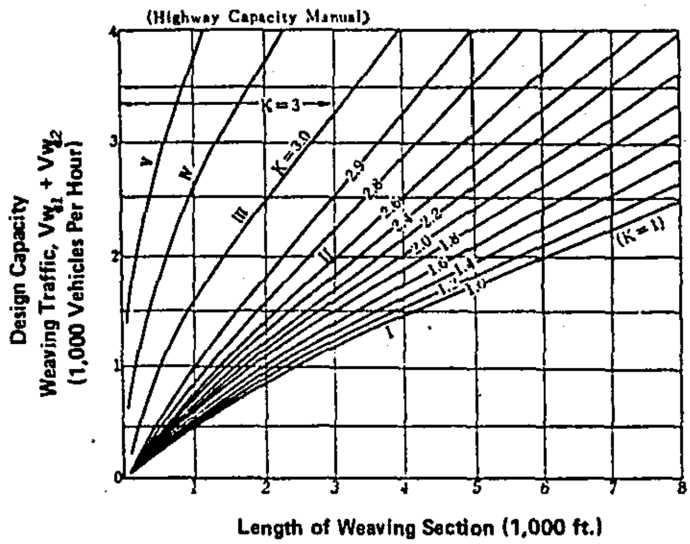


Table 4-8 Minimum Distance for Weaving

Weaving Traffic (PCU) \ Service Level	I	II	III
500 veh/h	300	200 m	70 m
1,000 "	800	400	150
1,500 "	1,200	650	280
2,000 "	1,800	900	520
2,500 "	2,400	1,200	600

Resultantly, from the viewpoint of weaving traffic, the interval of interchanges should be longer than above-mentioned minimum distance by one kilometers.

Fig. 4-14 Categorize Graph

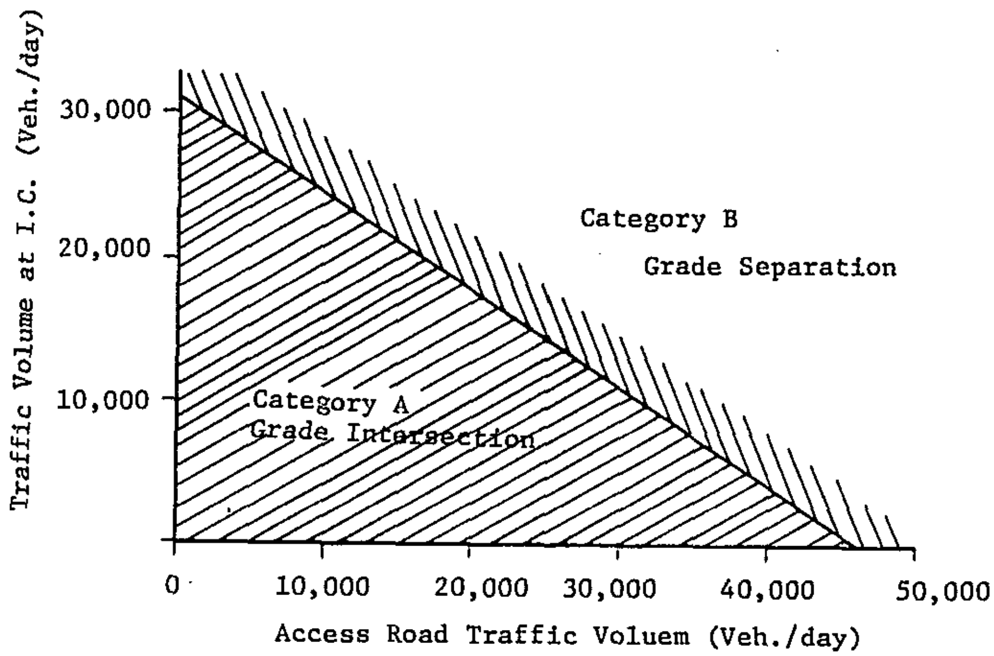
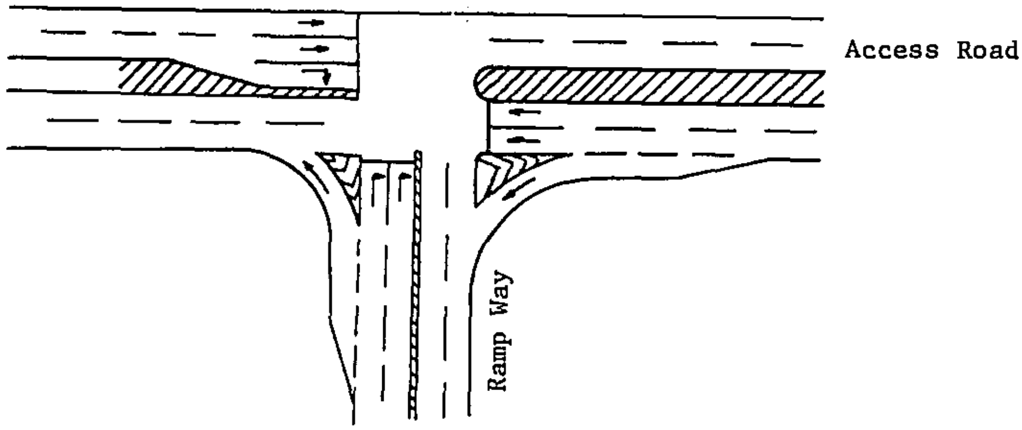


Fig. 4-15 At Grade Intersection



Number of lanes for the weaving section will be calculated by the following equation.

$$N = \frac{V + (k - 1)\ Vw2}{SV}$$

where, N : Number of lanes

Vw2 : Less traffic of weaving

V : Total traffic volume

SV : Traffic capacity per lane

k : Factor

4-3-6 Stage Construction for the Interchange with Surface Road

The following figure (Fig. 4-14) shows the necessary point for grade separation by the forecasted traffic volume for 10 years after opening.

4-3-7 Traffic Capacity of Diamond Type Interchange

Traffic capacity of a diamond type interchange is shown in Fig. 4-16. Fundamentally, when the forecasted traffic for 20 years after opening comes into the category B, other types such as a double trumpet type, a cloverleaf type and etc., should be considered to be possible to make a grade separated intersection.

Fig. 4-16 Traffic Capacity of a Diamond Type Interchange

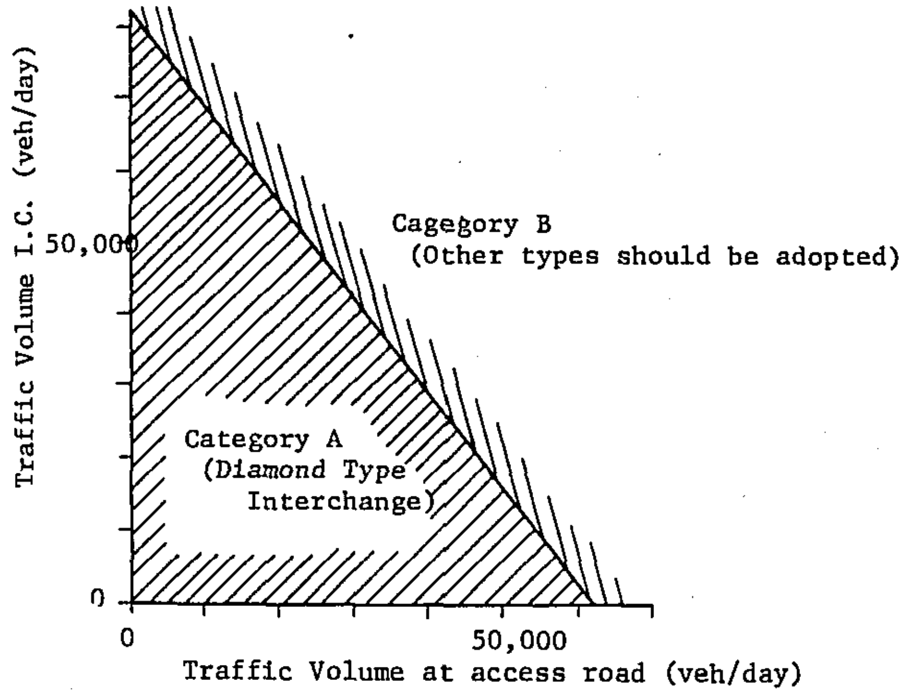
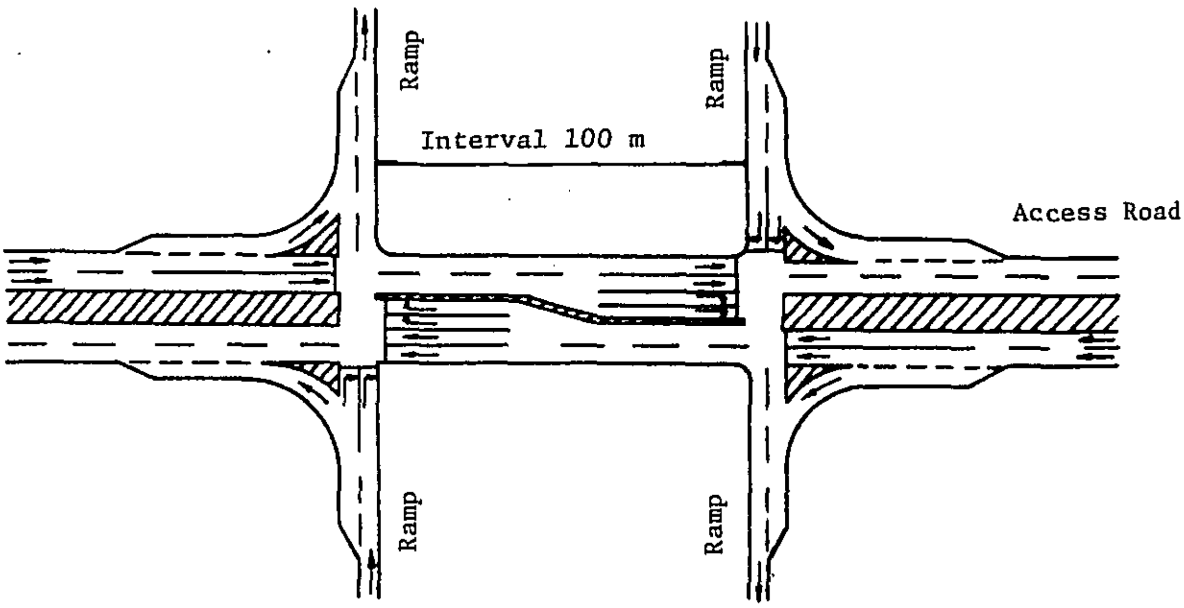


Fig. 4-17 At Grade Intersection



4-4 Analysis on the Number of Trafiic Lanes

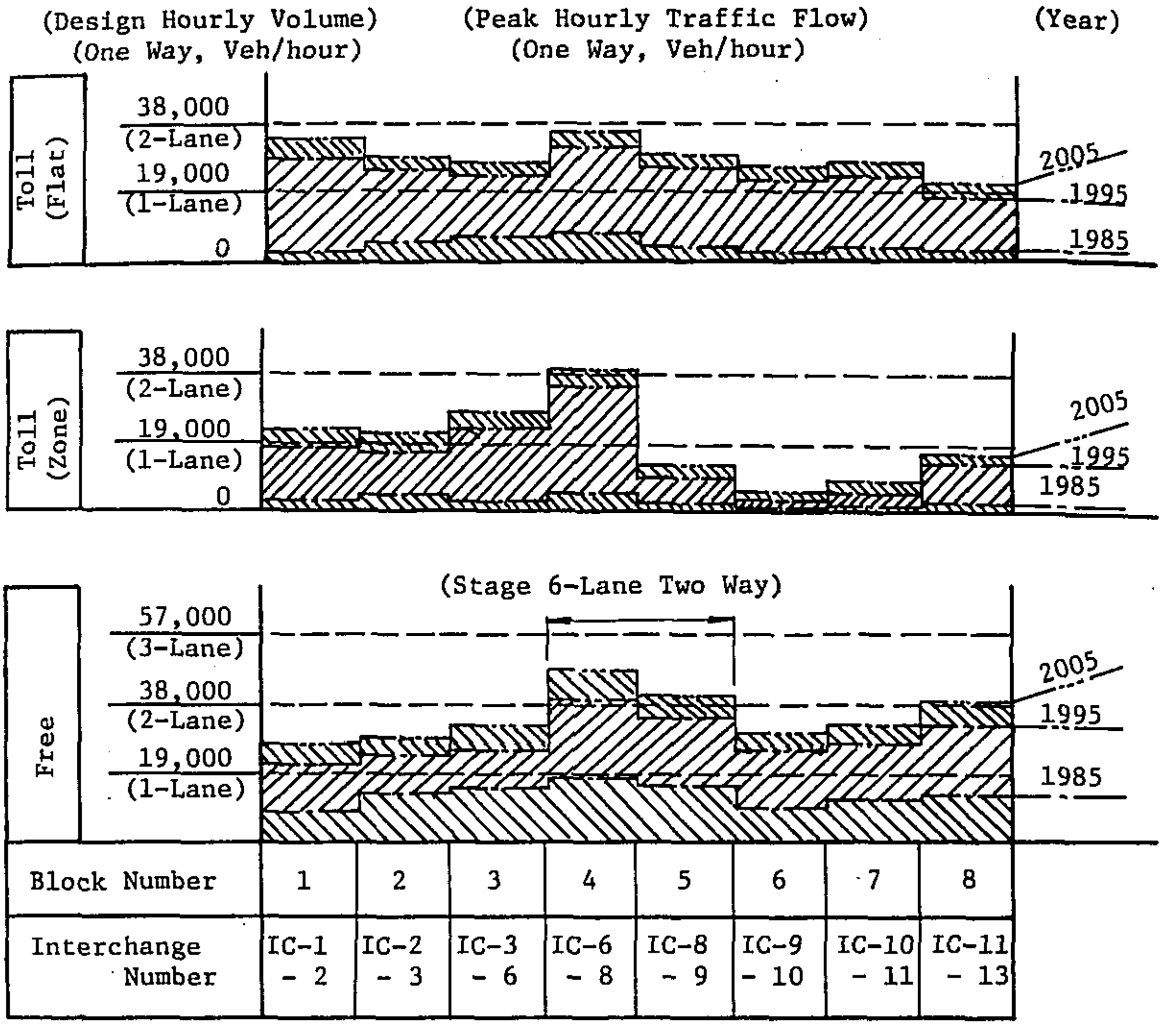
The required number of traffic lanes is determined from equation 4-1 and the fractional values are rounded up to the higher figure. However, if the fraction is very small, considering that both the design basic traffic capacity and the design traffic volume are approximate values, the factors for calculation of the design basic traffic capacity, the characteristics of the project road whereby stage expansion is possible, the traffic lane may be determined by cutting off the fraction.

$$\text{Required traffic lane (one direction)} = \frac{\text{Planned traffic volume(veh/day)} \times \text{one direction concentration rate(50\%)}}{\text{Design basic traffic capacity (19,000 veh/day)}}$$

(equation 4-1)

The resulting required number of traffic lanes for the Ring Road are shown in Fig. 4-18. In the case of free road, blocks 4 and 5 will be expanded to 3 lanes in each direction in 1995, 10 years after opening, and for all other sections, it will be 2 lanes in each directions.

Fig. 4−18 Traffic Flow Volume by Segment



4-5 Comparative Studies on the Planning of the Main Route

4-5-1 Comparison on the Three-dimension Alignment

(1) Horizontal alignment plan

The control points are the points which form restrictions limiting the route that the road can be pass from technical and social points. As described in section 4-1, the control points are to be in accord with the importance and character of the Ring Road and they cover topographical and geological factors, as well as technical, economic and social environmental factors such as public facilities, cultural treasury, etc. Also some pilot plan on the project road has already been made by the Jakarta City and Bina Marga, and the restrictions that effect the local conditions have also to be adhered to.

(a) The alignment has to be established within a corridor of 500 m in width stipulated by Bina Marga.

(b) Of the major radial roads that interesect with the Ring Road, the locations of interchanges with the Jagorawi Highway and Jl. Bekasi are predetermined.

(c) The route has to be kept at least 500 m away from the military facilities at Jl Hankam.

(d) Where land acquisition is completed, the alignment has to be planned within the acquired level.

(e) The regions where developments have been planned and approved by Jakarta City have to be avoided.

Based on the above control points, the route location is made with consideration on the balance of earth work and also workability, and the result is that although these are several local comparative alternatives at the middle of the Ring Road near Ciliwang River, on the whole these are not many comparative alternatives for the entire route. Therefore only one alternative is established for the horizontal alignment plan.

Two alternatives in design speed of 120 km/h and 100 km/h are set from the points of the character and importance of the project road, the planned traffic volume, the situation in access control

Fig. 4 - 19   FLOOD AREA IN THE PROJECT AREA

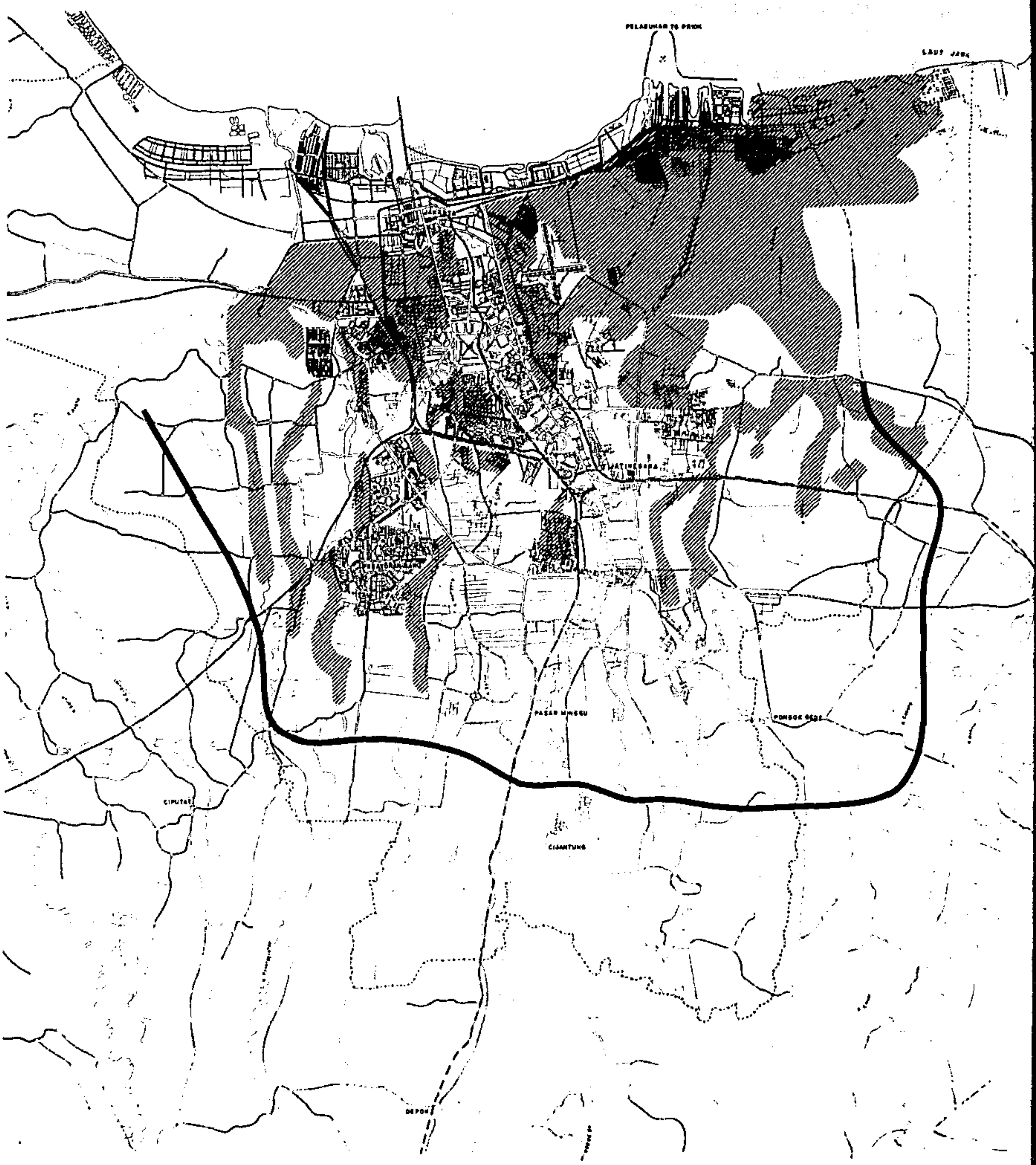
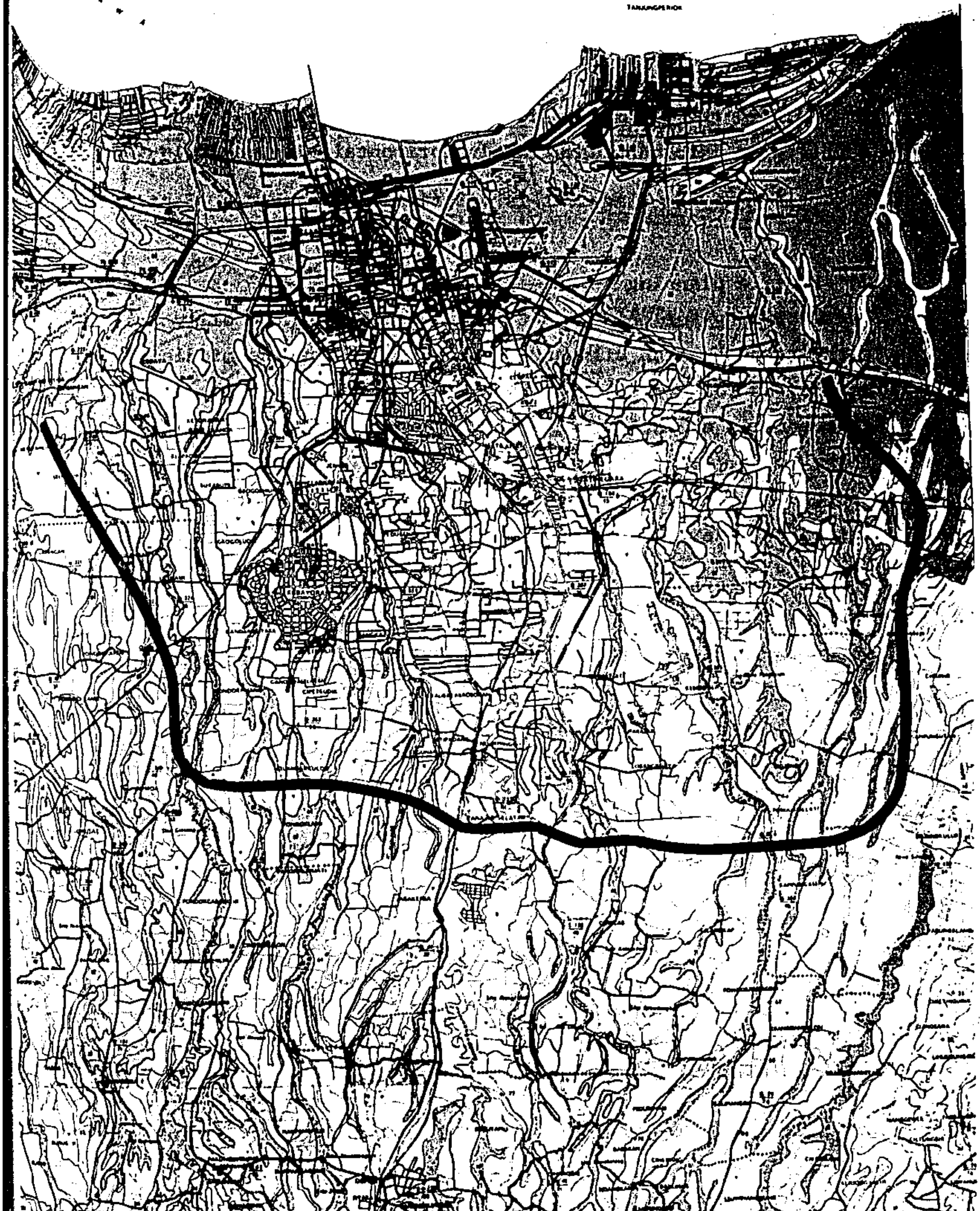


Fig. 4-20 ALLUVIUM AREA IN THE PROJECT AREA



Alluvium area

and the topography of the locality. However, since at the section where the road traverses builtups areas, it is planned to have alternating embankment and cut sections, and also since from the point of coordination of the interchanges, the horizontal curve radius is so flexibly planned as not to be rigidly in conformity with the minimum design standard, the design speed factor is not taken into consideration in horizontal alignment plan.

The outline of the alignment is described in Chapter 6, Section 6-2.

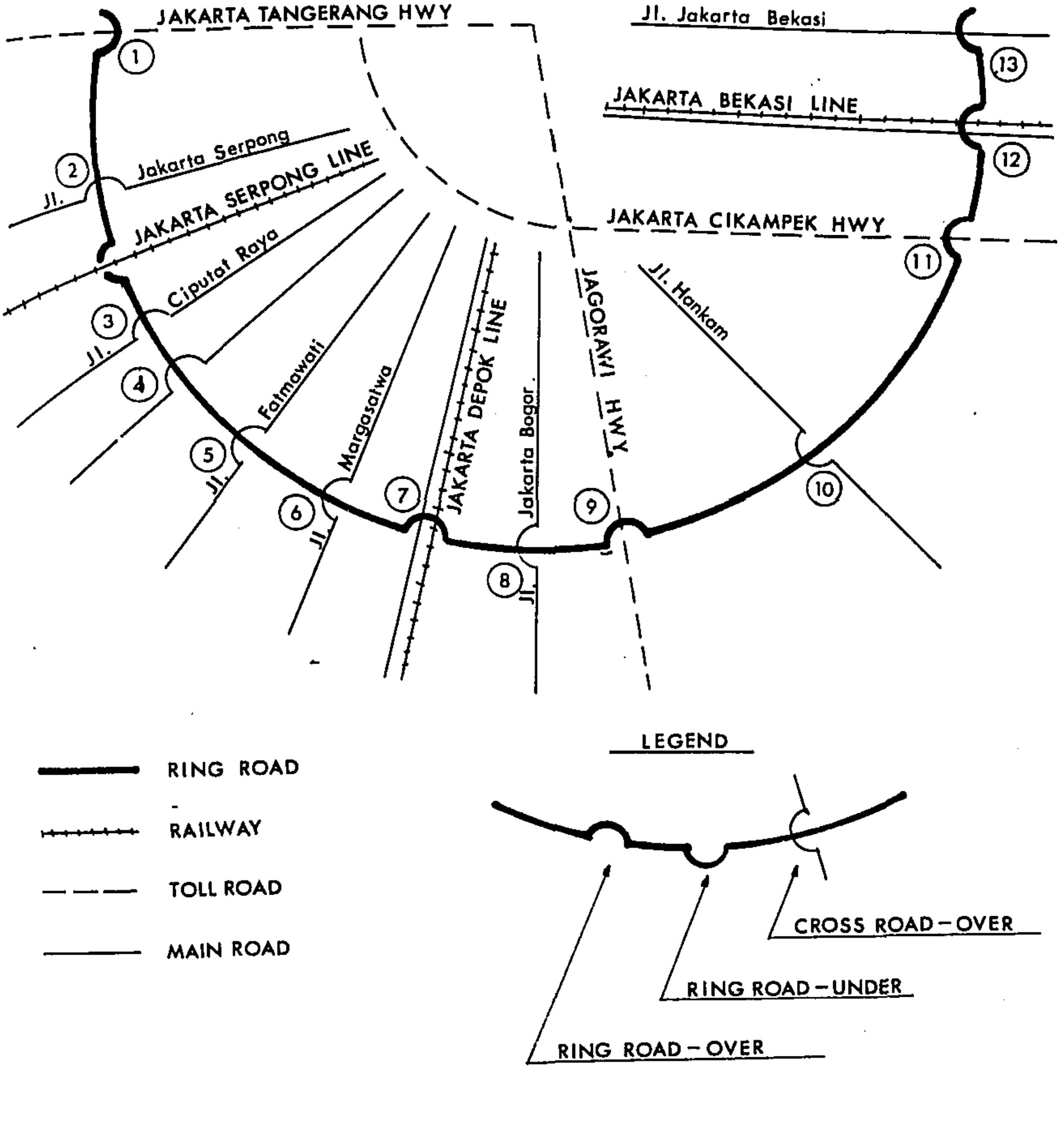
(2) Profile planning

The topography for the project area is such that the hilly area to the right bank of Diliwang River which is now the middle of the project road, is highest in elevation (G.L. = 50 m) and the difference in elevation with the coastal plain at the two ends of the route (G.L. = 3.0 m) is about 47 m. As the road runs in a curve from the coastal plain to the hilly area, the vertical gradient of the route is on the whole very gradual.

In the comparative study of the vertical alignment, due to the fact that basically the minimum vertical curve for a section between two interchanges is affected by the difference in design speed, and that the overall balance of earthwork volume is also affected, comparison is made of the two alternatives in design speed of 120 km/h and 100 km/h.

As for study of vertical alignment at railway crossings, since the future development plan on railway is not know, it is so planned that the alignment of the railway will not be altered in order to maintain future coordination, and alternatives are studied for the cases of the Ring Road overpassing or underpassing the railway. For crossing with inter-city toll highways and other ordinary radial roads, the method of grade separation is determined from the point of suitability of the type of interchange to be adopted. The reduction of embankment and cut volume as well as the volume of borrow earth will favorably effect the construction cost and construction time required so that particularly at railway and road crossings, the vertical alignment

Fig.4-21 GRADE SEPARATION METHOD AT THE CROSSING POINT WITH THE RADIAL ROADS AND RAILWAYS.



is so determined that where there are no problems regarding drainage and ancillary maintenance works, the balance in earthwork volume is given top priority. Comparison on earthwork volume is carried out by computer by the earth volume curve for the whole route, selecting the most favorable crossing system at crossings and studying on the alternatives of 120 km/h and 100 km/h in design speed.

4-5-2 Alternative Studies on Method of Implementation

(1) General

The construction of an expressway requires very large investment due to various design requirements. For this reason, to obtain maximum economy it is desirable to study the alternative of stage construction to meet traffic demand at various stages instead of completing the final requirement from the beginning.

Stage construction may largely be divided into stage construction of the cross section by varying the traffic lanes and profile stage construction by deferring some construction sections. And there come four alternatives of stage construction as shown in the following to be studied.

1) Tollway 4 lanes 2 stages 2 segments
2) Tollway Initial 2 lanes 2 stages 3 segments
3) Tollway Initial 2 lanes 3 stages 3 segments
4) Toll free 4 lanes Initial 2 stages 2 segments

In the following the summary of each alternative is described.

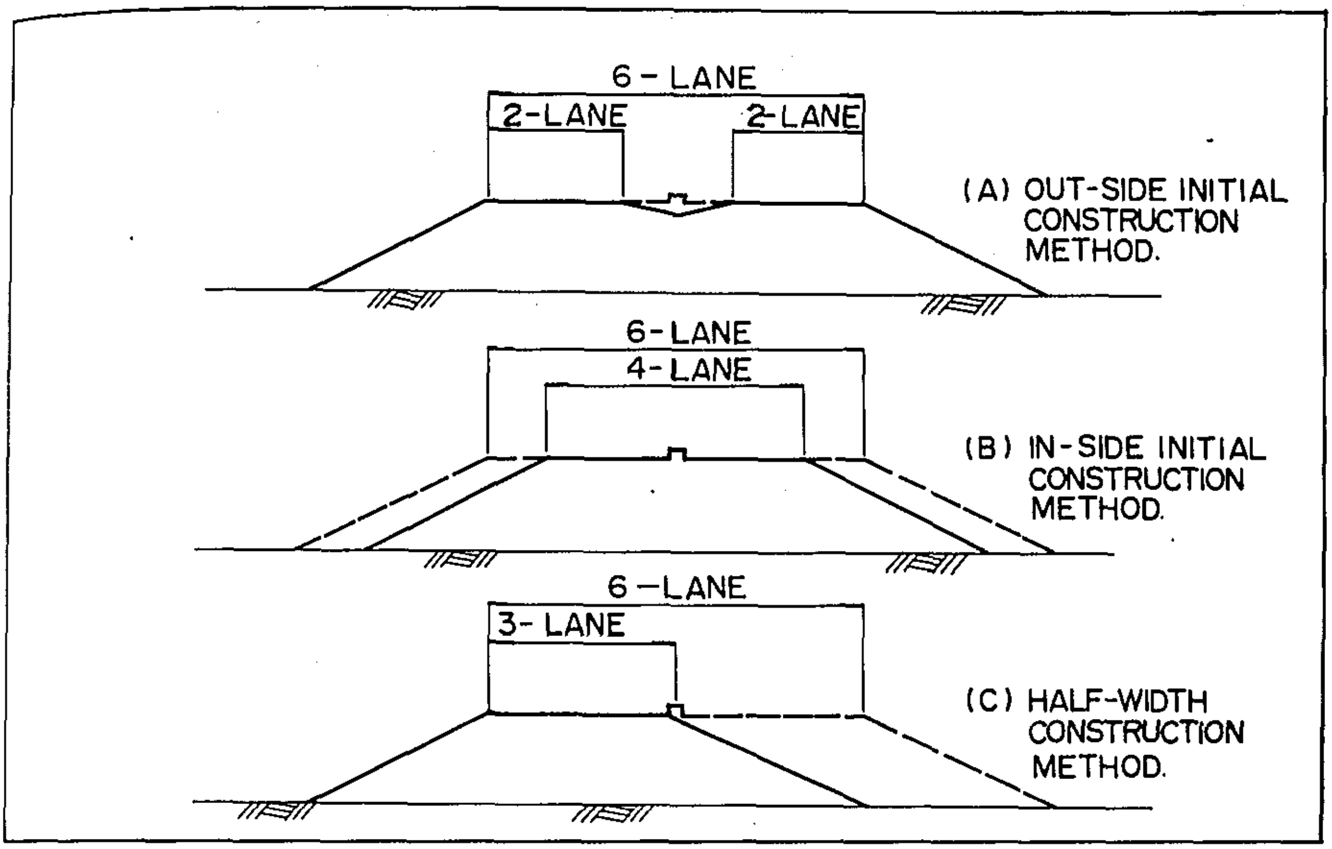
(2) Tollway 4 lanes 2 stages construction

As the initial construction, western segment, 26 km is constructed to meet the traffic demand and the second construction, the eastern segment, 22 km is constructed by four lanes from the opening day.

(3) Freeway 4 lanes 2 stages construction

As described in Section 4-4 above, the planned future traffic lanes requirement for the project road in the case of a free road, a part of the western section will require 6 lanes in 1995, or 10 years after opening. It is therefore desirable to carry out the

Fig. 4-22 Different Methods of Stage Construction



As for bridge the expansion will involve addition to the completed bridge so taht it is difficult to determine an economic type of bridge for expansion. Therefore from the point of ease in construction rather than economy, it is proposed that the bridge be constructed at 6 lanes from the beginning.

construction of this section in pace with traffic requirement by construction of 4 lanes in the initial stage and expanding to 6 lanes in the future.

As seen in Fig. 4-22, in the case of stage construction of traffic lanes, there are three different methods available, namely (A) Construction of the initial 4 lanes from the outer side, (B) Construction of the initial 4 lanes from the inside, and (C) Construction of 3 traffic lanes on the side and using the three lane cross section to temporarily serve 4 lane requirement.

(4) Initial two lane stage construction

This stage construction can save the initial investment cost and can meet the traffic demand by many stages. The conditions for design are as follows:

- Tollway
- Distance proportional tariff
- 120 km/h of design speed
- Segment division

1) Western segment (12.3 km)
   Jakarta - Tangeran Highway (IC-1) - Jl. Ciputat Raya (IC-3)

2) Southern Segment (13.85 km)
   Jl. Ciputat Raya (IC-3) - Jagorawi Highway (IC-9)

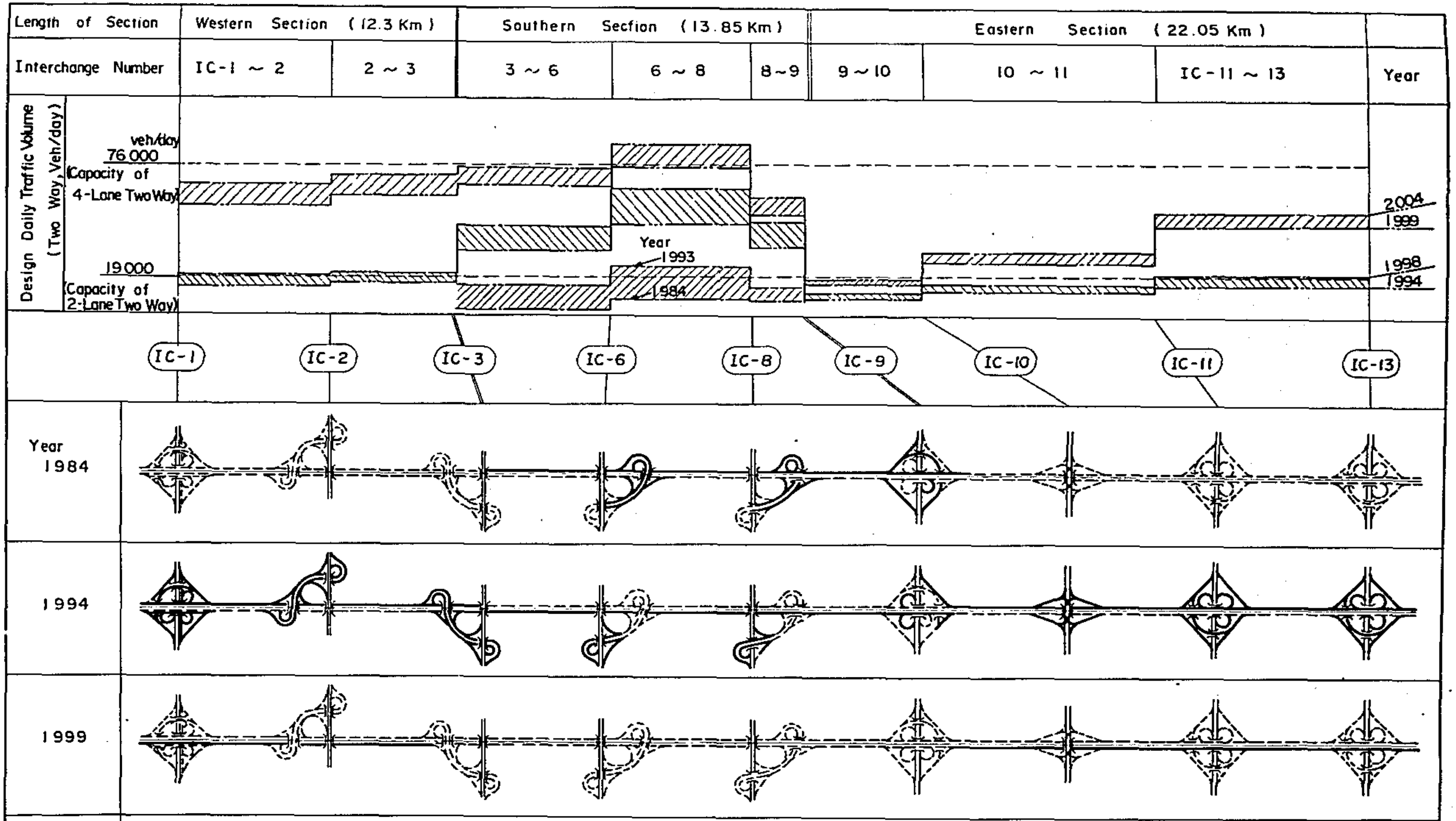
3) Eastern Segment (22.05 km)
   Jagorawi Highway (IC-9) - Jl. Jakarta-Bekasi (IC-13)

- Sequence of Segments

1) Two stage method
   initial stage; southern segment, 2 lanes
   second stage; southern additional 2 lanes

2) Three stage method
   initial stage southern segment, 2 lanes
   second stage southern segment additional 2 lanes, and western and eastern segment 2 lanes.
   Third stage western and eastern segment additional 2 lanes.

Fig. 4-23 DESIGN DAILY TRAFFIC VOLUME & STAGE CONSTRUCTION SEQUENCE



Remarks: The above figures show the area of the case of 3-Stage Construction. In case of 2-Stage Construction, 2nd Stage (1994) and 3rd Stage (1999) of 3-Stage Construction completed at the same time by 1994.

- Others

1) Initial 2 lanes will be constructed for the 2 lanes of inside of typical cross section.

2) Earthwork will be done for the ultimate stage.

3) The bridges for the through way will be constructed for initial 2 lanes.

4) Box and pipe culverts, over bridges and etc., will be constructed for the ultimated stage.

5) Construction of Interchanges will be done for two stages considering the traffic demand.

6) For the operation of initial 2 lanes, there should be needed some special consideration and study.

(5) Pavement

In the comparative analysis on pavement, studies are made on the case of providing from the beginning the pavement required to bear the traffic load throughout the entire project period and that of stage construction by making overlay at a subsequent stage.

After analysis of the results of the annual planned traffic volume based on the "ASSHO Interim Guide for Design of Pavement Structure" for the design of the pavement, it is proposed that the surface pavement layer of asphalt concrete at the initial stage be 5 cm thick and an overlay of 10 cm made 10 years after opening of the road. This stage construction will reduce the initial investment by 20%. The method has also the advantage that in case the future traffic growth deviates from the forecast, the final construction may be adjusted to suit the actual traffic situation.

4-6 Comparative Alternatives on Interchange

4-6-1 General

The type of interchange will differ according to the method of operation (toll road or free road), toll system (uniform toll rate or sectional toll rate), and the characteristics of the connecting road (inter-city toll road or ordinary road). Comparative analysis will have to take into consideration the traffic volume, topography comfort, safety, geometric structure of each type of interchange and economy before a decision can be made on the most suitable type.

The possible types of connection with an inter-city toll road in case that the Ring Road is also a toll road are the turbine type, clover type, double trumpet type, etc. Of these, the turbine type is generally favorable since both the inter-city toll road and the Ring Road will be with a high design speed of 120 km/h or 100 km/h so that it is undesirable to reduce the design speed of the ramp to below 60 km/h (half that of the main route). However, if there is a great difference in the traffic volume by directions, it is more economical to adopt the modified clover type with a provision of a direct connecting ramp (design speed: 60 km/h) for the direction of heavy traffic. In this case, from the points of detour distance, land area, etc., for the right turning traffic, the limit of curve radius of the ramp is 80 m and the desing speed of the loop is set at 40 km/h.

In the case of the Ring Road being a free road, the type to be adopted will be the double trumpet type from the point of toll collection for the inter-city toll road. It will be difficult to provide the toll gate for other types.

As for connection with ordinary roads, where traffic can be handled by level crossing with the ordinary road, the possible types of interchanges are the diamond type, single trumpet type, incomplete clover type, etc. Of these alternatives, the diamond type will require dispersal of the toll gates (two gates for uniform toll rate system and 4 gates for sectional toll rate system). However, the construction cost is very low and safety

Table 4- 9 Comparison of Types of Interchange (Connecting with regional toll way)

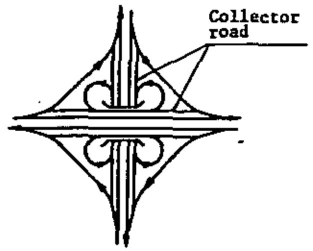
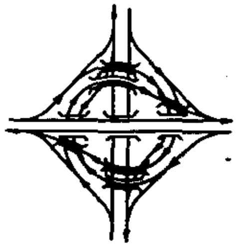
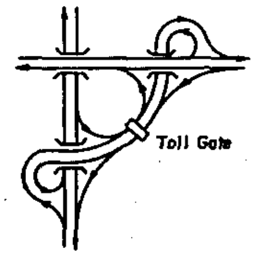
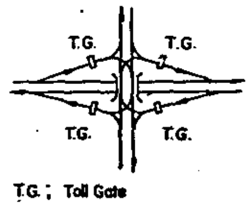
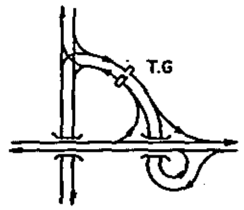
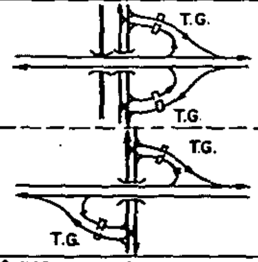
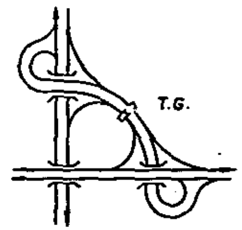
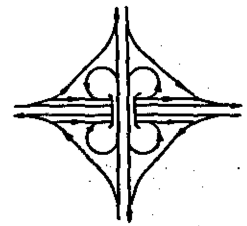
Items / Type		① Clover Leaf	② Turbine	③ Double Trumpet	Remarks
					
Land Use		° Transport facility concentrated and is favorable from the point of land use ° Transport facility concentrated and is favorable from the point of land use ° Land area is 280,000 m^2.	° Transport facility concentrated and is favorable from the point of land use ° Land area is 230,000 m^2.	° Land area concentrated to one side, and there will be a piece of triangle shaped land leftover ° Land area is 260,000 m^2.	
Traffic Flow & Safety		° *All right turning ramps are in loops* ° Detour distance of right turn traffic long so that a radius of 80m is the limited, and the design speed has to *be dropped to 40 km/h.* ° Weaving occurs between loops reducing the traffic capacity, but this can be improved by provision of collector *roads to improve safety and increase* capacity ° From the first the ramps come in the order of entrance exit-entrance so *that judgement is required of drives* and provision of suitable guide signs is difficult. ° Driver is liable to lose the sense of direction	° *All right farming ramps are in a semi* direct connection ° Detour distance of right turning is shorter than (1) and the radius is *large so that with the same area as* (1) the design speed can be raised to 60 km/h. ° The proceeding direction of right *turning traffic is in the general* destination direction ° Safety is higher than (1).	° *Two loop ramps occurs* ° Traffic detour distance is long and the limit of curve radius is about 70m so that design speed has to be reduced to about 40 km/h. ° Weaving occurs near the toll gate ° Driver is liable to lose the sense of direction ° Advantages if there is great difference in traffic by direction	
Provision of Structures		Collector Road Bridges: 2 bridges	Interchange Bridge: 8 bridges	Interchange Bridge: 2 bridges	
Installation of Toll Gate		not possible	not possible	possible	
Rough Construction Cost* (100 million Rp)		15	36	14	
Evaluation	Flat Tariff	○	◎	△	◎ Excellent ○ Good △ Fair × Not possible
	Zone Tariff	○	◎	△	
	Toll Free	×	×	◎	

Table 4-10 Comparison of Types of Interchange (Connecting with ordinary road)

Traffic Handling at Connecting Road / Types / Items		Level Crossing (Signals)			Grade Separation		Remarks
		① Diamond	② Single Trumpet Type	③ Incomplete Clover Leaf	④ Double Trumpet	⑤ Clover Leaf	
							
Land Use		• Trnasport facility concentrated at one point and point of land use • Land area is 50,000m².	• Land area concentrated to one side and there will be triangular piece of land leftover. • Land area is 130,000m².	• Effective where the connecting road is along railway, river or other obstables. • Land is 120,000m².	• Land area concentrated to one side and there will be a triangular piece of land leftover • Land area is 200,000m².	• Transport facility concentrated and is favorable from the point of land use • Land area is 200,000m².	
Traffic Flow		• Traffic detour distance is shortest	• Loop ramp occurs at one point • Detour distance is long and is favorable when difference is great for traffic volume by direction	• Curve radius is small but 2 loop ramps occur • Higher traffic handling capacity than (1) • Traffic detour distance becomes long	• Loop ramp occurs at 2 points • Detour distance is long and is favorable if there is great difference between traffic volume by direction	• All right turning ramps are in loop and detour distance is long. • Weaving occurs between loops, reducing the traffic capacity, but this may be improved by providing collector road and thus increase in capacity.	
Safety		• Inflow and outflow direction is the same as main route and safety is high.	• Low safety at loop ramps and care has to be taken on the location of installation	• Small curvature ramps occur at two locations and safety is low.	• Low safety at loop ramps • Weaving occurs near toll gate • Driver liable to lose sense of direction	• Low ramp is low in safety but may be improved by providing collector road. • From the first the ramps come in the order of entrance - exit - entrance so that judgement is required of drivers and provision of suitable guide signs is difficult • Driver tends to lose the sence of direction	
Stage Construction (future connection)		not possible	possible	not possible	———	———	
Installation of Toll Gate		2 (Flat) 4 (Zone)	1 gate	2 gates	1 gate	not possible	
Provision of Structures		none	Interchange Bridge ---- 1	none	Interchange Bridge ---- 2	Collector Road Bridge --- 2	
Rough Construction Cost (100 million Rp)*		3	10	4	14	13	
Evaluation	Flat Tariff	**O**	△	O	**O**	×	**O** Excellent
	Zone Tariff	**O**	△	— O	**O**	×	O Good △ Fair
	Toll Free	**O**	△	O			× Not possible

Remarks: * Excluded Land Acquisition, Land Compensation and Tollgate Construction Cost.

in high so that on overall evaluation, the diamond type is the most desirable type. For the same reason, the diamond type is also suitable when the Ring Road is a free road.

When the Ring Road is a toll road and grade separation with the connecting road is necessary, from the point of toll collection, the double trumpet type is a suitable type. If the Ring Road is a free road, the possible type will be the double trumpet type and the clover type from the points of traffic volume by direction and of landuse conditions.

The comparative merits of the various types of interchanges are as shown in Tables 4-8 and 4-9.

4-6-2 Technical Comparison

(1) Location of provision of interchange

The location of interchanges connecting the inter-city toll roads will be the 3 locations as shown below for both the road and free road.

As for connection with the ordinary roads, analysis is made for the 10 locations as shown in Table 4-12 from the point of traffic demand, future transportation network, town planning, future landuse, .etc., and installation at 6 locations is proposed for both the cases of toll road and free road. Moreover, in the case of a free road, the structure will be of partial access control so that vehicles can also enter the Ring Road from the frontage roads between interchanges.

Table 4-11 Location of Interchanges
(inter-city toll road)

I.C. No.	Station	Name of Crossing Road
1	0 + 000	Jakarta - Tangerang Highway (under planning)
9	24 + 570	Jagorawi Highway (under construction)
11	38 + 370	Jakarta - Cikampok Highway (under planning)

Table 4-12 Location of Interchanges Studied
(With the Arterial Toll-Free Roads)

I.C. No.	Station	Name of Crossing Road
2	6 + 090	Jl. Jakarta - Serpong Highway (Planning)
3	10 + 960	Jl. Ciputat - Raya
4	13 + 000	Road East of Pondok Indah (Planning)
5	14 + 000	Jl. Fatmawati
6	17 + 055	Jl. Margasatwa
7	19 + 400	Jl. Jakarta - Depok
8	22 + 565	Jl. Jakarta - Bogor
10	29 + 180	Jl. Hankam
12	41 + 840	Planning Road along the existing railway
13	46 + 610	Jl. Jakarta-- Bekasi

Note: ----- Designed Interchanges

(2) Determination of the type of interchange

Studies on the type of interchange to be adopted for the intersection with the 9 radial roads are made according to the items listed in Section 4-6-1 for the three cases of the Ring Road: (1) adopting the uniform toll rate system, (2) adopting the sectional fare rate system, and (3) being a free road. The process is as shown in Fig. 4-17 and the selected types of interchanges are summarized in Fig. 4-18 ∿ Fig. 4-20.

The various factors analysed, the traffic volume and the construction cost of the interchanges are summarized from Table 4-16 to Table 4-24.

Since there is little difference in forecasting traffic volume due to the design speed (120 km/h or 100 km/h) the traffic volume for the design speed of 120 km/h is adopted both for the cases of uniform toll rate and sectional fare rate alternatives. For the free road the results of the 100 km/h design speed are adopted.

The landuse plan prepared by Jakarta City is used for evaluation of the landuse of the vicinity of interchanges.

Fig. 4 — 24

FLOW DIAGRAM FOR SELECTION OF INTERCHANGE TYPES

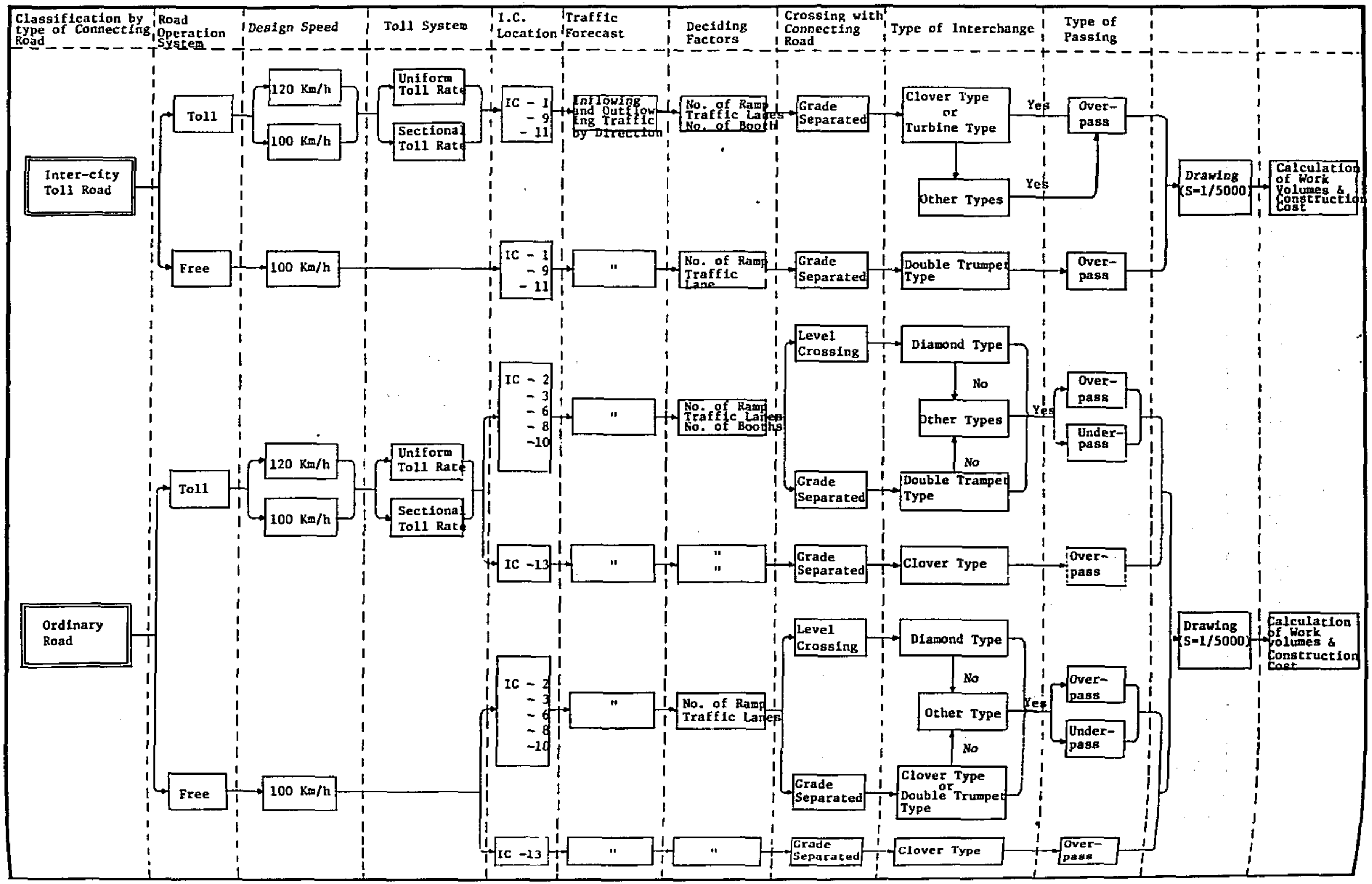
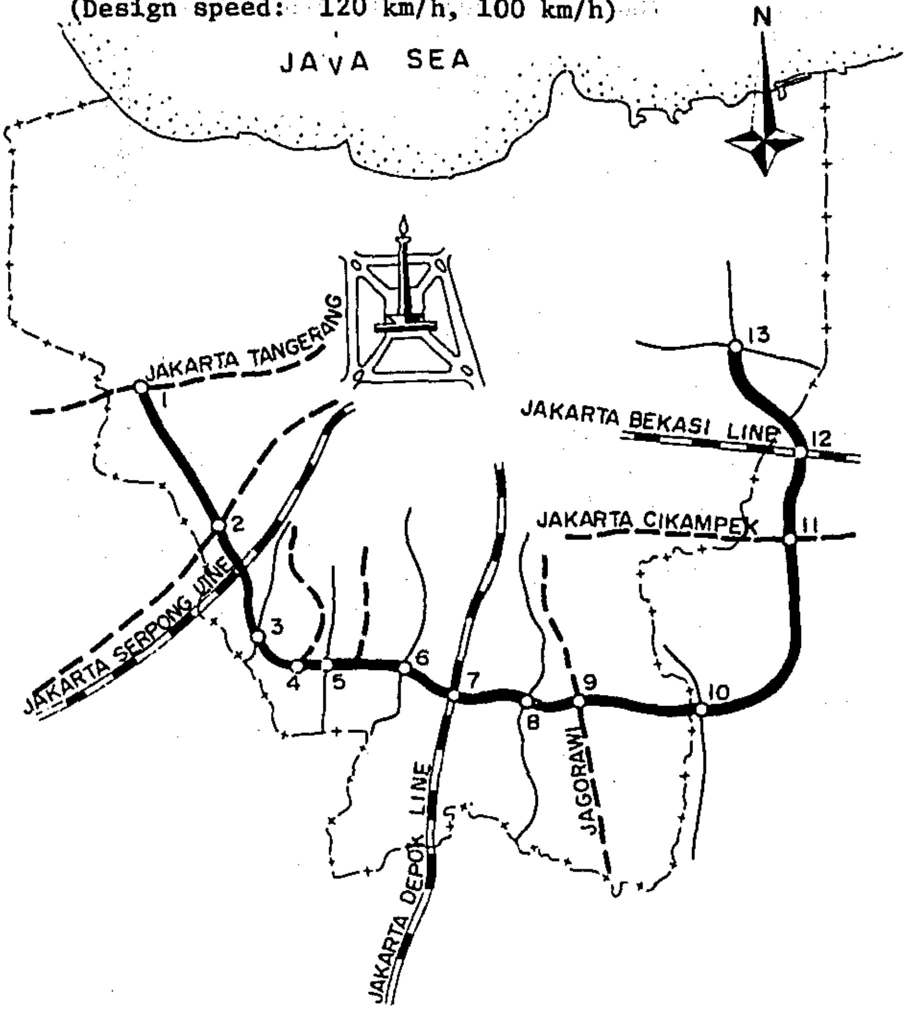
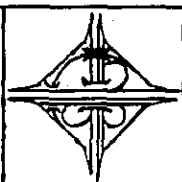
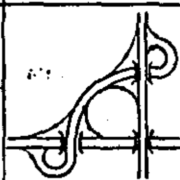
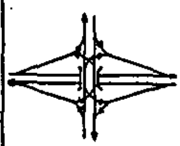
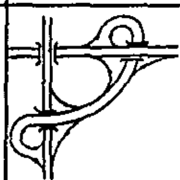
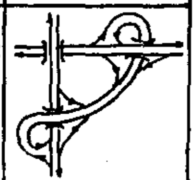


Table 4-13 **Flat Tariff (Uniform toll rate) System**
(Design speed: 120 km/h, 100 km/h)



	IC No. (Station)	IC - 1 (0 + 000)		IC - 2 (6 + 090)	IC - 3 (10 + 960)	IC - 6 (17 + 055)	IC - 8 (22 + 565)
	Sketch						
Project Cost (100 million Rp)	Const. Cost	34	27	16	4	14	16
	Land Cost	7	7	5	3	19	5
	Total	41	34	21	7	33	21

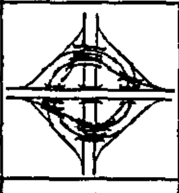
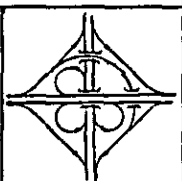
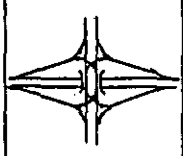
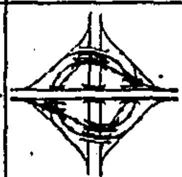
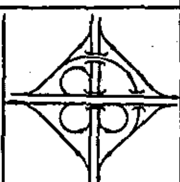
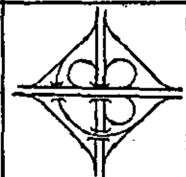
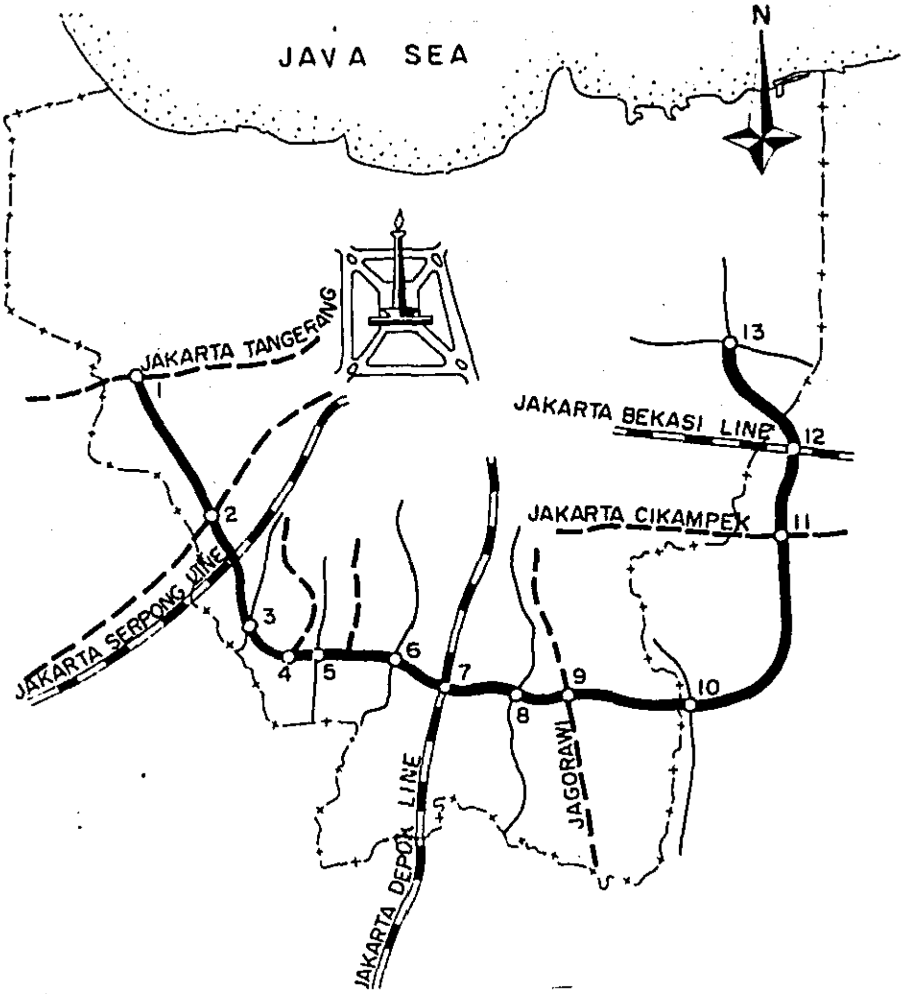
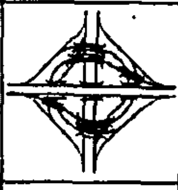
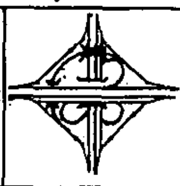
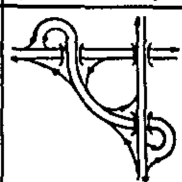
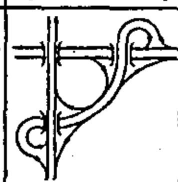
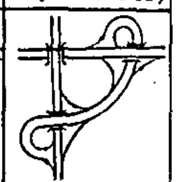
	IC No. (Station)	IC - 9 (24 + 570)		IC - 10 (29 + 180)	IC - 11 (38 + 370)		IC - 13 (46 + 610)
	Sketch						
Project Cost (100 million Rp)	Const. Cost	31	18	9	37	22	17
	Land Cost	0	0	1	4	4	7
	Total	31	18	10	41	26	24

Table 4-14 Zone Tariff (Sectional toll rate) System
(Design speed: 120 km/h, 100 km/h)



IC No. (Station)		IC - 1 (0 + 000)		IC - 2 (6 + 090)	IC - 3 (10 + 960)	IC - 6 (17 + 055)	IC - 8 (22 + 565)
Sketch							
Project Cost (100 million Rp)	Const. Cost	31	24	20	19	23	23
	Land Cost	7	7	5	26	19	5
	Total	38	31	25	45	42	28

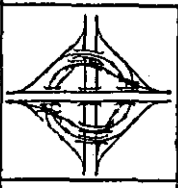
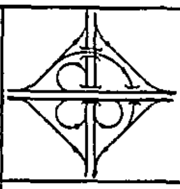
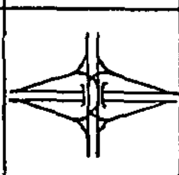
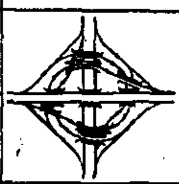
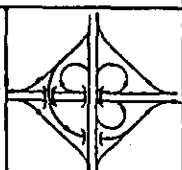
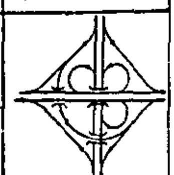
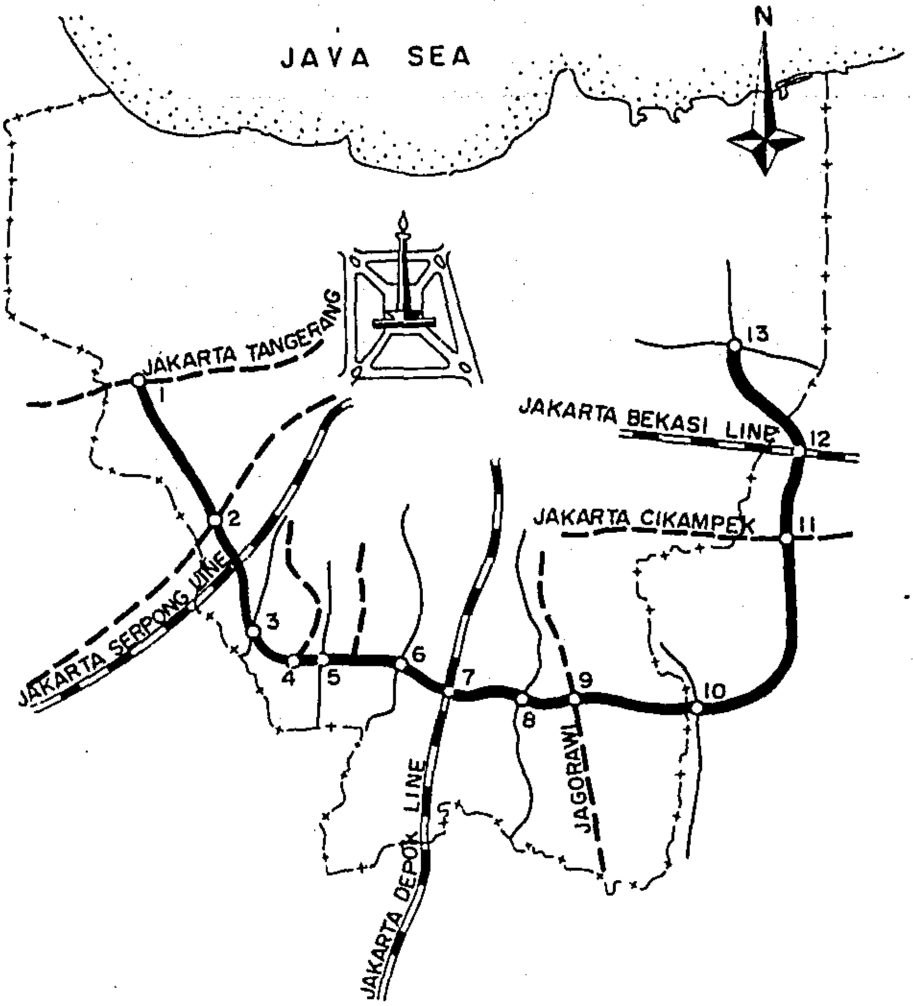
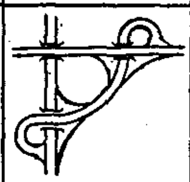
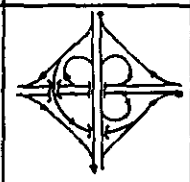
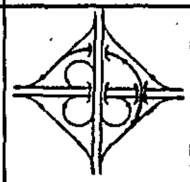
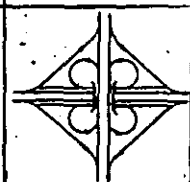
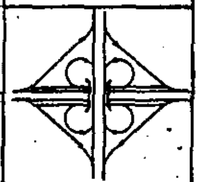
IC No. (Station)		IC - 9 (24 + 570)		IC - 10 (29 + 180)	IC - 11 (38 + 370)		IC - 13 (46 + 610)
Sketch							
Project Cost (100 million Rp)	Const. Cost	26	13	10	32	17	20
	Land Cost	0	0	1	4	4	7
	Total	26	13	11	36	21	27

Table 4-15 Toll Free Alternative
(Design speed: 100 km/h)



IC No. (Station)		IC - 1 (0 + 000)	IC - 2 (6 + 090)	IC - 3 (10 + 960)	IC - 6 (17 + 055)	IC - 8 (22 + 565)
Sketch						
Project Cost (100 million Rp)	Const. Cost	19	12	16	10	16
	Land Cost	6	6	21	15	6
	Total	25	18	37	25	22

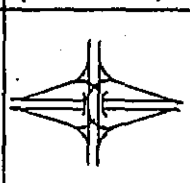
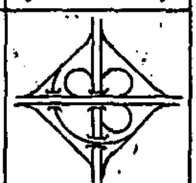
IC No. (Station)		IC - 9 (24 + 570)	IC - 10 (29 + 180)	IC - 11 (38 + 370)	IC - 13 (46 + 610)
Sketch					
Project Cost (100 million Rp)	Const. Cost	17	8	18	14
	Land Cost	3	1	5	6
	Total	20	9	23	20

Table.4-16 IC - 1 (0 +000)

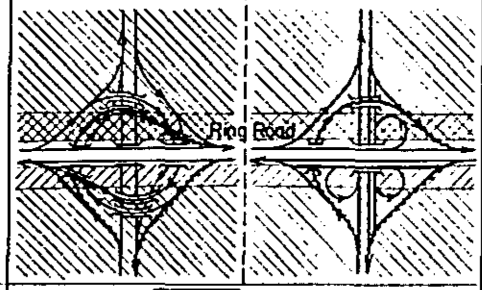
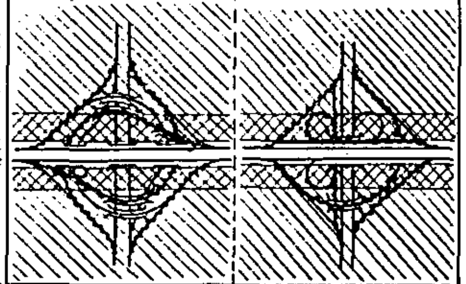
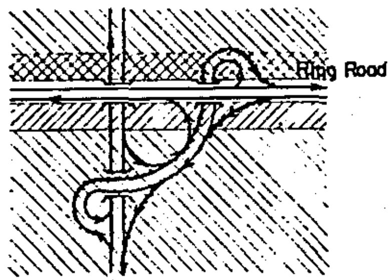
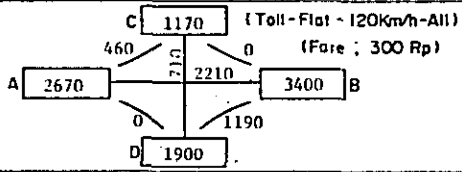
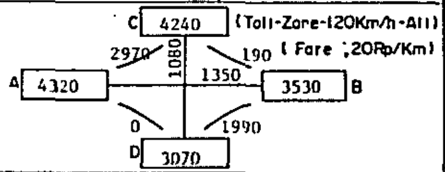
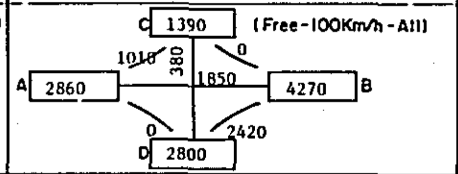
Item / Ring Road Operation System		Flat	Zone	Free
		Turbine ¦ Modified Cloverleaf	Turbine ¦ Modified Cloverleaf	Double Trumpet
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp				
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 8% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005				
Total Project Amount (hundred million Rp)	Construction Cost			
	Land Acquisition & Compensation Cost			
	Total			
Comment		There are the above two alternatives. As desirbed *in section 4-6-1, the clover type* is inferior to the turbine type in safety, comport and for traffic at weaving section but since the traffic is at interchange is concentrated in the direction B D, A C, it is economical to provide semi-direct connecting ramp for the D to B direction and provide collector Road for the C to A direction to form a modified clover type. However, design speed at the ramp is reduced to 40 km/h.	There are the above two alternatives. As *described in section 4-6-1, the clover* type is inferior to the turbine type in safety, comport and for traffic at weaving section but since the traffic is at interchange is concentrated in the direction B D, A C, it is economical to provide semi direct connecting ramp for the A to C direction and provide collector Road for the D to B direction to form a modified clover type. However, *design speed at the* ramp is reduced to 40 km/h.	From the point of toll collection, it is the double trumpet type. The choice of the quadrant for the interchange is determined by the landuse and also the traffic volume by direction. In this interchange, the location as shown in the above figure is favorable.
RFFERENCE				

Table 4-17 IC - 2 (6 +050)

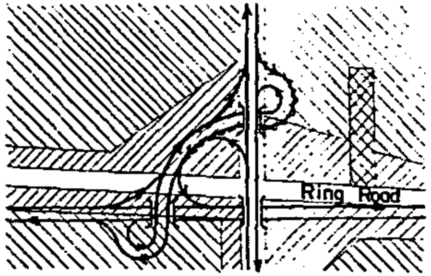
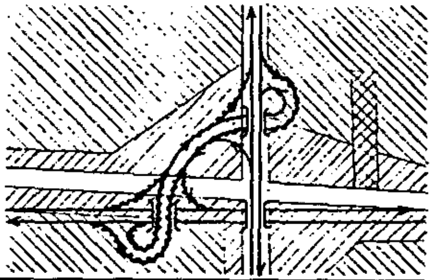
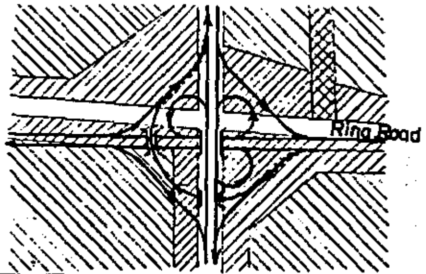
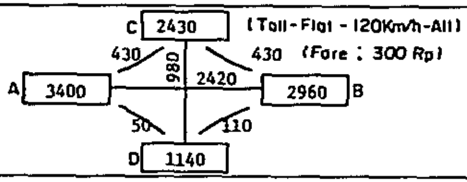
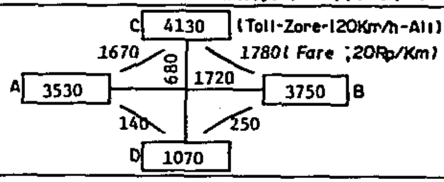
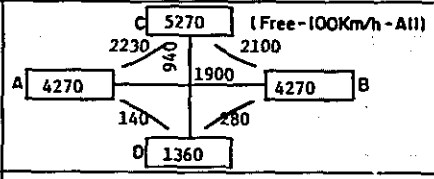
Item \ Ring Road Operation System		Flat	Zone	Free
Sketch Plan *Legend* ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp		Double Trumpet  	Double Trumpet 	Modified Cloverleaf 
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 8% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005		 	 	
Total Project Amount (hundred million Rp)	Construction Cost			
	Land Acquisition & Compensation Cost			
	Total			
Comment		Due to the fact that traffic at connecting road cannot be handled by level crossing, the *double trumpet is adopted*. The quadrant as shown above is favorable from the points of landuse and traffic volume by direction	Same as left	Due to the fact that traffic at connecting road cannot be handled by level crossing, the possible types are double trumpet or modified clover. Since the landuse of the surrounding is green belt, the modified *clover is adopted for concentration of the* facility. Although the C to A direction traffic volume is heavier than that for B to C from the point of safety because the loop will be hidden by the bridge if the loop is provided for C to A.
REFERENCE		Cf. Fig. 4-16	Cf. Fig. 4-16	Cf. Fig. 4-16

Table 4-18 IC - 3 (10 +960)

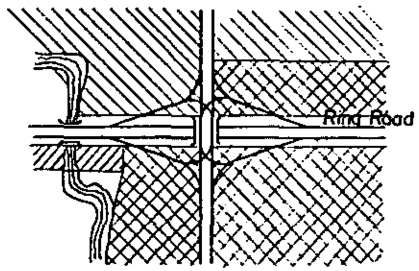
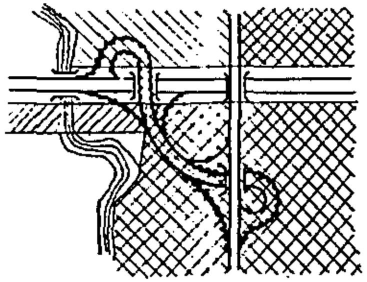
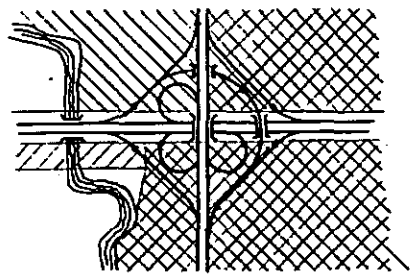
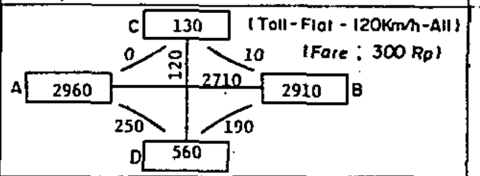
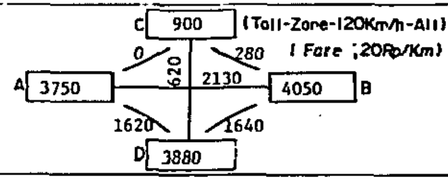
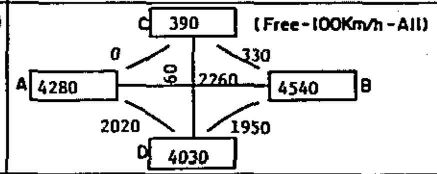
Item \ Ring Road Operation System		Flat	Zone	Free
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp		Diamond 	Double Trumpet 	Modified Cloverleaf 
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 8% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005				
Total Project Amount (hundred million Rp)	Construction Cost	4	19	16
	Land Acquisition & Compensation Cost	3	26	21
	Total	7	45	37
Comment		Since traffic on the connecting road can be handled by level crossing, the diamond type is adopted.	Since traffic on connecting road cannot be handled by level crossing, the double trumpet type is adopted. The above quadrant is chosen from the points of landuse, traffic volume and the angle of intersection of two roads.	Since traffic on connecting road cannot be handled by level crossing, the alternative types are either double trumpet or modified clover type, and from the landuse and topographical conditions the concentration of the transport facility is more desirable.
REFERENCE		Cf. Fig. 4-16		

Table.4-19 IC - 6 (17+055)

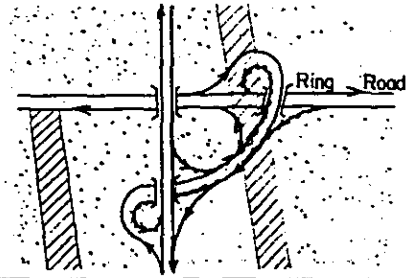
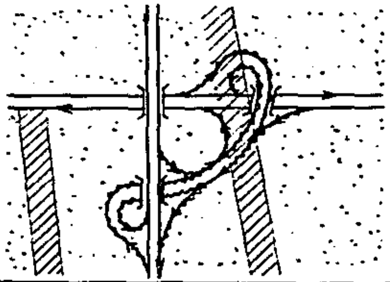
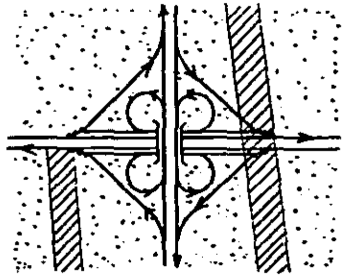
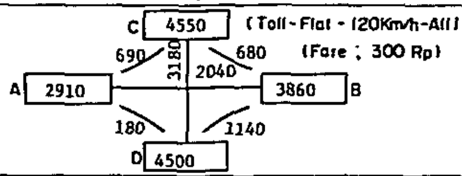
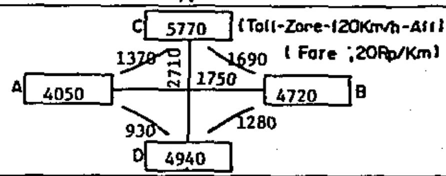
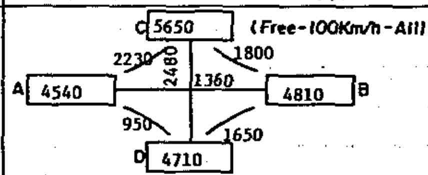
<table>
<tr><td>Ring Road Operation System / Item</td><td>Flat</td><td>Zone</td><td>Free</td></tr>
<tr><td>Sketch Plan
Legend
; Public Building Office
; Residential Area
; Village
; Green
; Industrial Area
; River
; 1-Lane One Way Ramp
; 2-Lane One Way Ramp</td><td>Double Trumpet

</td><td>Double Trumpet
</td><td>Cloverleaf
</td></tr>
<tr><td>Peak Hourly Traffic Flow (One Way)
Unit ; Veh/hour
Peak Ratio ; 8%
Heavy Car Ratio ; 10%
Directional Distribution ; 60%
Year ; 2005</td><td>
</td><td>
</td><td>
</td></tr>
<tr><td>Total Project Amount (hundred million Rp) — Construction Cost</td><td>14</td><td>23</td><td>10</td></tr>
<tr><td>Land Acquisition & Compensation Cost</td><td>19</td><td>19</td><td>15</td></tr>
<tr><td>Total</td><td>33</td><td>42</td><td>25</td></tr>
<tr><td>Comment</td><td>Due to the fact that traffic at connecting road cannot be handled by level crossing, the double trumpet is adopted. The quadrant as shown above is favorable from the points of landuse and traffic volume by direction</td><td>As traffic of connecting road cannot be handled by level crossing, the double trumpet type is adopted. From the points of view that the 1st and 2nd quadrants are quick built up and also from the traffic direction the above location is shown.</td><td>Since the traffic of connecting road cannot be handled by level crossing, the choice is between a double trumpet or a clover type. As traffic in most directions do not show great difference, the concentration by the clover type with provision of collector road is favorable.</td></tr>
<tr><td>REFERENCE</td><td>Cf. Fig. 4-16</td><td>Cf. Fig. 4-16</td><td>Cf. Fig. 4-16</td></tr>
</table>

Table 4-20 IC - 8 (22 +565)

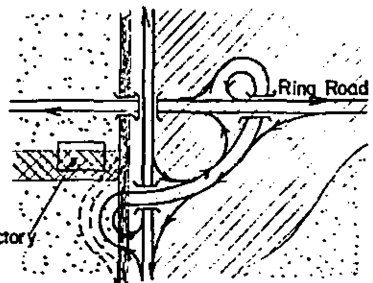
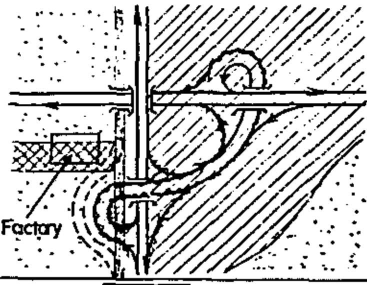
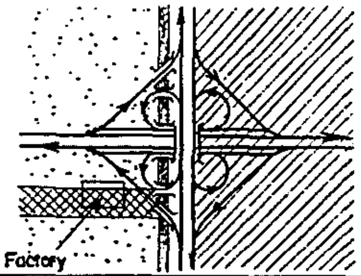
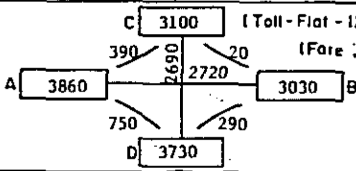
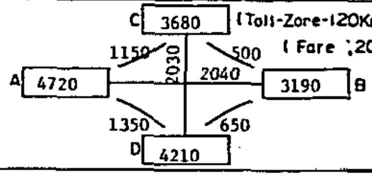
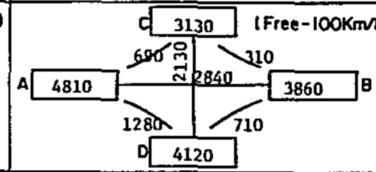
Item / Ring Road Operation System		Flat	Zone	Free
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp		Double Trumpet 	Double Trumpet 	Cloverleaf 
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 6% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005		(Toll - Flat - 120Km/h-All) (Fare ; 300 Rp) 	(Toll-Zone-120Km/h-All) (Fare ; 20Rp/Km) 	(Free-100Km/h-All) 
Total Project Amount (hundred million Rp)	Construction Cost	16	23	16
	Land Acquisition & Compensation Cost	5	5	6
	Total	21	28	22
Comment		As the traffic of connecting road cannot be handled by level crossing, the double-trumpet type is adopted. Since these are factories in the 3rd quadrant and the connecting road runs along a river, the interchange is placed as show above, with *part of the river relocated.*	Same as left	Since the traffic of connecting road cannot be handled by level crossing the choice is between a double trumpet or a clover type. As traffic in most directions do not show great difference, the *concentration by the clover type* with provision of collector road is favorable.
REFERENCE		Cf. Fig. 4-16, Clause 4-3-2 (2)	Cf. Fig. 4-16, Clause 4-3-2 (2)	Cf. Clause 4-3-2

Table 4-21 IC - 9 (24+570)

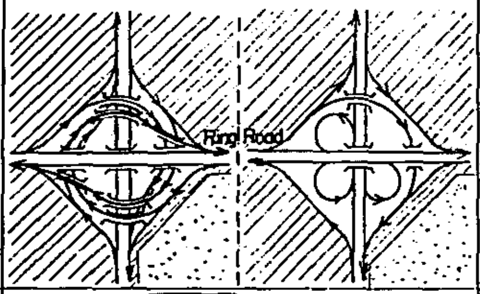
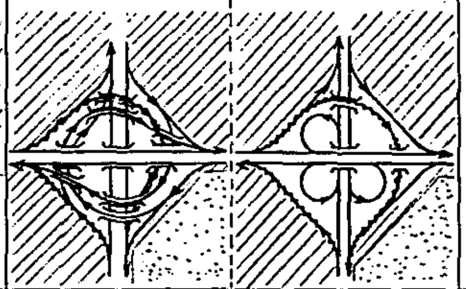
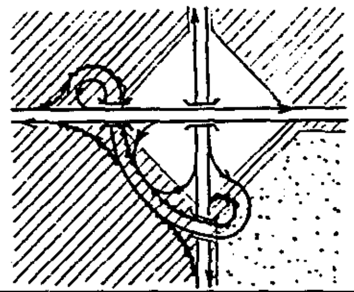
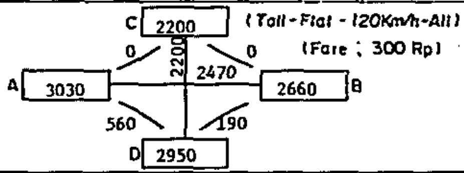
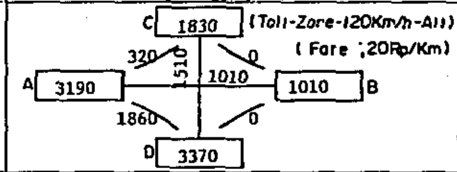
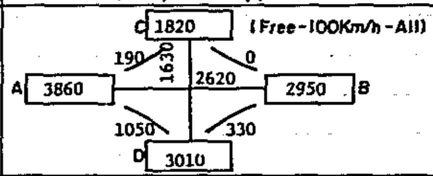
Item / Ring Road Operation System		Flat		Zone		Free
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp		Turbine	Modified Cloverleaf	Turbine	Modified Cloverleaf	Double Trumpet
						
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 8% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005						
Total Project Amount (hundred million Rp)	Construction Cost	31	18	26	13	17
	Land Acquisition & Compensation Cost	0	0	0	0	3
	Total	31	18	26	13	20
Comment		The above two are the possible alternatives. Although the clover type is inferior to the turbine type in safety, comfort and for the traffic capacity at the weaving section, since the traffic at this interchange is particularly heavy in the A D direction, it is more economical to adopt the modified clover type with a semi direct ramp provided for the A to D direction. However, the design speed of ramps has to be limited to 40 km/h.		*Same as left*		From the point of toll collection, it is the double trumpet type. The choice of the quadrant for the interchange is determined by the landuse and also the traffic volume by direction. In this interchange, the location as shown in above figure is favorable.
REFERENCE		Cf. Clause 4-3-2		Cf. Clause 4-3-2 (2)		Cf. Clause 4-3-2 (2)

Table 4-22 IC - 10 (29 +180)

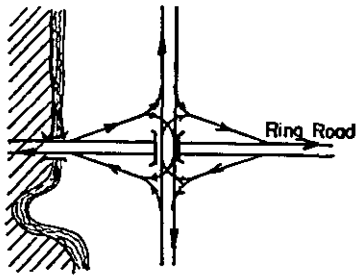
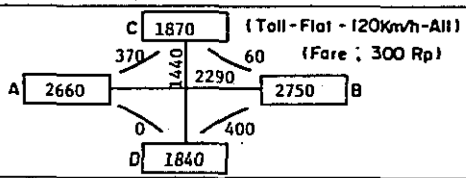
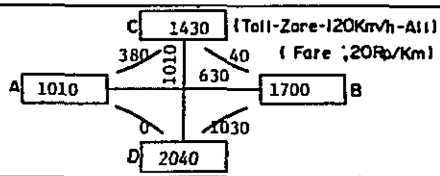
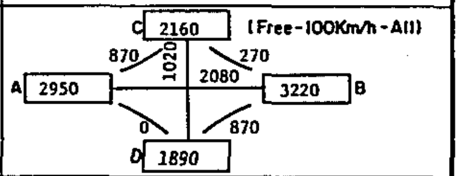
Item / Ring Road Operation System		Flat	Zone	Free
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp		Diamond 	Diamond Same as left	Diamond Same as left
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 8% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005				
Total Project Amount (hundred million Rp)	Construction Cost	9	10	8
	Land Acquisition & Compensation Cost	1	1	1
	Total	10	11	9
Comment		Since traffic on the connecting road can be handled by level crossing the diamond type is adopted.	Same as left	Same as left
REFERENCE		Cf. Fig. 4-16	Cf. Fig. 4-16	Cf. Fig. 4-16

Table .4-23 IC - 11 (38 +370)

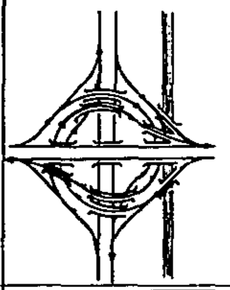
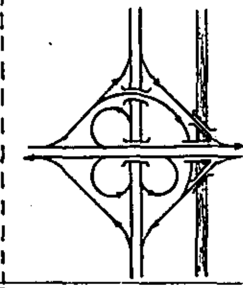
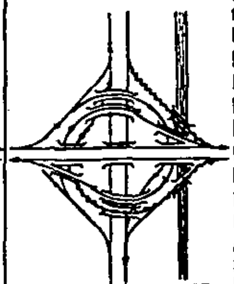
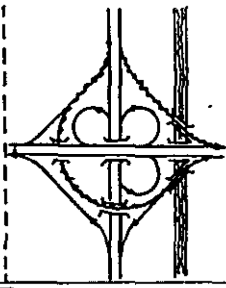
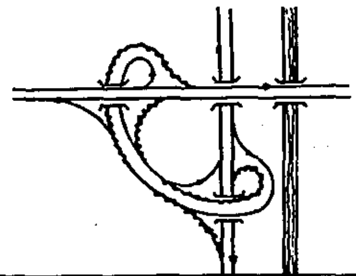
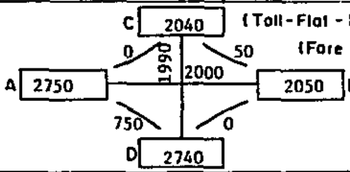
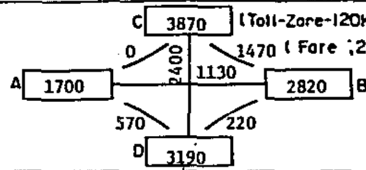
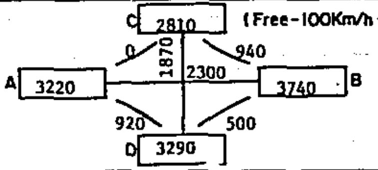
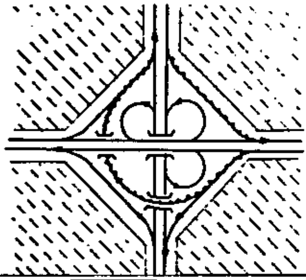
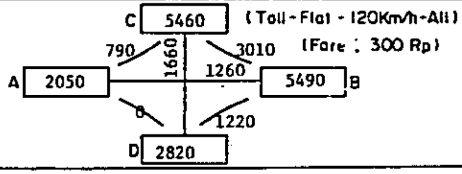
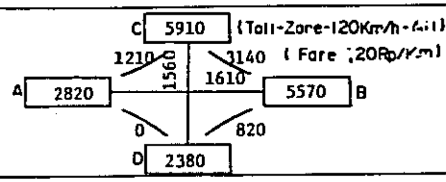
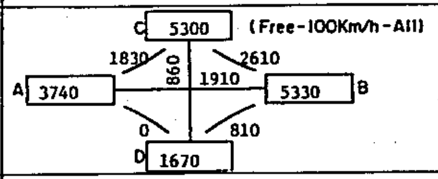
Item / Ring Road Operation System	Flat		Zone		Free
	Turbine	Modified Cloverleaf	Turbine	Modified Cloverleaf	Double Trumpet
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp					
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 8% Heavy Car Ratio ; 10% Directional Distribution ; 60% Year ; 2005	 C 2040, A 2750, B 2050, D 2740, 0, 1990, 2000, 50, 750, 0	(Toll-Flat-120Km/h-All) (Fare ; 300 Rp)	 C 3870, A 1700, B 2820, D 3190, 0, 2400, 1130, 1470, 570, 220	(Toll-Zone-120Km/h-All) (Fare ; 20Rp/Km)	 C 2810, A 3220, B 3740, D 3290, 0, 1870, 2300, 940, 920, 500 (Free-100Km/h-All)
Total Project Amount (hundred million Rp) — Construction Cost	37	22	32	17	18
Land Acquisition & Compensation Cost	4	4	4	4	5
Total	41	26	36	21	23
Comment	The above two are the possible alternatives. Although the clover type is inferior to the turbine type in safety, comfort and for the traffic capacity at the weaving section, since the traffic at this interchange is particularly heavy in the A D direction, it is more economical to adopt the modified clover type with a semi direct ramp provided for the A to D direction. However, the design speed of ramps has to be limited to 40 km/h.		Traffic volume is heavy in the A C direction and it is economic to adopt the modified clover type, providing semi direct ramp for the B to C is right turn traffic.		From the toll system, the double trumpet type is adopted. Due to the presence of a canal along the connecting road, the interchange is placed as shown above.
REFERENCE					

Table 4-24 IC - 13 (46 +610)

Item \ Ring Road Operation System		Flat	Zone	Free
Sketch Plan Legend ; Public Building Office ; Residential Area ; Village ; Green ; Industrial Area ; River ; 1-Lane One Way Ramp ; 2-Lane One Way Ramp		Modified Cloverleaf 	Modified Cloverleaf Same as left	Modified Cloverleaf Same as left
Peak Hourly Traffic Flow (One Way) Unit ; Veh/hour Peak Ratio ; 6% Heavy Car Ratio ; 10% Directional Distribution ,60% Year ; 2005				
Total Project Amount (hundred million Rp)	Construction Cost	17	20	14
	Land Acquisition & Compensation Cost	7	7	6
	Total	24	27	20
Comment		Since traffic of connecting road cannot be handled by level crossing, the double trumpet or the clover type, providing semi direct ramp for the B to C direction traffic.	Same as left	Same as left
REFERENCE				

4-6-3 Study on the Intervals of Interchanges

The locations of interchanges of this Ring Road are shown in Fig. 4-27.

There is one section not to be able to keep the necessary interval for allocation of the traffic signs, which is from I.C.-8 (STA. 25+565) to I.C.-9 (STA. 24+570). In the following study for this section is described.

(1) Interval of Interchanges

Fig. 4-25 Tollway (Uniform Rate and Distance Proportional Toll Rate)

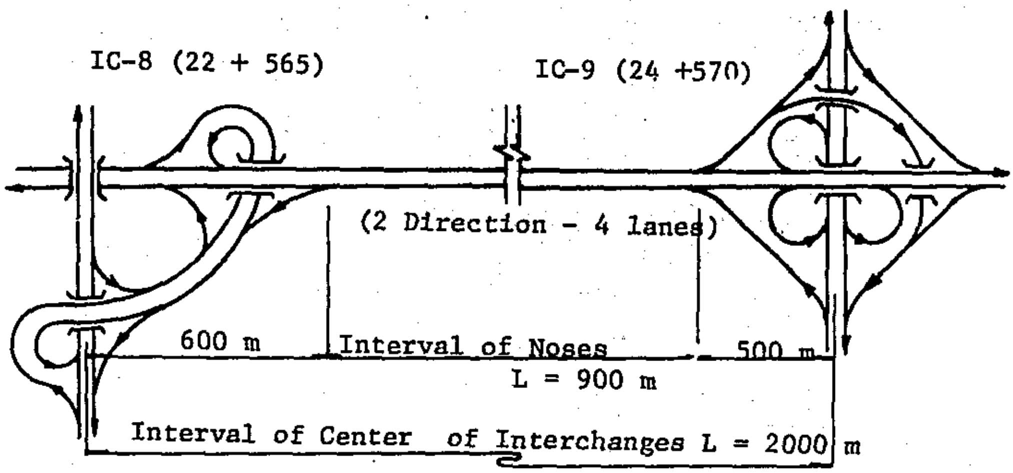


Fig. 4-26 Toll Free

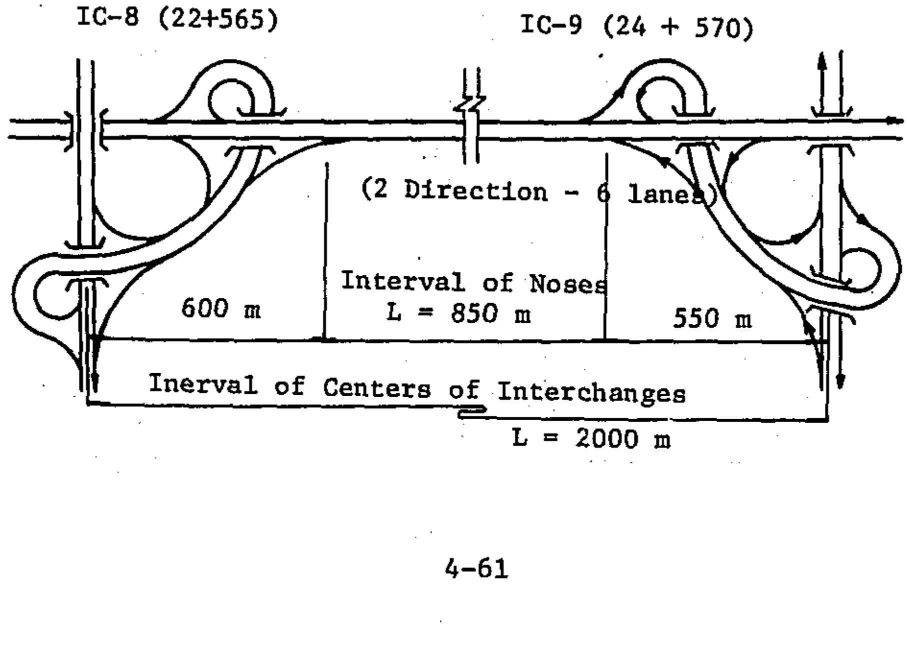
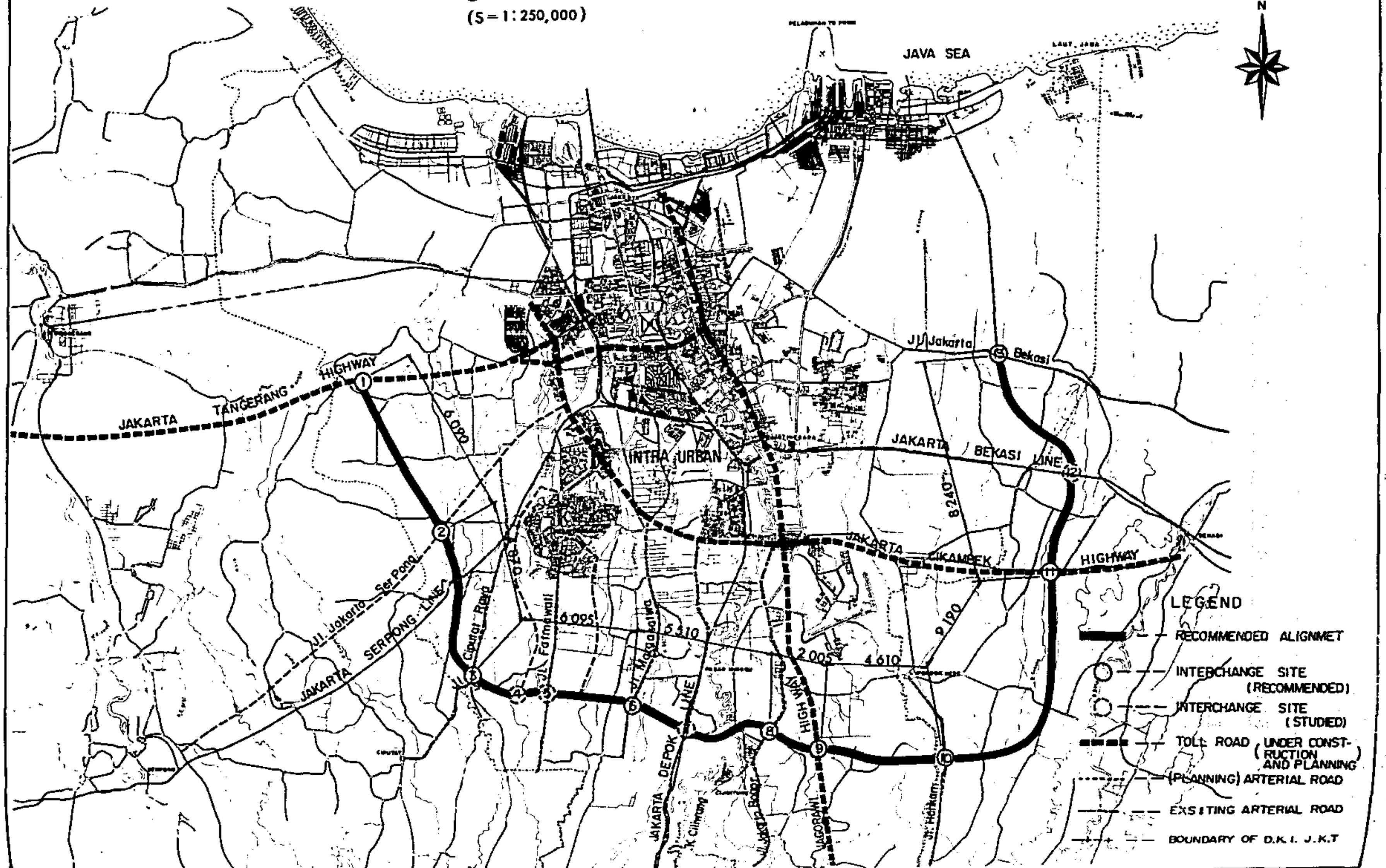


Fig. 4-27 PLAN
(S = 1:250,000)



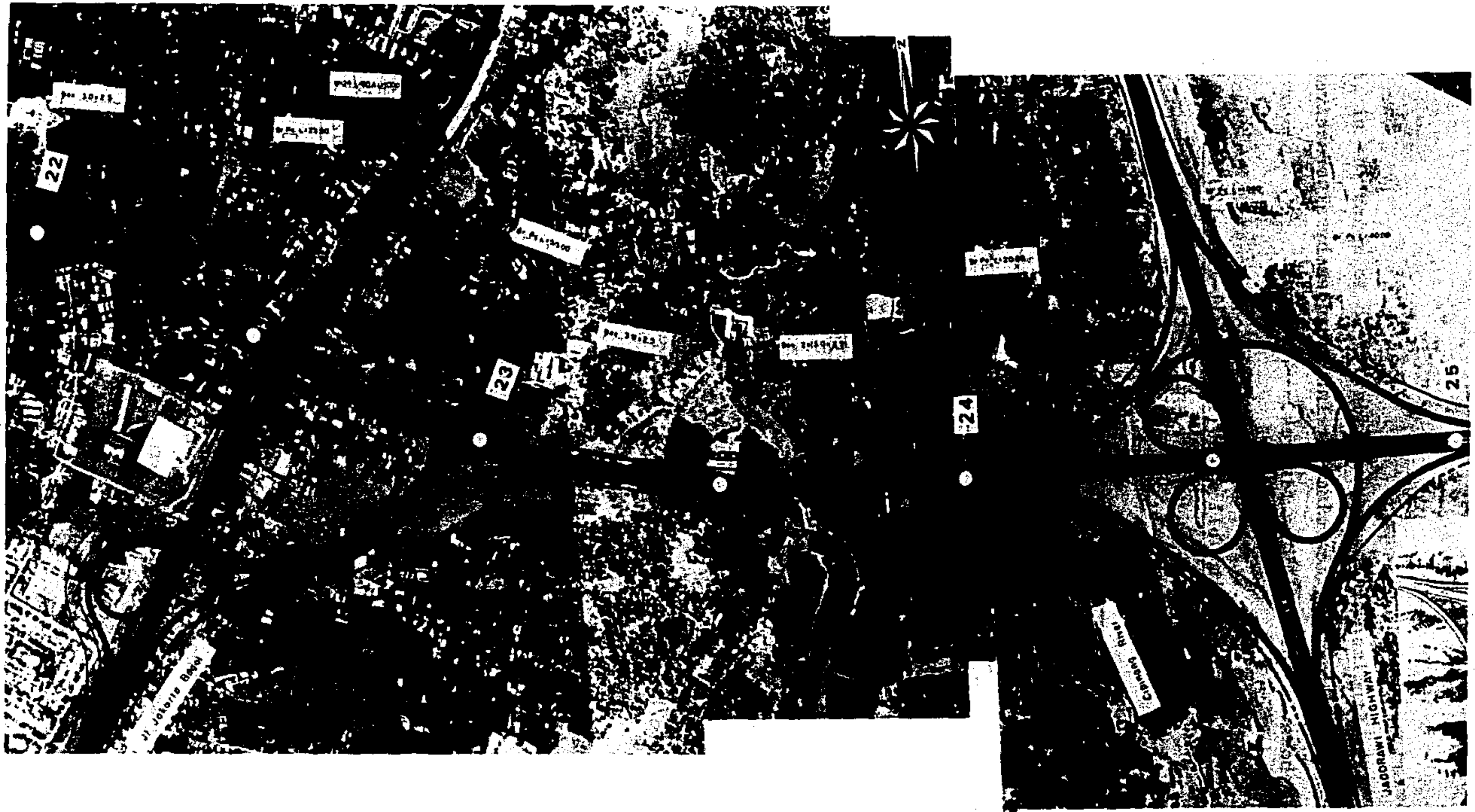


Fig. 4-28 INTERVAL OF THE INTERCHANGE BETWEEN IC-8 AND IC-9

(S = 1 : 10,000)

(2) Studies for weaving traffic

The weaving traffic volume at Interchanges by alternative is shown in the following figures.

Fig. 4-29 Uniform Toll Rate (T-01; Toll-Flat-120 km/N-All-13.5 Rp/km)

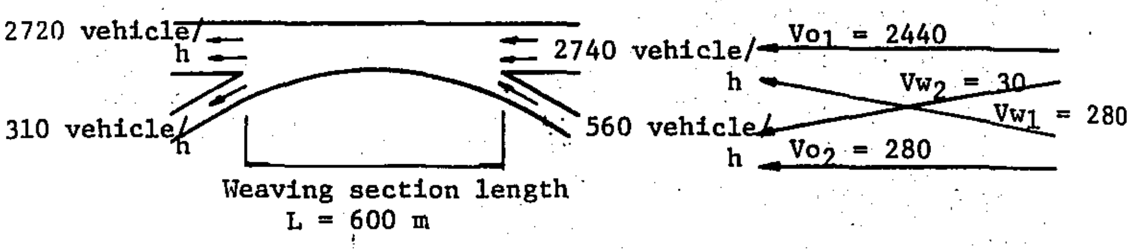


Fig. 4-30 Distance Proportional Toll Rate

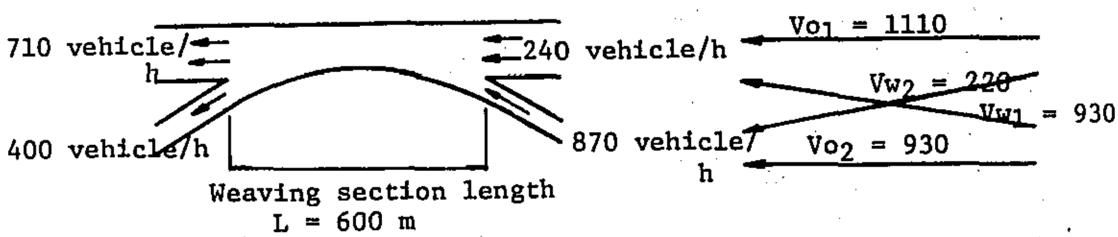
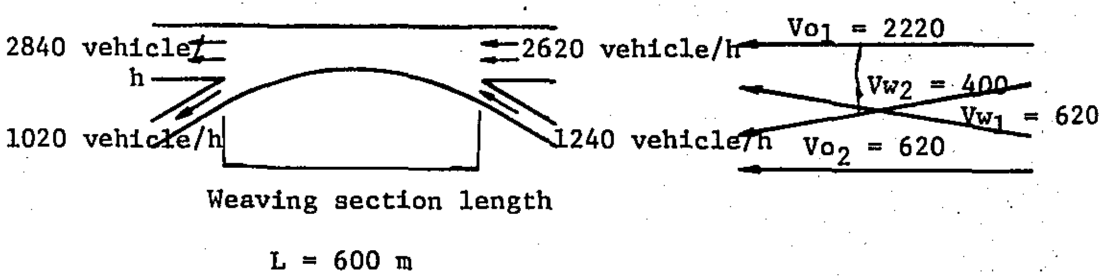


Fig. 4-31 Toll Free (F-01; Free-100 km/h-All)



As shown above, in case of uniform toll rate, the weaving traffic is so small to be no problem.

But, in the cases of distance proportional toll rate and toll free, some examination for lanes of the weaving section should be needed.

In case of distance proportional toll rate:

$$N = \frac{1110 + 2 \times 220 + 930 + 930}{1820} = 1.9 < 2 \text{ lanes}$$

In case of toll free:

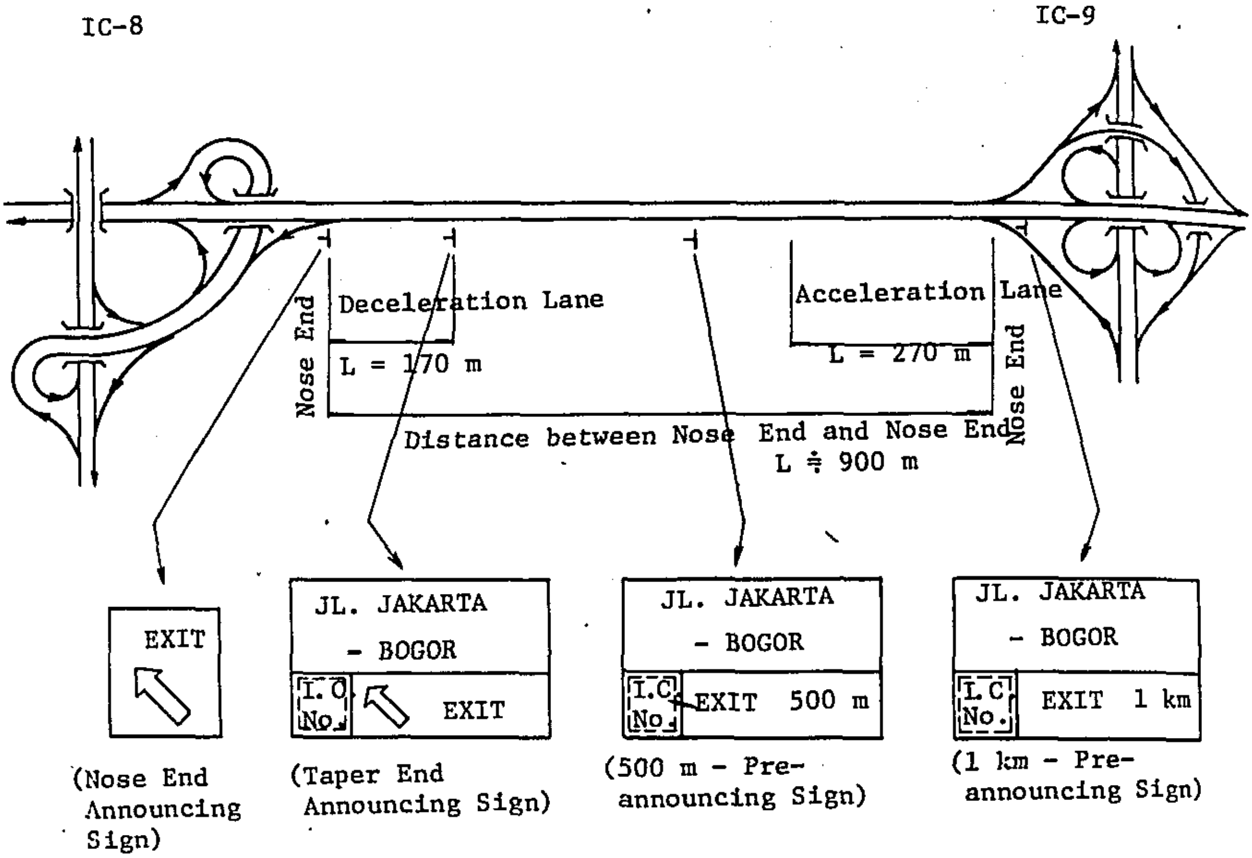
$$N = \frac{620 + 1.6 \times 400 + 2220 + 620}{1780} = 2.3 < 3 \text{ lanes}$$

From above calculation, for both cases, additional lanes in the weaving section are not needed.

(3) Allocation of traffic signs

The allocation of traffic signs is shown in Fig. 4-32. In this figure, although 2 km-preannouncing sign is avoided, 1 km-preannouncing sign and 500 m-preannouncing sign are allocated as overhead signs of enlarged size to keep the traffic safety.

Fig. 4-32 Arrangement of the Traffic Sign (IC-8 ∿ IC-9)



4-7 Sumary of Comparative Altermatives

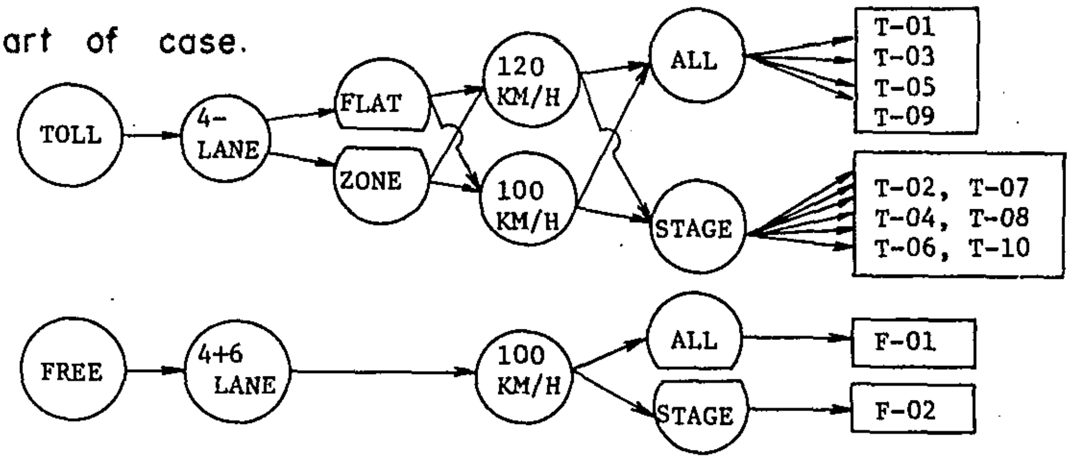
In the previous section a description of the various factors for the planning of the main route and its interchanges as shown in Fig. 4-2 has been made and the 12 alternatives established for comparative analysis in the feasibility study of this project are summarized in Fig. 4-25.

Table 4-25 CASE NUMBER OF CONSTRUCTION COST ESTIMATE

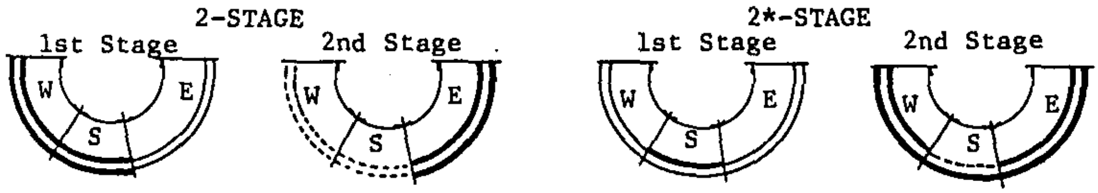
TOLL/FREE	NUMBER OF LANE	COLLECTING SYSTEM	DESIGN SPEED (KM/H)	CONSTRUCTION METHOD	CASE NO. F; FREE T; TOLL
FREE	4 + 6 LANE		100	ALL	F-01
				2-STAGE	F-02
TOLL	4-LANE	FLAT	120	ALL	T-01
				2-STAGE	T-02
			100	ALL	T-03
				2-STAGE	T-04
		ZONE	120	ALL	T-05
				2-STAGE	T-06
				2*-STAGE	T-07
				3-STAGE	T-08
			100	ALL	T-09
				2-STAGE	T-10

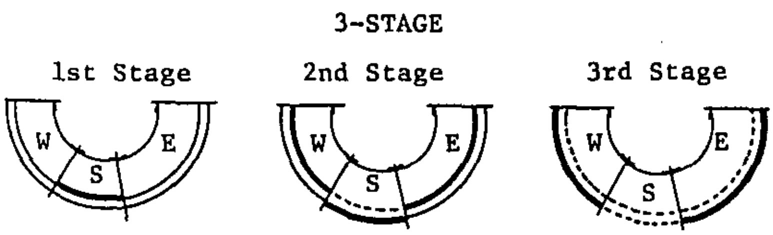
Notes;

1. Flowchart of case.



2 Case of stage construction.





Legend;

W; Western Section (12.3km)

S; Southern Section(13.85km)

E; Eastern Section (20.05km)

CHAPTER 5 FORECAST OF FUTURE TRAFFIC VOLUME

5-1 Method of Forecast and Alternatives

5-1-1 Basic Concept on Demand Forecast

From the point of view of the Jakarta Ring Road being a part of the urban transport facility for Jakarta, the following are the problems of the existing traffic situation which the Ring Road will have to contribute to solving.

(1) Securing of traffic capacity

The Ring Road has to serve as a distributor and collector road for the commuting traffic that concentrates into the urban center during the peak hours and also serve to provide a circular traffic facility to the traffic generated through the development of the low density areas of the city.

(2) Securing of proximity

The Ring Road has to provide a means of free access to all parts of the city of Jakarta.

(3) Provision of good service

The Ring Road has to fulfil the requirements of a speedy, safe, comfortable and convenient transport facility.

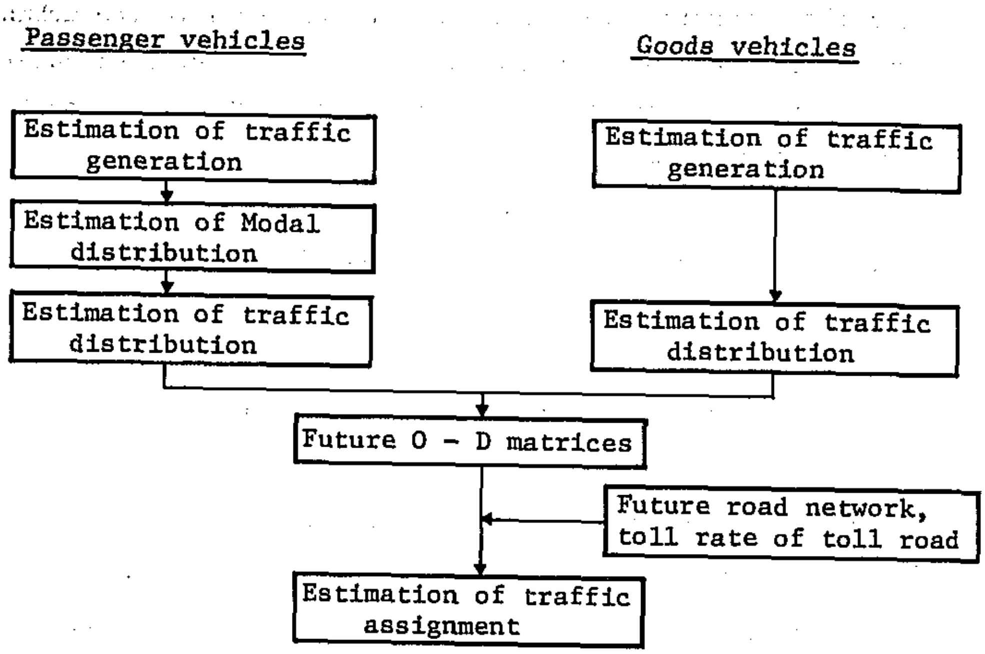
To answer to the above requirements, the basic concept is analysed in the following paragraphs.

In estimating the traffic demand of Jakarta, the passenger vehicle traffic is based on the analysis of the daily activities of the populations, and the traffic demand is quantified in the concept of 'trips.' Also, as may be seen from the results of the traffic surveys and travel speed surveys, the problems of present traffic in Jakarta are mainly concentrated in the morning peak commuting hours. Therefore, besides the analysis or the daily traffic phenomenon of passenger vehicles, the supply and demand relation during the peak hours is also analysed.

Forecast of goods vehicle traffic is based on the goods vehicle trips generated through future goods flow, and careful studies are made of the future changes of goods handling facilities such as ports, cargo terminals, etc. The characteristics of good vehicle traffic are that the variation of traffic is stable in relation to time variation in the day, as has been verified through past surveys, and analysis on goods vehicles traffic is therefore made only for daily traffic.

The basic concept for forecast of traffic demand may be summarized in the flow chart as shown in Fig. 5-1.

Fig. 5-1 Conceptual Flow Chart of Forecast of Traffic Demand



5-1-2 Estimation of Passenger Vehicle Traffic

The passenger vehicle traffic volume in forecast basing on the person-trip and the basic process is described below and summarized in the flow chart shown in Fig. 5-2, whereby analyses are made for the daily and the hourly traffic volumes.

(1) Analysis of the O-D matrices of 1972 (person-trip).
The 1972 O-D matrices by B/M and the person-trip O-D matrices by JMATS were analysed for their conditions of generation and relation to economic indicators.

(2) Formulation of traffic generation model and distribution model.

From the basic O-D matrices, the person-trip generation and distribution models were formulated.

(3) Establishment of 1976 O-D matrices (person-trip).

Basing on the economic indicators, and using the generation and distribution models formulated, the O-D matrices were calculated for the year 1976, which is the base year of this study.

(4) Checking of the established O-D matrices at screen line.

Theoretical O-D matrices are distributed to the traffic lines and checked against actual cross-section traffic volumes at screen lines in order to verify the distribution methodology adopted.

(5) Determination of the control total of future person trip.

The control total of future person trip is calculated from the future economic indicators.

(6) Analysis of modal split

The control total of future person trip of passenger vehicles is split into passenger car trips and bus trips.

(7) Estimated of trip generation by zones

Trip generation by zones is estimated for passenger cars and buses.

(8) Determination of future road network

The future road network to be taken into consideration is determined taking into consideration the future urban activities and economic activities of the city.

(9) Establishment of future O-D matrices

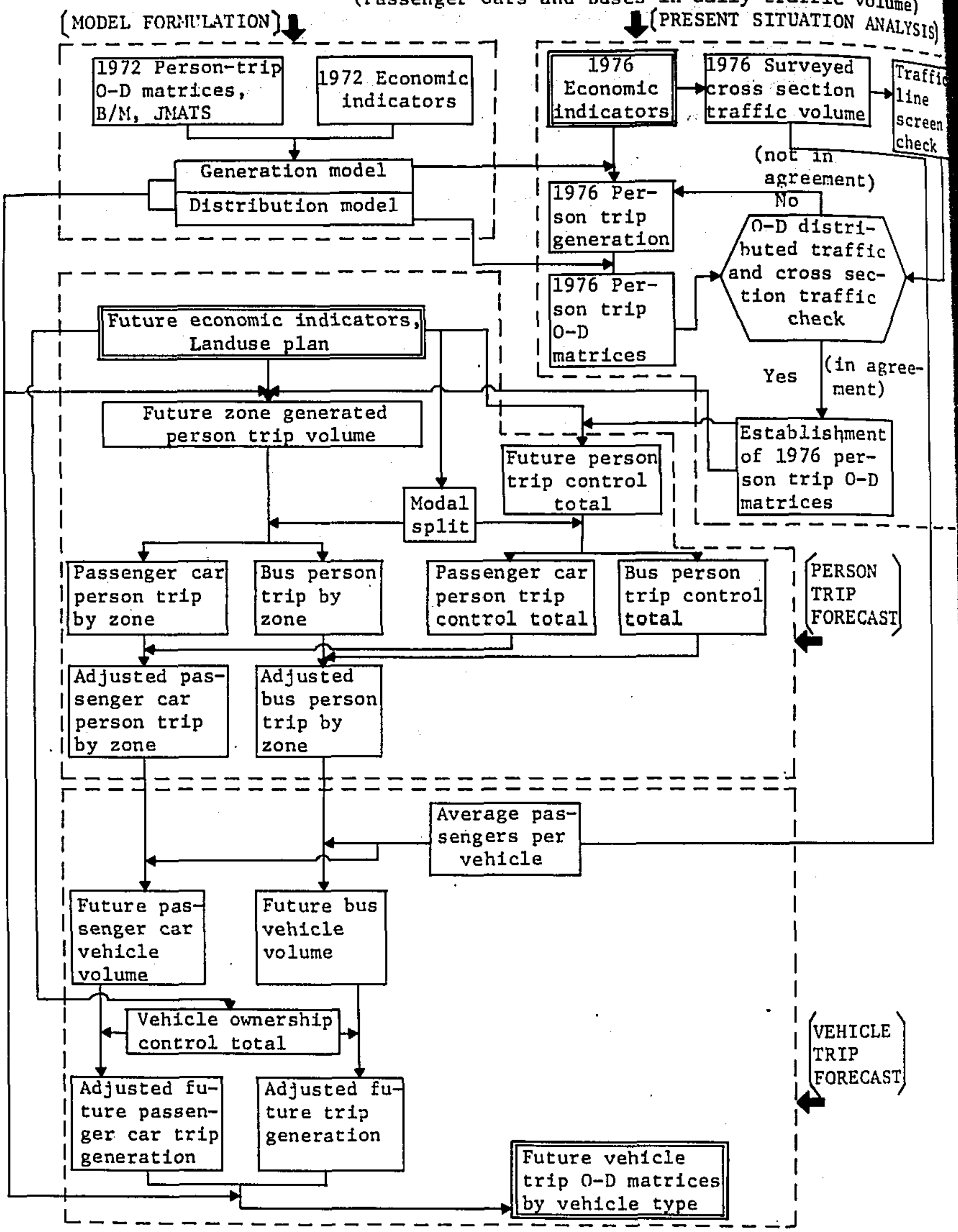
The O-D matrices are established taking into consideration the future changes in inter-zonal relation after completion of the future road network.

(10) Determination of the toll rate

Toll rates for both the case of uniform toll and that of sectional rate are set within the limit of the benefits estimated for the road users.

Fig. 5-2 Flow Process of Establishment of O-D Matrices for Passenger Vehicles

(Passenger Cars and Buses in daily traffic volume)



(11) Traffic assignment

Traffic assignment is made for the different alternatives together with the goods vehicle traffic in the manner described in subsequent section.

5-1-3 Estimation of Goods Vehicle Traffic

The goods vehicle traffic volume is forecast by analysing the relation of production and consumption of major commodity items in Jakarta and the volume of goods flow between Jakarta and other regions by mode of transport and by traffic direction. The work process of the basic component factors is described below and also summarized in the flow chart in Fig. 5-3.

(1) The consumption volume of main commodity items in the whole of Indonesia in 1973 is computed from the production volume and the imported and exported volume of each item.

(2) The consumption volume of Jakarta is computed as a share of the national total consumption by the proportion of economic indicators, population, etc.

(3) The goods flow in and out of Jakarta (including goods flow by ship) and the goods flow within Jakarta City are estimated from the balance between production in Jakarta, basing on statistical data, and consumption in Jakarta as computed in step (2) above.

(4) From the information on the goods flow by modes of transport (including ship) between Jakarta and other regions, collected through surveys, 1972 B/M O-D matrices, port statistics and statisties of Jakarta City, adjustments are made for the goods flow volume calculated for the 3 major items in production and consumption, in order to establish the volume of goods flow in 1973.

(5) From the figures established in step (4) for the goods flow volume by modes of transport (including ship) for the year 1973 between Jakarta and other regions, the pattern of goods flow for 1976 is established by using the model equation between the goods

flow volume and economic indicators and also taking into consideration the masterplan for the port of Tg. Priok.

(6) The production and consumption of major commodity item in Jakarta were calculated in relation to economic indicators and population, and from the goods flow volume of 1976 established in step (5), the volume of goods flow by truck for the year 1976 by directions is estimated.

(7) The estimated figures obtained in step (6) are checked against the actual survey data on cross section vehicle traffic volume carried out in 1977.

(8) If the check shows favorable results, then the validity of the assumptions in steps (5) and (6) is verified, and the assumptions are adopted for forecast of future goods traffic demand from 1985 to 2000. If the theoretical figures do not tally with actual results, the assumptions in steps (5) and (6) are modified and the process repeated for establishment of theoretical volume for 1976.

(9) The goods flow volume by modes of transport for 1985 to 2000 between Jakarta and other regions is established using the model formulated in step (5) and basing on the masterplan for Tg. Priok.

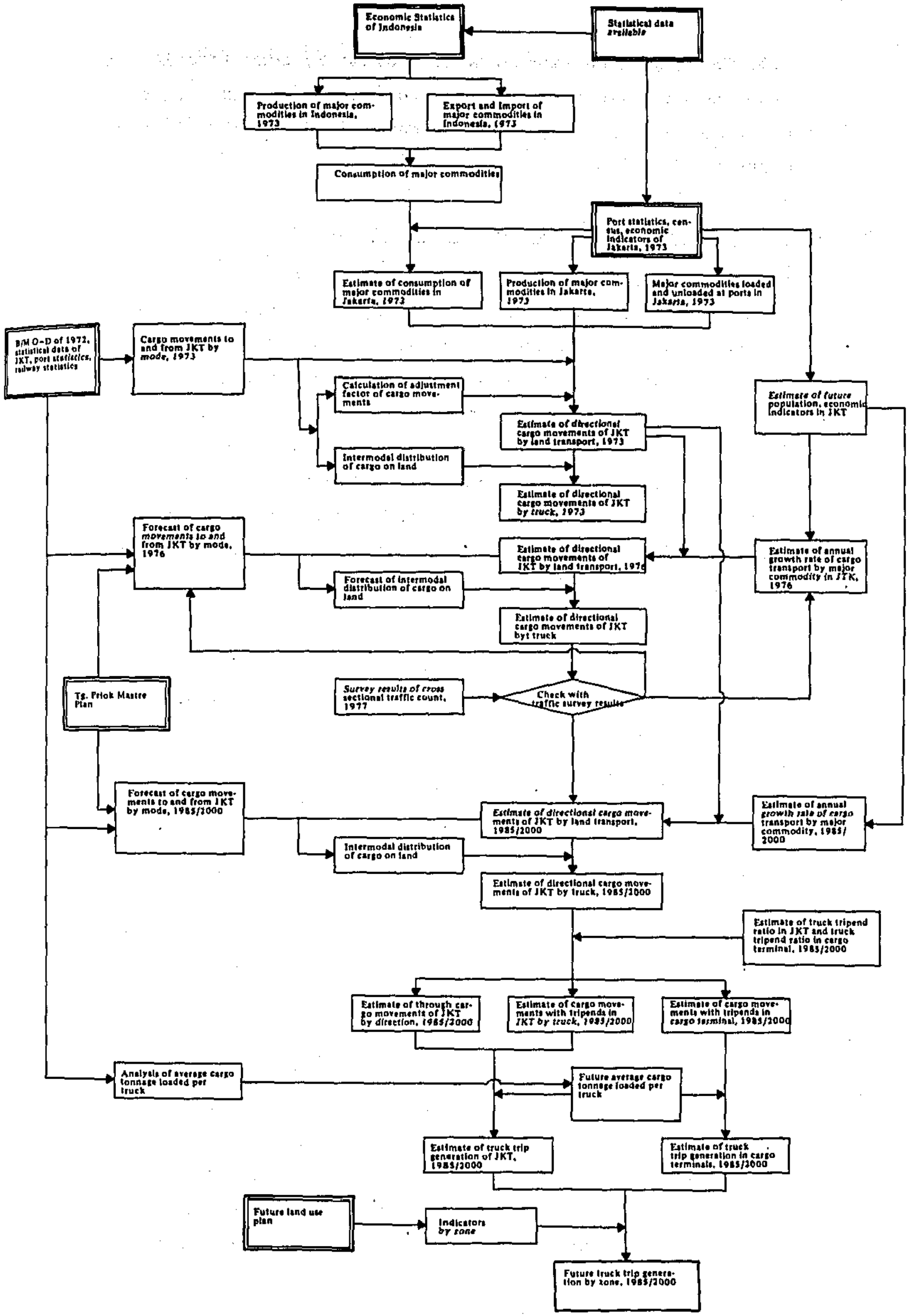
(10) From the production and consumption of major commodity items in Jakarta forecast from future economic indicators and population and the relation with the goods flow volume by modes of transport established in step (9), the volume of goods flow by truck is estimated for the year 1985 to 2000.

(11) Estimates are made of the share of trucks entering the urban center and that using the truck terminal.

(12) The average load volume per truck is estimated from the 1972 B/M O-D matrices and other goods flow statistics of Jakarta, and the future average load volume per truck is forecast.

(13) The volume of truck traffic generation is calculated from the results of steps (10), (11) and (12), taking into consideration the rate of usage of the truck terminal.

Fig. 5-3 Flow Diagram for the Analysis of Truck Trip Generation by Zone



(14) The generated truck traffic volume by zone is calculated from the economic indicators by zone based on the future land-use plan. The above process is summarized as shown in the flow chart in Fig. 5-3.

5-1-4 Comparative Studies of Forecast Alternative

As described previously, the forecast of demand is separately made for persons flow and goods flow, and various alternatives concepts and methods are compared. The basic principle is to make comparative analysis of all possible alternatives. However, since this will incur very enormous volume of data, even if with the assist of the electronic computer, it is necessary to make selective elimination of some alternatives basing on the possibility from the points of present and future urban activities of Jakarta. In the following, a description is made of the comparative analysis of the various items and the reason for their respective observations.

(1) Comparative alternatives on traffic generation

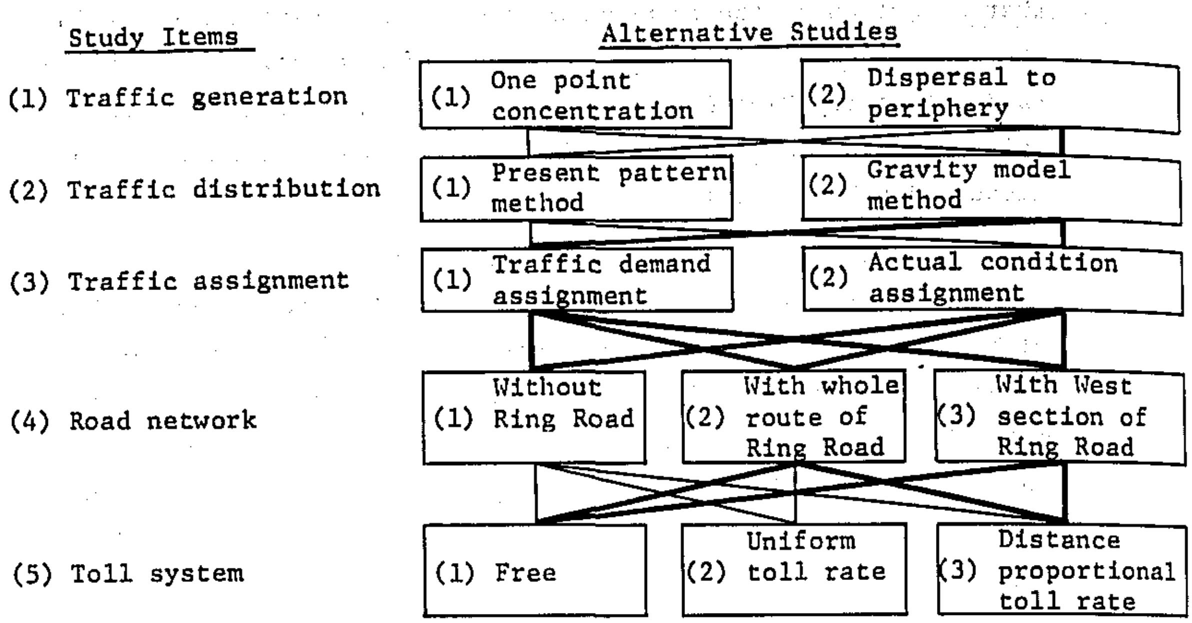
From the past trend of urbanization of Jakarta, it is observed that the future development will be along the same trend of concentrated urbanization centering around the existing CBD. In anticipation of the future economic growth of Jakarta it can be deduced that the urban activities of Jakarta will also increase in intensity. From the standpoint that besides being a commercial and business center, the city of Jakarta is also a potential residential region capable of providing favorable residential services, it can be expected that problems in transportation, housing, environment and other urban aspects will in future become more acute. To ensure future healthy urban activities in Jakarta, the maintenance of harmony between the source of traffic generation and the urban transport facilities is of great importance. This has been clearly indicated by examples of other major cities in the world. On analysis of the balance between the urban activities and the transport facilities in CBD of Jakarta, it is found that the one-point concentrated pattern of urban development is very undesirable, and in the forecast of traffic generation the calculation is made based on a pattern that a portion of the commercial and business facilities within the CBD has dispersed to the periphery of Jakarta. It is without saying that the Ring Road will play a very important role in maintenance of transport facilities to ensure activities of the dispersed urban functions.

(2) Comparative alternatives on traffic distribution
For the consideration on the future relation between the regions within the city and between the city and other regions, the "present pattern method" of distribution and the "gravity model method" which is generated from the present pattern are studied, and the analysis is made based on the gravity model method and also from the point of future distribution of population, the "opportunity model" is also studied. The present pattern method is very effective for the forecast on a short term but is not effective for a long term forecast whereby conspicuous changes in urban phenomena can be expected, such as in the case of the project under study. Therefore, the gravity model method is adopted taking into consideration the future changes of urban activities, the future improvement and construction of urban transport facilities (mainly roads) and the consequent changes in distribution pattern.

(3) Comparative alternative on traffic assignment
The study on the project road is made for both the case of opening the road as (1) a free public road and the case of the road as a toll road. The toll systems under comparative studies are for (2) the case of uniform toll rate and (3) the case of distance - proportional - increase toll rate.

The above mentioned comparative alternatives are summarized in Fig. 5-4.

Fig. 5-4 Comparative Alternatives for Traffic Forecast



Note: ——— denotes flow of alternatives studied.

5-2 Indicators and Car Ownership by Zone

5-2-1 Indicators

Indicators by zone which have been examined for traffic demand forecast are classified as follows:

(1) Indicators of population and economic activities
Population, principle source of traffic generation, is analysed and estimated by categories of the residential population (by density, by residence category) for trip generation and the employed population (by sector, by work places by residential places) for trip destination respecting the future landuse plan.

(2) Indicators for landuse
Respecting the relation between the transportation system plan and the landuse plan, indicators are studied in both cases of the concentrated pattern and the dispersed pattern.

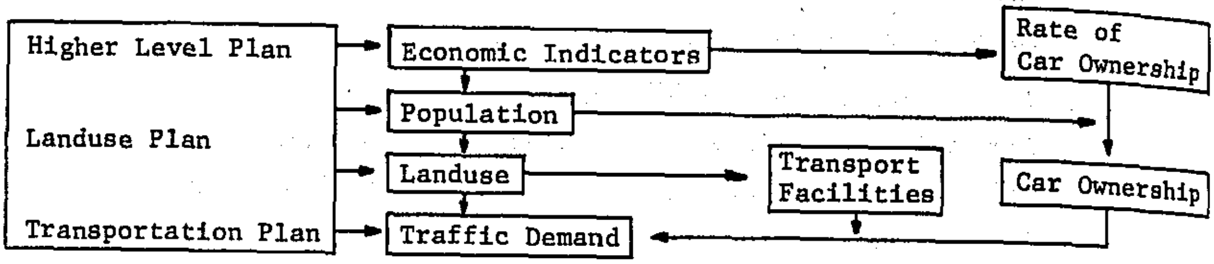
(3) Indicators on traffic demand
Estimation of the traffic demand should be influenced by both categories of indicators of population and economic activities and those of landuse because of its nature. In this study, the demand will methodologically reflect the changes of them.

Also, the car ownership, being the indicator for a passenger car trip generation, is analysed as the function of income conditions.

(4) Indicators on transport facilities
Several alternatives on the road network are studied for the entire studied area and on a zone basis, analysis is made on particularly the sources of goods trip such as the locations of the zones with goods handling facilities, ports, and cargo terminals and also the future scale of the facilities.

Since the above factors have very strong inter-relation in the operation the factors cannot be estimated independently but co-ordination has to be made between the factors. The conceptual relation between the factors is as shown in Fig. 5-5.

Fig. 5-5 Conceptual Relation between the Various Factors



5-2-2 Forecast of Vehicle Ownership

As described in section 1-3-3 on the present situation of vehicle ownership, it is seen that the rate of ownership in Jakarta shows a very high correction with the per capita GRDP, and forecast of future vehicle ownership is made basing on the regressive equation of the relationship.

(1) Forecast of future GRDP

Except for the year 1974, the real annual average growth rate of GRDP for the period 1970 to 1974 was recorded at 9% ∿ 12%. On the otherhand the annual growth rate of national GDP for the same period was 7% ∿ 8%.

Considering the accumulation of private sector investment and public investment, and the pivotal role of Jakarta in the economic activities of Indonesia, it can be anticipated that the GRDP of Jakarta will maintain a high growth rate for the future. On the otherhand, the population of Jakarta has been increasing at a high rate of over 4% in pace with the urbanization of Jakarta. Such high rate of population increase has exceeded the capacity of population absorption of Jakarta and is not only detrimental to the healthy economic development of the city but also brings about social problems.

It is in view of this that the Jakarta Masterplan (1965-1985) and the JABOTABEK plan were prepared in order to disperse the population of Jakarta to the periphery. On the side of investment, efforts were made to promote the industrial development of Boger, Tangerang and Bekasi so that the whole of JABOTABEK region will, as an integral metropolitan region, be developed under a well-balanced overall regional development plan.

From the above considerations, the future annual rates of growth of GRDP in Jakarta are assumed as follows:

1970 ∿ 1980 : 9%
1981 ∿ 1990 : 8%
1991 ∿ 2000 : 7%

Accordingly, the past and future GRDP of Jakarta will be as shown in the following tables.

Table 5-1 GRDP and Its Average Annual Growth Rate in Jakarta

Item	1970	1971	1972	1973	1974
GRDP (Million rupiah in 1969 constant price)	234,893	260,483	283,761	319,744	370,616
Per capita GRDP (rupiah)	54,642	57,136	59,545	64,293	71,512
Annual growth rate (%)	9.3	10.9	8.9	12.7	15.9

Source: Regional income of Jakarta, 1969 ∿ 1974.

Table 5-2 Forecast of Future GRDP in Jakarta

	1980	1985	1990	1995	2000
GRDP (Million rupiah in 1969 constant price)	621,559	913,274	1,341,899	1,882,083	2,639,718
Per capita GRDP (rupiah)	94,462	119,695	159,370	207,506	276,990

(2) Future rate of car-ownership

The future rate of car ownership is calculated with the regressive equation established in section 1-3-3 and shown below:

$$Y = 0.506\ X - 1.915$$

where, X : per capita GRDP (in 1,000 rupiah)

Y : vehicles/1,000 persons

Table 5-3 Future Rate of Vehicle Ownership

	1980	1985	1990	1995	2000
Per capita GRDS (rupiah)	94,462	119,695	159,370	207,506	276,990
Per capita GRDP (US$)	313	397	529	688	919
Vehicles/1,000 persons	45.9	58.7	78.7	103.1	138.2
Total number of vehicles (in 1,000)	302.0	447.9	662.7	935.1	1,317.0

Note: US$1 = Rp 301.5 (at 1969 average conversion rate)

A list of rate of vehicle ownership of other countries in the world in relation to the per capita GDP in 1969 constant price is given below for reference purpose.

Table 5-4 Per Capita GDP and Rate of Vehicle Ownership in Several Countries

Country	*Per capita GDP (US$)	Vehicles/ 1.000 persons
Japan	1,944	147
United States	4,578	510
France	2,813	297
Fed. Rep. of Germany	2,526	217
Italy	1,556	186
Sweden	3,697	292
U.K.	1,987	237
Thailand	185	8.3
Brazil	349	29.3
Venezuela	1,013	68.7

*Note: At 1969 constant price

Spurce: Statistical Yearbook, 1973, United Nations

For purpose of cross-checking, the interrelation between rate of vehicle ownership and per capita GDP of the countries listed are plotted against the graph of the regressive equation adopted for Jakarta as shown in Fig. 5-6.

Fig. 5-7 TREND DIAGRAM OF VEHICLE OWNERSHIP BY TYPE IN JAKARTA

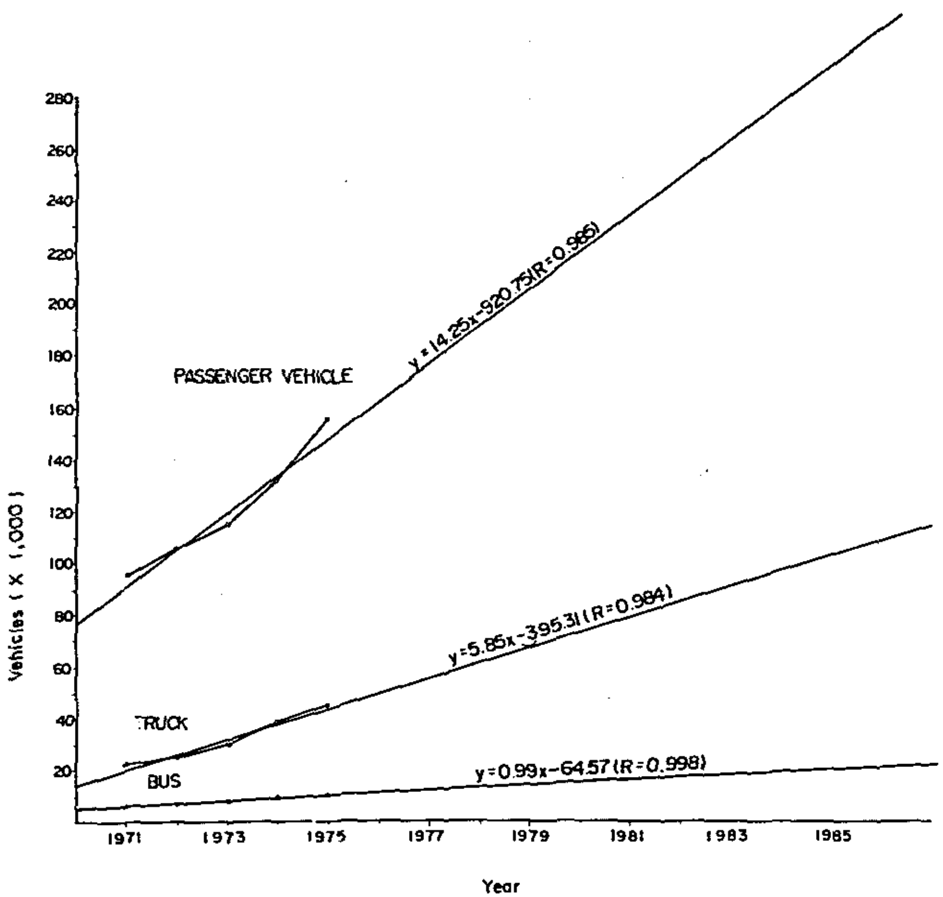
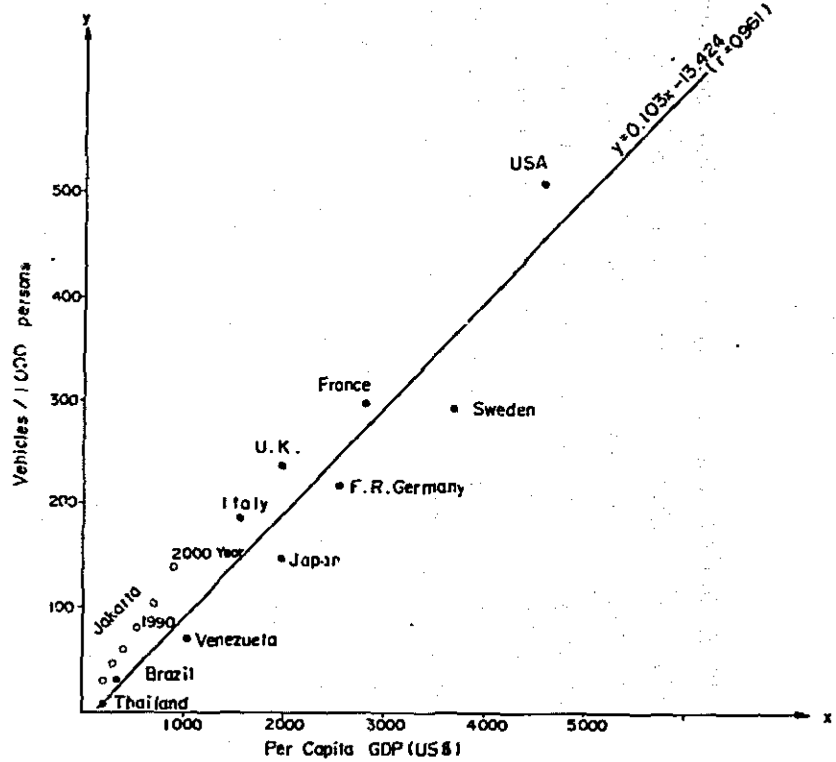


Fig. 5-6 PER CAPITA GDP AND RATE OF VEHICLE OWNERSHIP IN SEVERAL COUNTRIES



From the figure, it may be seen that the future rate of Jakarta City is higher than those of the reference countries in relation to the per capita GDP. However, considering that in the case of Jakarta, the forecast is made for a metropolitan area, the higher figure is considered tolerable, and it is concluded therefore that the regressive equation adopted in ample valid for forecast of future rate of vehicle ownership in Jakarta.

(3) Vehicle ownership by types of vehicles

The statistical data on the vehicle type composition is shown in Table 5-5. It is difficult to determine the future composition, but from the data it is noted that from 1971 to 1975 the composition of bus has remained comparatively stable at around 4.7 - 5% whereas the composition of passenger cars has gradually decreased from 77.5% to 73.7%. On the other hand, the share of trucks has shown an increasing trend from 17.8 to 21.6. This is due to the fact that Jakarta is most highly concentrated in population in Java and in the whole of Indonesia, and, as a commercial and business center, the demand on goods is great and that it has the port of Tg. Priok which caters for international and inter-insular trade, and with the large storage and industry area in the hinter-land of the port is being developed. Moreover, the industrial development in the neighbourhood of Jakarta also contributes to a large demand in transport of goods by truck.

Table 5-5 Composition Ratio by Type of Vehicle

	1971	1972	1973	1974	1975
Total vehicles (in 1,000)	122.8	134.9	152.6	177.4	207.0
Passenger car(%)	77.5	76.5	75.7	73.8	73.7
Truck (%)	17.8	18.5	19.3	21.3	21.6
Bus (%)	4.7	5.0	5.0	4.9	4.7
Total (%)	100.0	100.0	100.0	100.0	100.0

The future composition by type of vehicle is determined by time trend regression as shown in Fig. 5-7 and the various parameters on the regressive equation are as follows:

Passenger car:

$$Y_P = 14.25\ X - 920.75 \quad (R = 0.985)$$

Truck:

$$Y_T = 5.85\ X - 395.31 \quad (R = 0.984)$$

Bus:

$$Y_B = 0.99\ X - 64.57 \quad (0.998)$$

Where X : Year (71, 72 .....)

Y_P : Number of passenger car

Y_T : Number of truck

Y_B : Number of bus

R : Correlation coefficient

The composition is determined by conversion of the number of vehicles derived from the above equation and the results are summarized in the following Table.

Table 5-6 Forecast Future Vehicle Type Composition

Vehicle type	1976	1980	1985	1990	1995	2000
Passenger car	73.0	71.5	70.5	69.9	69.5	69.3
Truck	22.2	23.7	24.7	25.4	25.8	26.0
Bus	4.8	4.8	4.8	4.7	4.7	4.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

From the forecast results of future total number of vehicles and the future vehicle type composition, the future number of vehicles by types are determined as follows:

Table 5-7 Forecast Future Vehicle Ownership by Vehicle Type in Jakarta

Vehicle Type	%	1976 1,000 Vehicles	%	1985 1,000 Vehicles	%	1990 1,000 Vehicles	%	1995 1,000 Vehicles	%	2000 1,000 Vehicles
Passenger car	73.0	154.8	70.0	313.5	69.0	457.3	69.0	645.2	68.5	902.1
Truck	22.0	46.7	25.0	112.0	26.0	172.3	26.0	243.1	26.5	349.0
Bus	5.0	10.5	5.0	22.4	5.0	33.1	5.0	46.8	5.0	65.9
Total	100	212.0	100	447.9	100	662.7	100	935.1	100	1,317.0

(4) Forecast of vehicle ownership by zone

The traffic demand, particularly of the person trip, which is estimated in the form of the number of trips made by each person in a day, varies according to the living environment represented by the vehicle ownership situation of the household, and in this study analysis is made along this line. The rate of vehicle ownership is closely connected to the economic activities and especially when the objective region is in zone or household or smaller units, the rate is related to the average income level of the small unit. In Jakarta, since the income level may be represented by the housing situation, and the housing situation of the area is related to the population density, in order to estimate the vehicle ownership by zone, the calculation is made from the rate of vehicle ownership based on the analysis of the population of each zone and the income structural composition of the population. From the results of such analysis, the rate of vehicle ownership according to the density of population by target years is shown in the following table.

Table 5-8 Rate of Vehicle Ownership by Population Density by Year

Rank	Population Density (persons/ha)	Rate of Ownership (vehicles/1,000 persons)	
		1985	2000
a	∿ 250	122	222
b	250 ∿ 400	42	78
c	400 ∿	14	25
K	∿ 500	9	17

The vehicle ownership for each zone calculated by multiplying the figures is shown in the above table with the population of each zone according to the population density classification, and with the previously established total vehicles for Jakarta as the control total, the number of vehicles calculated is modified accordingly. The results of the number of vehicles by zone is as shown in Table 5-9.

Table 5-9 FUTURE PASSENGER VEHICLES REGISTERED BY ZONE

Zone No.	1985 Estimated	1985 Definite	Zone No.	2000 Estimated	2000 Definite
1	2,589	2,677	1	2,435	2,613
2	3,416	3,532	2	3,233	3,470
3	8,397	8,682	3	14,461	15,523
4	6,734	6,963	4	9,766	10,483
5	4,345	4,493	5	5,326	5,717
6	1,197	1,238	6	27,544	29,566
7	15,543	16,071	7	29,324	31,476
8	4,348	4,496	8	7,467	8,015
9	2,644	2,734	9	8,792	9,437
10	4,346	4,494	10	20,243	21,729
11	2,416	2,498	11	12,832	13,774
12	34,062	35,220	12	18,025	19,348
13	7,437	7,690	13	8,669	9,306
14	7,244	7,491	14	23,205	24,908
15	6,829	7,061	15	16,471	17,679
16	8,212	8,491	16	41,849	44,920
17	8,694	8,989	17	36,821	39,524
18	9,017	9,323	18	41,529	44,577
19	12,074	12,484	19	30,127	32,338
20	7,982	8,253	20	12,756	13,692
21	16,457	17,017	21	30,631	32,879
22	18,407	19,033	22	19,865	21,323
23	5,504	5,691	23	14,498	15,562
24	3,864	3,996	24	17,656	18,951
25	4,830	4,994	25	12,253	13,153
26	5,177	5,353	26	24,114	25,884
27	1,399	1,447	27	41,522	44,569
28	5,796	5,993	28	31,633	33,954
29	6,280	6,494	29	19,106	20,508
30	11,592	11,986	30	37,434	40,181
31	10,927	11,298	31	10,276	11,030
32	6,887	7,121	32	12,779	13,717
33	3,367	3,482	33	28,828	30,994
34	3,182	3,290	34	7,975	8,560
35	3,050	3,154	35	17,970	19,288
36	4,830	4,994	36	15,906	17,073
37	9,369	9,688	37	23,103	24,799
38	6,280	6,494	38	17,967	19,285
39	5,729	5,924	39	61,355	65,858
40	5,023	5,193	40	5,561	5,969
41	7,717	7,979	41	19,116	20,519
Total	303,193	313,500	Total	840,423	902,100

5-3 Development Plans and Future Transport Network

Guidelines of the future development plans in DKI Jakarta are as follows by Replita II.

1. Development in the Commercial and Service Sectors — Economical Infrastructure Development
2. Development in the Industrial Housing and Tourism Sectors — Social, Administrative Facilities Improvement

Under these guidelines, as principal policies, execution of the migration planning and promotion of constructions in various fields, are being studied, in order to encounter the intensive population growth in DKI Jakarta.

Among them, some of deeply related plannings with traffic demands are as follows:

- Improvement plan of intra city traffic
- Improvement plans of land transports and sea transports facilities
- Extension of central markets of foods
- Preparation of warehouses
- Development of Kampung houses

For those plans and executions, major urban transport facilities such as roads, ports, airports terminals and others have been developed and extended.

In this study, those situations are fully respected for a demand forecast, described as follows:

(1) Smooth the urban transport

Present situation on the urban transport will be highly declined onto the road transport. In recent years, it has progressed in a bid extent in the betterment and new construction of roads, and this condition is reflected on the future road network of this study.

(2) Improvement of land transports and marine transports facilities.

The importance of the marine transport facilities, Tg. Priok Port and Sunda Kelapa Port will be kept growing and for this reason the cargo flow through Tg. Priok Port is one of the important element for the demand forecast. The masterplan of Tg. Priok Port is fully respected.

(3) Preparation and development of storehouses and terminals.

In order to smooth the future cargo movements, it must be needed to establish the proper cargo circulation system to get resultantly a decrease of the truck running trip-kilometers. And this also has some influence to promote the urban transport to smoothing and develop the transport facilities in general.

Three cargo terminals are proposed in this study to achieve the above mentioned purpose in the suburban area of DKI Jakarta connecting the ports, the terminals and the demand sites to smooth the flow of cargo.

(4) Others

Among other development plans, the construction of a new international airport and new residential areas in suburban areas give the great impact on the promotion of demand and change of pattern.

5-4 Establishment of 1976 O-D Matrices

5-4-1 Methodology

The basic data of present situation used in traffic forecast are on the person trip basis using the 1972 B/M O-D matrices and the JMATS O-D matrices. As for goods flow, the available data other than the above O-D matrices are the 1973 data on production and consumption.

The base year for the analysis in this study is determined in 1976, and all economic factors from the available year to 1976 are analysed of the variation and checked against the cross section traffic volume of 1976. The trips under study are divided into passenger vehicles trips and goods vehicles trips.

5-4-2 Analyses of Passenger Vehicles

The analysis of passenger vehicles is made based on the 1972 O-D matrices, the 1972 economic indicators and 1976 economic indicators.

(1) Analysis of 1972 O-D matrices

The past O-D matrices available on person-trip are the 1972 B/M O-D and the JMATS O-D matrices. The zone division of these O-D matrices are as follows:

Table 5-10 Zone Division of Past O-D Matrices

O-D Matrices	Jakarta	Periphery	Remarks
B/M O-D	1 zone	28 zones	
JMATS O-D	29 zones	3 zones	Medium size zones.

From the table, it is seen that the B/M O-D are suitable for analysis of long distance trips over a wide region and the JMATS O-D are oriented to analysis of short distance trips within Jakarta. Here, the analysis of traffic in Jakarta will be based on the JMATS zoning and studies of inter-regional trips will be based on B/M O-D matrices.

(2) Formulation of person-trip generation and distribution model.

The model expressing the relation between the economic indicators and the traffic volume are formulated based on the 1972 generated and distributed traffic volumes.

1) *Formulation of trip generation model*

From the economic indicators analysed in sections 2-6 and 5-2, the factors which have strong relation with the traffic generation are compiled as follows:

*Analysed variables

The 1972 trip generation volumes by zones (persons/day)

*Analysing variables

1. Resident population (1972)
2. Resident population by income stratum (1972)
3. *Resident-based employed population by occupation* (1972)
4. Landuse area by usage classification (1972)
5. Vehicle ownership
6. Number of factories by size
7. Land area by population density (1973)
8. Employed-location-based employed population by sector (1972)

The other additional factors analysed are as follows:

9. Zone area
10. Area of kampung districts
11. Future landuse area

Basically the model is a multi-variable linear model, and analysis is made for the various situation of correlation between the generated volume and the variable factors. The results are as follows:

a. With resident population by stratum as variables (case 1)

$$Y = 3{,}193.9X_1 + 144.8X_2 - 473.0X_3 \quad (R=0.903)$$

where, X_1 = resident population in permanent housing units.

X_2 = resident population in semi-permanent housing units.

X_3 = resident population in temporary housing units.

b. With resident population by stratum as variable (case 2)

$$Y = 3,428.2X_1 - 697.2X_2 \quad (R= 0.887)$$

where, X_1 = resident population in permanent housing units.

X_2 = resident population in semi-permanent housing units.

c. With resident population and employed location based on tertiary industry employed population as variables.

$$\underline{Y = 1,151.4X_1 - 138.9X_2 + 2,235.0Z_1} \quad (R= 0.960)$$

where, X_1 = resident population in permanent housing units

X_2 = resident population in semi-permanent housing unit.

Z_1 = tertiary industry employed population.

d. With landuse area as variables

$$Y = 111.5X_1 + 1,138.8 - 238.7X_3 - 70.4X_4 \quad (R= 0.977)$$

where, X_1 = area of residential area

X_2 = area of commercial and public facilities areas

X_3 = area of industrial area

X_4 = area of other usage

e. With employed population by sector as variables

$$Y = -8.1X_1 - 1.0X_2 + 3.8X_3 \quad (R= 0.953)$$

where, X_1 = primary industry employed population

X_2 = secondary industry employed population

X_3 = tertiary industry employed population

Basing on the resulting inter-relation matrices between the analysing variables and the analysed variables, and also fully taking into consideration the availability of data in 1976 and the possibility of forecast for the variables in the target years, it is decided that the variable that can best explain the trip generation is that of (c) where the resident population and the tertiary industry employed population are adopted as variables. The basic concept is that the zone trip generation is defined by the residential population and the day time employed population.

2) Formulation of distribution model

Considering that the target year of forecast will extend to as far as 20 years in future, and that during this analysis period, there are many possible changes in the road conditions and situations including the implementation of the Ring Road, the "gravity model" and the opportunity model were chosen for comparative studies, eventually leading to the adoption of the following gravity model. From the analysis of the present O-D matrices on such factors as the inter-zonal travel time, the trip generation volume of each zone, and the inter-zonal trip distribution, the parameters of the model are determined as follows and also graphically shown in Fig. 5-8.

Gravity Model

$$Tij = Ti \times Tj \times \frac{k}{Dij^{n}}$$

where, Tij = distributed trip volume between zone i and zone j.

Ti = generated trip volume of zone i

Tj = generated trip volume of zone j

n and k = coefficients

Dij = required travel time between zone i and zone j

Parameters for passenger vehicles

Type of vehicle	n	k	Correlation coefficient
Passenger vehicle	1.00	1.047×10^{-6}	R = 0.80

(3) Cross checking at the screen line

To verify if the 1976 person trip O-D matrices so theoretical established do correctly reflect the movement of the population in Jakarta for the year 1976, five screen lines as shown in Fig. 5-9 are prepared for cross checking. In the checking process, in order to make comparison against the results of traffic surveys carried out in April, 1977, the assigned traffic volumes based on the theoretical 1976 O-D matrices are adjusted to 1977 values, and the results are as shown in Table 5-11. Since the theoretical

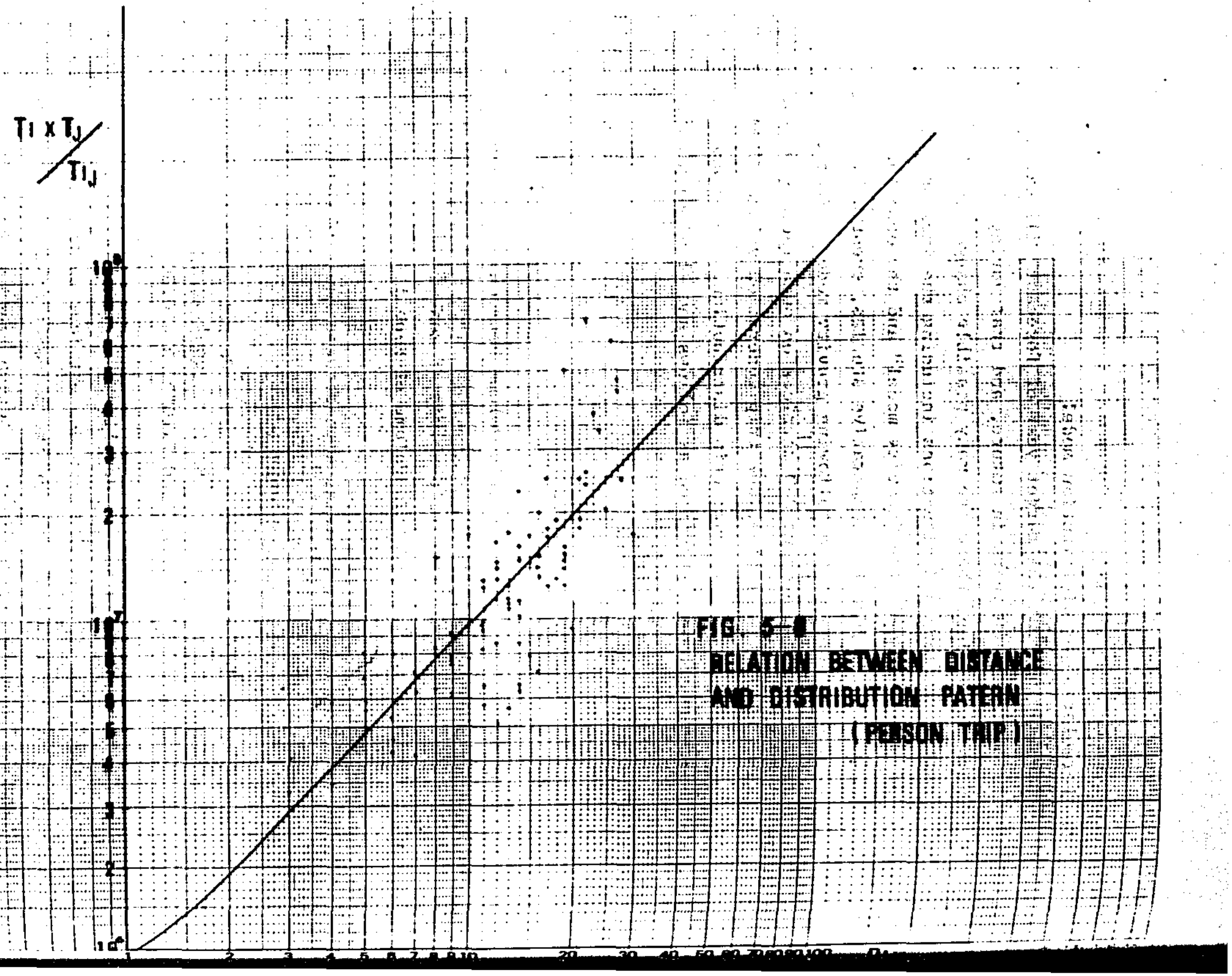


FIG. 5-8
RELATION BETWEEN DISTANCE AND DISTRIBUTION PATERN
(PERSON TRIP)

results can reasonably reflect the actual traffic situation, the theoretical O-D is confirmed as the established 1976 O-D matrices, based on which future forecast process is carried out.

Table 5-11 Comparison of Traffic at the Screen Lines

	Traffic volume based on theoretical O-D			Actual volume	Survey	
Screen	1976 distributed person-trip	1976 converted vehicle traffic	Adjusted 1977 Sedan traffic	1977 cross section traffic	1977 cross section traffic	Cross section
	persons/day	vehicles/day	vehicles/day	vehicles/12 hr.	vehicles/day	
A	50,215	8,425	9,183	10,133	13,173	Jakarta East
B	149,429	25,072	29,836	33,608	43,690	Jakarta South
C	50,686	8,504	12,416	13,366	17,376	Jakarta West
D	77,799	13,054	15,926	15,237	19,808	Jakarta intra-urban
E	206,976	34,728	41,326	51,909	67,482	Jakarta intra-urban

The coordination of the person-trip volume and vehicle traffic volume and of the 1976 and 1977 vehicle traffic volumes are carried out as follows.

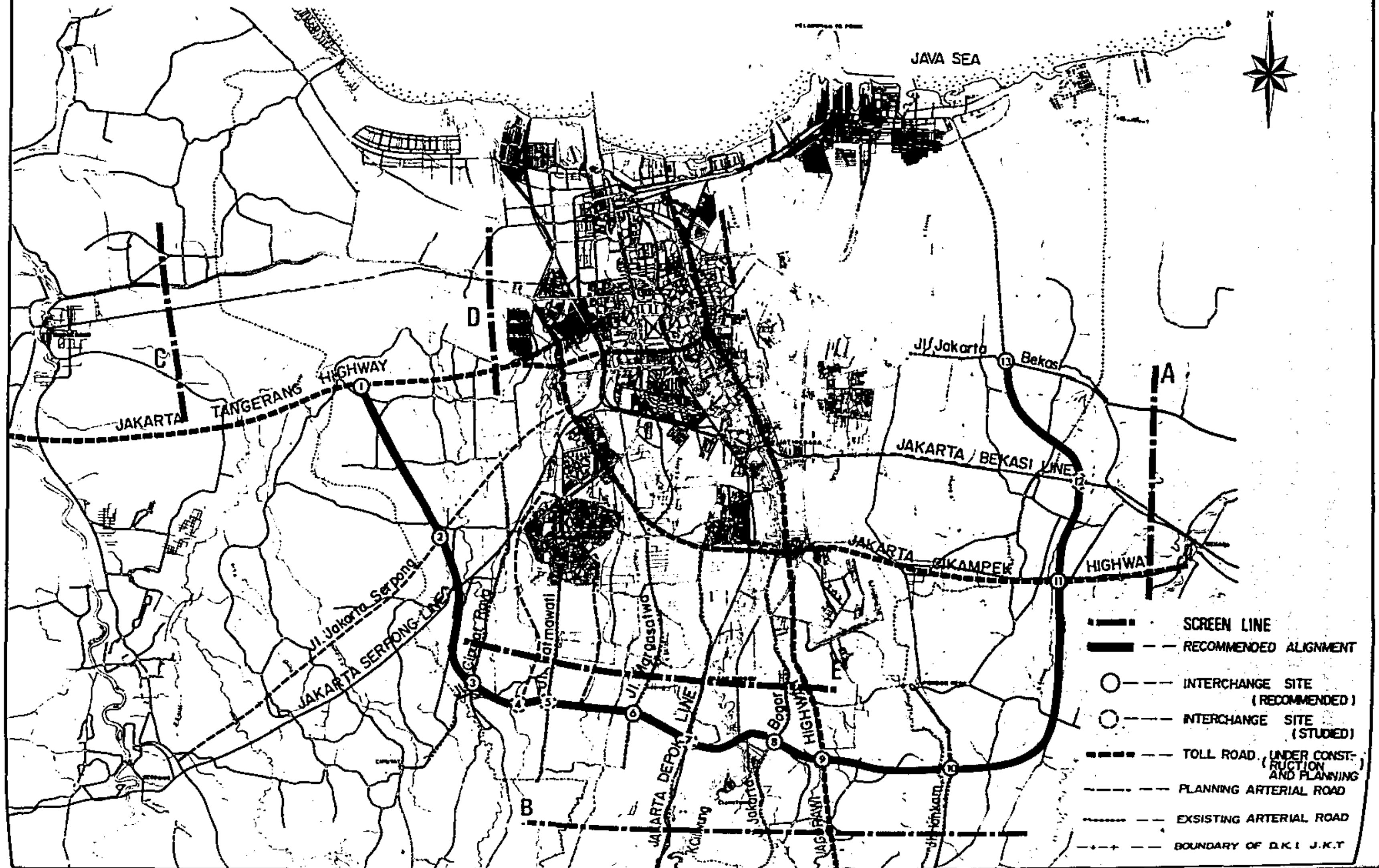
The person trip volume is converted into vehicle traffic volume by the vehicle type composition obtained from traffic survey and the average number of persons per vehicle is computed at 5.96 persons/vehicle. The adjustment of 1976 volume to 1977 volume is based on the past B/M data from 1971 to 1975 of the growth of traffic for each direction, and the average growth was 1.21 times. The surveyed 12 hours traffic volume is converted to 24 hour volume by the day time coefficient of 1.30 from the results of B/M and DKI 24 hour traffic surveys.

5-4-3 Analysis of Goods Flow

(1) Adjustment of production and consumption in Jakarta

As described in section 1-4, the production and consumption of

Fig.5-9
SCREEN LINE



commodities calculated for Jakarta has been adjusted in consideration of the regional desperity of production and consumption between Jakarta and the rural area so that for the agricultural and fishery products, the consumption for Jakarta is increased by 20% whereas the production and consumption volumes for Jakarta are increased by 30%.

(2) Total goods inflow and outflow

The basic concept of goods flow is that the difference between production and consumption of a commodity will become the quantity of goods flow for the commodity between the region and other regions, and the lesser between production and consumption will induce an intra-regional goods flow.

However, in economic activities, the difference between production and consumption needs not necessary form into goods flow within the region in total and a portion will flow out of the region in the from of leakage. Taking this point into consideration an assumption is made that an additional 20% is taken for the difference between production and consumption to make up part of inter-regional goods flow, so that the total of the inflow and outflow will be double the 20%, or 40%.

(3) Goods inflow and outflow at the ports

Of the total goods flow into and out of Jakarta, the volume handled at the ports are assumed by main commodity items as follows.

°Rice: 50% of the volume handled (in and out) at Tg. Priok flows between Tg. Priok and Jakarta city.

°Timber: 50% of consumption of Jakarta flows in from Tg. Priok.

°Textile, apparels and household wares: 10% of consumption in Jakarta and 20% of the flow between Jakarta and other regions are handled in Tg. Priok.

°Steel products and fuel: The entire consumption volume flows in from Tg. Priok.

Other commodity items: 15% of the total production and consumption volumes flow through Tg. Priok.

Table 5-12 Production and Consumption of Goods in Jakarta, 1973

Goods	Production	Consumption	Difference	Cargo movement of JKT: to/from outside JKT	to/from Tg. Priok	to/from outside JKT by land transport
Farm Food Corps	213,839	1,954,784	1,759,845	1,841,599	495,756	1,345,843
Rice	30,726	897,347	866,621	878,911	309,673	569,238
Maize	143	149,464	149,321	149,378	22,441	126,937
Cassava	8,486	473,239	464,753	468,147	72,259	395,888
Sweet Potato	836	101,676	100,840	101,174	15,377	85,797
Peanuts	282	11,447	11,165	11,278	1,759	9,519
Soybeans	0	21,515	21,515	21,515	3,227	18,288
Fruits	60,678	191,681	131,003	155,274	37,854	117,420
Vegetables	110,438	100,988	9,450	49,845	31,714	18,131
Potatoes	2,250	7,427	5,177	6,077	1,452	4,625
Estate Crops	0	304,463	304,463	304,463	45,669	258,794
Animal Husbandry	52,805	109,555	58,768	79,486	24,355	55,131
Livestock slaughtered	5,966	50,236	44,270	46,656	8,430	38,226
Eggs	3,299	13,558	10,259	11,579	2,529	9,050
Fresh milk	4,080	3,071	1,009	2,237	1,073	1,164
Meat	39,460	42,690	3,230	19,014	12,323	6,691
Fishery Products	9,751	55,130	45,379	49,279	9,732	39,547
Forest Products	0	622,997	622,997	622,997	311,499	311,498
Industrial Products	1,566,369	5,235,689	3,957,782	4,526,638	2,373,886	2,152,752
Food beverages & tobacco	468,136	763,435	355,299	518,553	175,736	342,817
Textile, clothing, furniture, etc.	213,307	120,147	93,160	141,219	40,259	100,960
Raw materials & auxiliary	159,749	362,622	202,873	266,773	78,356	188,417
Cement	0	307,977	307,977	307,977	46,197	261,780
Other construction materials	278,560	492,246	213,686	325,110	115,621	209,489
Iron & steel products	37,272	78,579	41,307	56,216	28,882	27,334
Fertilizer & pesticides	57,903	6,832	51,071	53,804	9,710	44,094
Fuel	0	1,590,390	1,590,390	1,590,390	1,590,390	0
Small & household manufacturing	302,740	1,053,049	750,309	871,405	203,368	668,037
Other manufacturing products	108,702	460,412	351,710	395,191	85,367	309,824
Total	1,842,764	8,282,618	6,749,234	7,424,462	3,260,897	4,163,565

Deducting the volume of flow through Tg. Priok from the adjusted total volume of goods flow between Jakarta and other regions calculated from the production and consumption of the main commodity items, the difference makes up the volume of goods flow by land. The results are summarized in Table 5-12.

(4) Analysis of goods flow between Jakarta and other regions by modes of transport.

The volume of goods flow between Jakarta and other regions by major commodity items for Jakarta has been listed in Table 5-12. However, this volume which is calculated through indirect calculation has to be verified with direct method.
For this purpose, the total volume of goods flow by modes of transport between Jakarta and other regions as summarized in previous section 1-4-4 and shown in Table 5-13 is utilized and the 1973 volume of goods flow by modes of transport is as shown below.

Table 5-13 Goods Flow by Mode of Transport, 1973

(Unit: 1,000 tons/year)

By sea	By rail	By truck
8,360	1,034	8,511

The petroleum products which are conveyed into Tg. Priok and flow out directly after processing are not included in the above summary of goods flow volume by sea. The inflow and outflow volume by truck for 1973 is obtained by using the 1972 B/M O-D matrices for truck traffic and adjusting it to 1973 volume by the growth factor from 1972 to 1973 of total volume of truck conveyed goods, and then deducing the through traffic from the total.

(5) Calculation of adjusting factor for total inflow and outflow of goods.

The volumes obtained in step (4) are used as the control total for adjusting the total goods flow volume estimated by accumulation of each major commodity item from the relation of production and consumption and the adjusting factor α is calculated as follows:

$$A = E - F$$

$$(C + D) - (B - F\alpha) \quad A\alpha$$

$$\alpha = \frac{C + D - B}{A - F}$$

where, A = Total goods flow volume by truck between Jakarta and other regions based on relation between production and consumption.

B = Statistical volume of goods flow by sea.

C = Statistical volume of goods flow by rail.

D = Statistical volume of goods flow by truck

E = Total goods flow volume estimated from the difference of total production and consumption.

F = The portion in E which is the goods flow volume between Tg. Priok and Jakarta.

Therefore, the calculation is as follows:

$$\alpha = \frac{1,034 + 8,511 - 8,360}{4,164 - 3,261} = 1.312$$

The adjusting factor 1.312 is therefore adopted for adjusting the estimated volume of goods flow in all directions.

(6) Goods flow by direction in 1973

The volume of goods flow by direction is estimated considering the conditions described in steps (1) to (5), and basing on the total volume of goods flow of Jakarta as summarized in Table 5-12.

1) Intra-regional goods flow (excluding flow with Tg. Priok)
From the production and consumption volume by major commodity items as listed in Table 5-12, the estimation is made from the accumulated total of the lesser of the two volumes as follows.

1,688,074 x 1.312 x 0.8 x 2 = 3,544 thousand tons/year

2) Goods flow between Tg. Priok and Jakarta city
(assuming that the volume handled by rail is negligible)

3,261,000 x 1.312 = 4,278 thousand tons/year

3) Goods flow between Tg. Priok and other regions
(Please refer to Table 5-13)

8,360,000 - 4,278,000 = 4,082 thousand tons/year

Of this volume, the modal split between rail and truck is determined in proportion to the total goods flow by modes between Jakarta and other regions in 1973, as follows.

Truck: $4,082 \times \frac{8,511}{8,511 + 1,034} = 3,643$ thousand tons/year

Rail: $4,082 \times \frac{1,034}{8,511 + 1,034} = 439$ thousand tons/year

4) Goods flow between Jakarta and other regions

(8,511 + 1.034) - 4,082 = 5,463 thousand tons/year

The modal split is made in the same way as step 3) as follows:

Truck: $5,463 \times \frac{8,511}{9,545} =$ 4,868 thousand tons/year

Rail: $5,463 \times \frac{1,034}{9,545} =$ 591 thousand tons/year

(7) Estimation of 1976 goods flow by direction

1) Goods flow between Jakarta and other regions by mode of transport.

From the past statistical data, it is noted that the volume of goods flow between Jakarta and other regions is well correlated with the per capita GRDP of the population of Jakarta and the time trend method is adopted to estimate the goods flow volume for 1976. However, the volume of goods flow by sea is adopted from the master plan of Tg. Priok and 10% of the volume handled by other ports is added to that of Tg. Priok and then deducting 4% as the portion that is transferred within the port area.

The 1976 total goods flow by modes of transport is thus calculated as follows:

Table 5-14 Goods Flow by Mode of Transport, 1976

(unit: 1,000 tons/year)

By sea	By rail	By truck
11.19C	1,218	16,385

2) Goods flow estimated from production and consumption of major commodity items (reference Table 5-12)

a) Intra-regional goods flow

a-1) The intra-regional flow of food farm crops, livestock and dairy products is determined from the production in Jakarta and that for fertilizer by consumption in Jakarta. Past data show that production of the above products is at a decreasing trend so that, assuming an index of 100 for 1973, the consumption of fertilizer drops to an index of 98. Therefore, the volume of intra-regional flow of food farm crops, livestock, dairy and fertilizer products is calculated as follows:

In 1973: (213,839 + 5,966 + 3,299 + 4,080 + 6,832) x 1.312 x 0.8 x 2 = 491,246 tons/year.

In 1976: 419,246 x 0.98 = 410,861 tons/year.

a-2) The intra-regional flow of fresh fish and meat is determined by production in Jakarta and that of textile, apparels and household wares etc., is determined by consumption in Jakarta.

The increase of intra-regional goods flow from 1973 to 1976 is assumed to be proportional to the increase in population.

In 1973: (39,460 + 120,147 + 9,751) x 1.312 x 0.8 x 2 = 355,517 tons/year.

In 1976: 355,517 x 1.135 = 403,512 tons/year.

a-3) The intra-regional goods flow of other products is determined by production in Jakarta and the growth from 1973 to 1976 is assumed to be proportional to the growth in GRDP.

In 1973: (408,136 + 159,749 + 278,560 + 37,272 + 108,702 + 302,740) x 1.312 x 0.8 x 2 = 2,718,798 tons/year.

In 1976: 2,718,798 tons x 1.377 = 3,743,785 tons/year.

b) Goods flow between Tg. Priok and Jakarta city (reference Table 5-14)

Assuming that the goods flow by rail is negligible, the goods flow volume through Tg. Priok is split into the volume between the port and Jakarta and that between the port and other regions proportional to the volumes handled in 1973.

In 1973: Between Tg. Priok and Jakarta: 4,278,000 tons/year

Between Tg. Priok and other regions: 4,082,000 tons/year

In 1976: $11,190,000 \times \frac{4,278,000}{4,278,000 + 4,082,000}$

$= 5,706,900$ tons/year

c) Goods flow between Tg. Priok and other regions (Unadjusted)

This is obtained by deduction of the volume between Tg. Priok and Jakarta from the total volume handled in Tg. Priok. The volume handled by rail will be subsequently adjusted.

In 1976: 11,190,000 - 5,706,900 = 5,483,100 tons/year

d) "Through" goods flow volume by truck

The through flow volume by truck for 1973 is estimated by computing the through traffic volume from the 1972 B/M O-D matrices and then multiplying the volume by the growth factor obtained through surveyed cordon increase in traffic from 1972 to 1973.

The 1976 through volume is assumed to increase from 1973 in proportion to the growth in GRDP from 1973 to 1976.

In 1973: $70,000 \times \frac{3,705}{2,677} = 97,000$ tons/year

In 1976: $97,000 \times 1.377 = 133,569$ tons/year

e) Goods flow between Jakarta and other regions (unadjusted)

The 1976 volume is obtained by deducting from the total of rail and truck flow volumes as shown in Table 5-13, the volume between Tg. Priok and other regions calculated in Step c), and also twofold the through volume calculated in Step d).

In 1976: (16,385,000 + 1,218,000) - (5,483,100 + 133,569 x 2) = 12,387,038 tons/year

f) Adjusted goods flow between Tg. Priok and other regions

The rail transport portion of the flow between Tg. Priok and other regions is calculated from the unadjusted volume obtained in Step c) and Step e) in proportion to the unadjusted total from Jakarta to other regions by adjusting the figures against the frame total of goods transported by rail in 1976, and the truck portion is obtained by deduction of the rail portion from the total flow with others regions.

That is, the goods flow by truck in 1976 is:

$$5,483,100 - 1.218 \times \frac{5,483,100}{5,483,100 + 12,387,038}$$

$$= 5,482,726 \text{ tons/year}$$

g) Adjusted goods flow between Jakarta and other regions

The volume is obtained from the unadjusted estimate by deduction of the rail portion according to the method described in Step f).

In 1976: $$12,387,038 - 1.218 \times \frac{12,387,308}{5,483,100 + 12,387,038}$$

$$= 12,386,194 \text{ tons/year}$$

The truck goods flow by direction for 1973 and 1976 may therefore be summarized as follows:

Table 5-15 Goods Flow by Truck by Direction, 1973 & 1976

(unit in 1,000 tons/year)

	1973	1976	Growth rate(%)
Jakarta - other regions	4,868	12,386	2.54
Tg. Priok - other regions	3,643	5,483	1.51
Subtotal	8,511	17,869	2.10
Through volume	97	134	1.34
Total goods flow with other regions	8,705	18,137	2.08
Intra-regional	3,544	4,558	1.29
Tg. Priok - Jakarta	4,278	5,707	1.33
Total flow within region	7,822	10,265	1.31

(8) Cross checking of goods flow by truck in 1976

The goods flow volume estimated for 1976 is checked by comparing the volume of goods flow across the boundary of Jakarta City against the cross section vehicle traffic volume.

Of the goods flow volume estimated for 1976, the portion that crossed the boundary of Jakarta is 18,137 thousand tons/year as seen in Table 5-15. Assuming 250 working days per year for trucks, the daily volume of goods that crossed the city boundary is 72,500 tons/day. On the others hand, the cross section traffic volume of trucks was recorded at 17,000 vehicles/12hr, according to the results of traffic surveys. (reference section 1-5). Assuming a day time ratio of 1.5 for trucks, the volume of truck traffic in 24 hours is estimated at 25,000 vehicles/day.

Since the traffic survey was carried out in April, 1977, the traffic volume is expected to have increased from 1976. However, disregarding such increase, and assuming that an additional 20% of truck traffic crossed the city boundary from minor roads that were not surveyed, the volume of goods that crossed the city boundary as calculated from traffic volume is as follows:

25,000 vehicles/day x 2.5 tons/vehicles x 1.2 = 75,000 tons/day

The cross checking verifies the validity of the estimated volume of goods flow in 1976, and the estimated figures are adopted in subsequent analyses.

(9) Formulation of goods distribution model

Goods vehicle distribution model is formulated for goods flow within the city by analysis of the present goods vehicle O-D matrices. The model used is the gravity model, just as in the case of person trip distribution. From the present O-D matrices, the relation between inter-zone time distance, the generated volume of each zone and the inter-zonal distribution volume are as shown in Fig. 5-10. And the parameters are calculated as follows:

Gravity Model

$$Tij = ti \times Tj \times \frac{k}{dij^n}$$

where, Tij = distributed traffic volume between zone i and zone j.

Ti = generated traffic volume of zone i

Tj = generated traffic volume of zone j

n and k = coefficients

Dij = time distance between zone i and zone j

Parameters

Vehicle type	n	k	Correlation coefficient
Truck	1.09	8.128×10^{-5}	R = 0.80

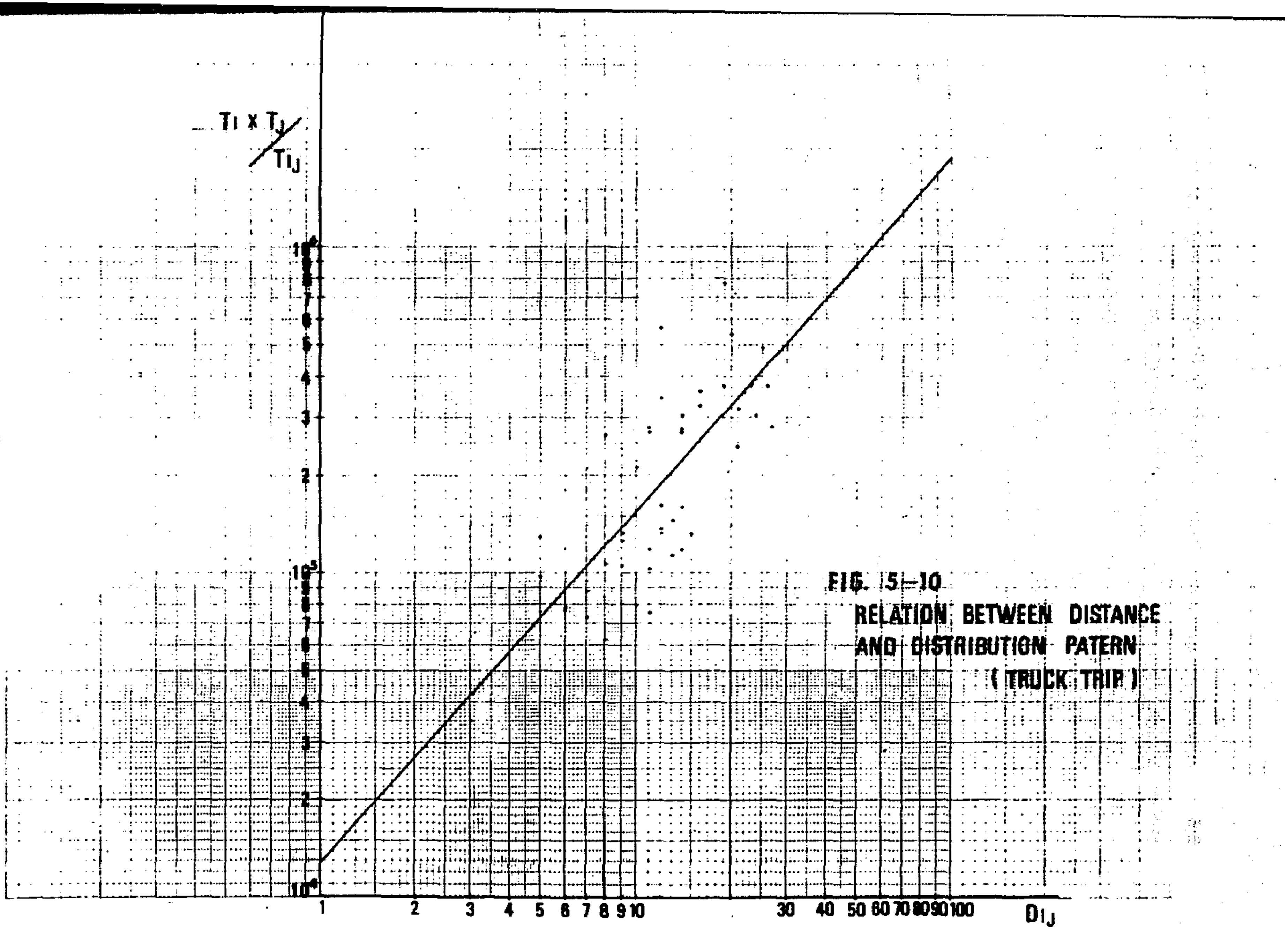


FIG. 5-10
RELATION BETWEEN DISTANCE AND DISTRIBUTION PATERN
(TRUCK TRIP)

5-5 Estimation of Future Passenger Vehicle Traffic Generation

5-5-1 Method of Estimation of Traffic Generation

The estimation of traffic generation is carried out by the following two steps.

(1) The establishment of the control total

This involves the estimation of the total intra-regional person trips and the total person trips between Jakarta and other regions, and since the person trip is composed of all types of passenger vehicles excluding trips by rail, the total is subdivided into control totals for passenger cars and that for bus the public transport vehicles.

(2) Estimation of trip generation by modes of transport (passenger car, bus) for each individual zone.

From the rate of vehicle ownership in accordance to income stratum, the passenger car trips and bus trips are estimated for each zone and the total of all zones adjusted with the control to the total established in step (1).

5-5-2 Determination of Future Control Total of Person Trips

In the calculation of the control total, the following alternative methods are studied.

a. The method based on the average number of trips per person.

b. The method based on a generation model.

c. The method based on the rate of vehicle ownership according to population density ranking.

(1) Average number of trips per person

From the analyses of the 1972 O-D matrices and the 1972 resident population the average number of trips per resident population is found to be 0.770 trip end/person.

(2) Generation model

The generation model for estimation of zone trip generation is as follows:

$$Y = 1151.4X_1 - 138.9X_2 + 2.235Z_1$$

where, X_1 = resident population in permanent housing unit.

X_2 = resident population in semi-permanent housing unit.

X_3 = employed population in tertiary industry.

(3) Rate of vehicle ownership according to population density ranking.

For each rank of population density, the control total of passenger vehicle person trip is obtained as follows:

(Population x rate of vehicle ownership x rate of vehicle usage x average number of persons per vehicle x average number of trips per vehicle).

By calculation of, the vehicle traffic volume x average number of persons per vehicle ÷ average trip length, for passenger car and bus respectively from the present O-D matrices, the total passenger vehicle control total is subdivided into passenger car trip control total and bus trip control total in the porportion so obtained.

The control total calculated by the above three methods are summarized as follows:

	1985	2000
1. Av. No. of trip per person	5,904	8,093
2. Generation Model	8,746	13,990
3. Rate of vehicle ownership	5,298	14,514

(unit: 1,000 trip ends)

For the following reasons, the results based on the rate of vehicle ownership according to population density ranking is adapted as the control total for this study.

1) The method based on the average number of trips per person is not suitable for Jakatta where the urban structure changes at a rapid pace. Also, since the population differs in occupation, age, sex, income, household structure and vehicle ownership, it is unsuitable to apply any single average number of trips uniformly to all population.

2) The generation model was formulated with data on a zone basis and the model is therefore basically applicable to a small

region at a zone level, so that although the application of the model to the entire Jakarta may provide a guiding figure, the result is not suitable for use as a control total.

3) The method which is based on the rate of vehicle ownership according to population density ranking is an effective method for a region such as Jakarta, where the extreme difference in level of living is existing among the resident population. In our field survey, the relation between housing density and the rate of ownership and the trip generation has been studied and analyzed in order to verify the validity of this method.

On analysis of all the results of calculation it is concluded that method based on the rate of vehicle ownership according to population density level can be applied to the pattern of growth of generated trips and the trip generation by the resident population, and the control total is calculated according to this method. The control total for the trip between Jakarta and other regions is computed as a percentage of the control total for the intra-regional trip at a share determined from the 1972 B/M O-D matrices and added to the intra-regional total. The framework for the various years thus calculated are summarized in Table 5-16.

As for trips generation of zones of external regions, due to the difference in characteristics of internal and external zones, and from the point of availability of data, a different methodology has to be employed. This is done by calculating the growth from the generated trip volume in the present O-D matrices by multiplying the present trip generation with the growth factory for resident population. Since the trip volumes of these external zones are not the total trips generated by the zones but the the trips connecting only with Jakarta, the growth is considered related to the growth of trips in Jakarta. The growth factor for trips generated in external zones in therefore divided as follows:

$$G_i = G_D \times G_{oi}$$

where, G_i = growth factor for trip generation of external zone i.

G_D = growth factor for resident population in Jakarta.

G_{oi} = growth factor for resident population in external zone.

The results of the trip generation of internal and external zones are as shown in Table 5-16.

Table 5-16 Framework of Jakarta for the Key Years

	1976	1985	2000
Vehicle Ownership (1,000 vehicles)			
Passenger car	154.8(1.00)	313.5(2.03)	902.1(5.83)
Bus	10.5(1.00)	22.4(2.13)	65.9(6.28)
Truck	46.7(1.00)	112.0(2.40)	349.0(7.47)
Total	212.0(1.00)	447.9(2.11)	1,317.0(6.21)
Resident population (in 1,000)	5,641(1.00)	7,667(1.36)	10,510(1.86)
Rate of vehicle ownership (veh/1,000 persons)			
Passenger car	27.4(1.00)	40.9(1.49)	85.8(3.13)
Bus	1.9(1.00)	2.9(1.83)	6.3(3.31)
Truck	8.7(1.00)	14.6(1.68)	33.2(3.82)
Total	37.6(1.00)	58.4(1.55)	125.3(3.33)
Person trip generation (1,000 trips/day)	2,677(1.00)	5,298(1.98)	14,514(5.42)
Person trip per resident population (trips/day)	0.47	0.69	1.38*1
Passenger vehicle trip generation (1,000veh/day)	-	1.047	3.080
Trip per passenger vehicle	-	3.34	3.41*2

Note: *1: the 1973 surveyed results of cities in Japan of over 500,000 in population is 1.52

*2: the 1973 surveyed results of cities in Japan of over 500,000 in population is 3.80

5-5-3 Estimation of Trip Generation by Zone, by Mode of Transport

The factors that strongly affect the passenger vehicle trip generation of a zone are (1) future resident population of the zones by population density ranking and (2) Rate of vehicle ownership by population density ranking. The indicators by population density ranking for 1985 and 2000 are as shown below and the steps for estimation of trip generation by zone are as shown in the subsequent page.

Table 5-17 Person Trips by the Population Density Category

Rank	Population density (persons/ha)	1985 Population (in 1,000)	1985 Rate of vehicle ownership (Veh/ 1,000P)	2000 Population (in 1,000)	2000 Rate of vehicle ownership (Veh/ 1,000P)	Average rate of vehicle usage	Av. No. of persons per vehicle	Av. No. of trips per person	1985 generated person-trip (in 1,000/ day)	2000 generated person-trip (in 1,000/ day)
a	∿250	·1687.3	122	2,842.0	222	0.80	2.0	2.5	823	2,524
b	250∿ 400	1408.4	42	2,092.2	78	0.85	2.7	2.3	312	861
c	400	1564.1	14	2,075.1	25	0.90	3.5	2.1	145	343
d	500	3007.2	9	3,502.7	17	0.90	3.5	2.1	179	394
Total (or Average)		7667.0	41	10,510.0	86	-	-	-	1,459 (1.00)	4,122 (2.83)

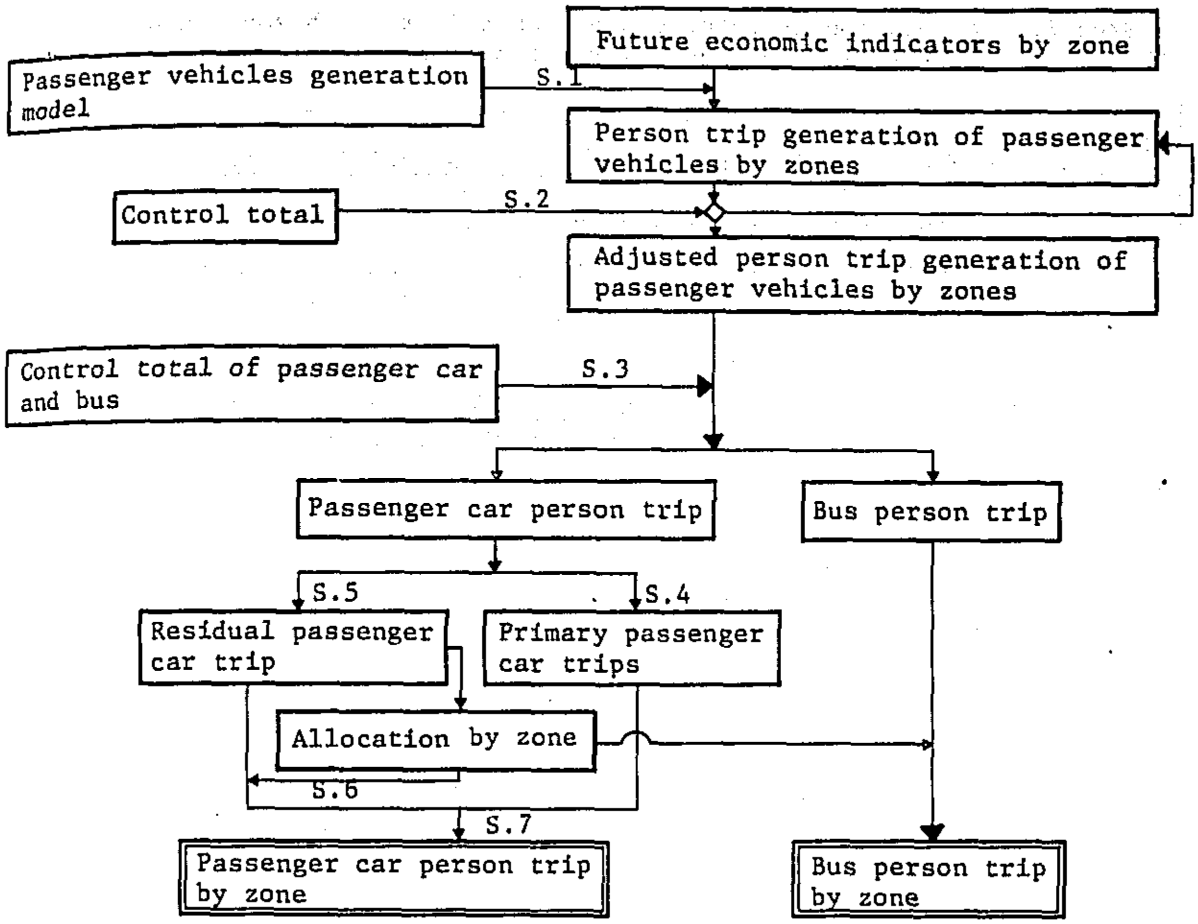
Reference: Figures for Japanese cities of 500,000 ∿ 1,000,000 in population, 1973.

1) Rate of ownership: 207.2 vehicles/1,000 persons

2) Average number of trips per vehicle: 3.8 trips

Based on the conditions described above, the passenger car trip and bus trip are estimated as follows:

Fig. 5-11 Flow of Estimation of Passenger car and Bus Person Trip



Step 1. The person trip generation by passenger vehicles is computed for each zone with the generation model based on resident population by state and employed population in tertiary industry.

Step 2. Adjustment with the control total.

Step 3. Division of total generated person trip into passenger car person trip and bus person trip using the control totals for passenger car and bus.

Step 4. Calculation of primary passenger car person trip for each zone by: resident population by density rank x rate of vehicle ownership x rate of vehicle usage x av. no. of persons per vehicle x 2.

Step 5. Deduction of total of primary passenger car person trip from the total passenger cars person trip.

Step 6. Allocation of residual trip to the zones proportional to the residual passenger car person trip of the zones.

Step 7. Determination of the zone passenger car person trip by adding primary trip and residual trip for each zone.

Step 8. Allocation of total bus person trip to each zone in proportion to the residual passenger car person trip of each zone.

5-5-4 Conversion of Person Trip Volume into Vehicle Traffic Volume

With the passenger car and bus person trip for each zone determined, the next step is to convert the person trip volume into vehicle traffic volume by the following formula.

$$\text{Passenger car vehicle trip (or Bus)} = \frac{\text{Passenger car (or Bus) person trip generated}}{\text{Average number of persons per vehicle}}$$

The average number of persons per vehicle is obtained by calculating the weighted average of the number of persons per vehicle by population density ranking used in the calculation of the control total for future passenger vehicles person trip generation. The number of persons per vehicle by population ranking is as listed below, and based on this the average number of persons for passenger cars is calculated at 2.43 persons/vehicle for 1985 and 2.33 persons/vehicle for 2000.

Table 5-18 Average Number of Persons per Passenger Car by Population Density Ranking

Ranking	Population density(p/ha)	Av. No. of persons per passenger car
a	∿ 250	2.0
b	250 ∿ 400	2.7
c	400 ∿	3.5
k	∿ 500	3.5

The average number of persons per bus is set at 33 persons/bus for both 1985 and 2000, taking into consideration the present statistics and future trend.

Table 5-19-1 FUTURE TRIPENDS OF SEDAN AND BUS BY ZONE

(Vehicle/Day)

Zone	1985		2000			
			Landuse: Concentrated		Landuse: Dispersed	
	Sedan	Bus	Sedan	Bus	Sedan	Bus
1.	58,792	8,284	147,625	19,558	122,595	16,073
2.	38,252	4,830	77,623	9,736	66,624	8,204
3.	46,438	4,419	106,130	10,108	106,259	10,126
4.	59,387	7,025	126,422	14,452	112,143	12,464
5.	32,562	3,587	70,462	8,016	64,462	7,180
6.	36,930	2,765	93,651	6,576	91,837	6,323
7.	28,181	843	79,892	4,042	78,773	3,886
8.	27,130	2,675	72,606	7,505	72,606	7,505
9.	4,635	60	29,468	1,791	29,442	1,788
10.	8,097	321	45,112	1,485	45,112	1,485
11.	3,824	73	24,111	689	24,111	689
12.	109,644	9,108	193,529	21,242	174,503	18,592
13.	21,007	1,437	48,203	4,277	47,750	4,214
14.	12,525	384	57,864	2,633	57,845	2,630
15.	14,539	738	49,587	3,006	49,901	3,050
16.	15,317	609	82,560	2,612	82,878	2,656
17.	14,570	389	69,488	1,858	69,469	1,855
18.	16,858	588	85,697	2,705	44,184	3,887
19.	18,092	207	56,984	1,538	56,962	1,535
20.	56,872	6,089	119,267	12,391	116,908	11,961
21.	53,352	3,593	160,083	12,867	160,083	12,867
22.	57,986	4,343	138,066	13,041	150,281	14,742
23.	22,252	1,722	62,705	4,400	62,705	4,400
24.	6,236	135	32,137	433	37,800	1,222
25.	7,832	175	34,738	1,621	60,255	5,175
26.	9,132	281	43,232	846	48,898	1,635
27.	8,786	909	77,238	1,885	77,237	1,885
28.	10,961	453	60,515	1,853	60,515	1,853
29.	11,874	491	42,051	1,702	54,815	3,479
30.	18,197	327	79,143	1,741	79,125	1,738
31.	65,585	6,639	160,044	15,644	157,196	15,248
32.	46,181	4,878	101,872	10,300	110,445	11,494
33.	16,808	1,536	60,303	2,417	60,303	2,417
34.	8,670	492	30,177	2,092	30,177	2,092
35.	6,842	382	37,456	1,532	37,457	1,532
36.	7,724	158	33,647	953	33,646	953
37.	15,665	413	53,087	1,706	53,065	1,703
38.	10,504	278	34,938	601	34,936	601
39.	18,653	1,542	149,032	7,819	149,032	7,819
40.	7,888	142	16,708	907	16,708	907
41.	11,762	163	37,625	1,249	44,730	2,239
Total	1,046,542	83,483	3,080,000	322,000	3,080,000	222,000

Table 5-19-2 FUTURE TRIPENDS OF SEDAN AND BUS BY ZONE

(Vehicle/Day)

Zone	1985		2000			
	Sedan	Bus	Landuse:Concentrated		Landuse:Dispersed	
			Sedan	Bus	Sedan	Bus
42.	2,672	787	8,164	2,305	8,164	2,305
43.	1,861	548	6,674	1,885	6,674	1,885
44.	1,827	538	6,437	1,818	5,437	1,818
45.	1,786	526	4,996	1,354	4,796	1,354
46.	1,811	533	4,650	1,313	4,650	1,313
47.	2,147	632	5,087	1,437	5,087	1,437
48.	1,561	460	3,742	1,057	3,842	1,057
49.	6,985	2,057	20,267	5,723	20,267	5,723
50.	909	268	3,070	867	3,070	867
51.	1,633	481	5,365	1,515	5,365	1,515
52.	1,906	561	5,950	1,680	5,950	1,680
53.	377	111	965	273	965	273
54.	6,245	1,839	15,469	4,368	15,469	4,368
55.	3,278	1,098	9,904	2,797	9,904	2,797
56.	2,841	837	6,837	1,931	6,837	1,931
57.	2,234	658	7,920	2,236	7,920	2,236
58.	1,420	418	5,343	1,509	5,343	1,509
59.	405	119	1,509	299	1,059	299
60.	3,308	974	10,165	2,870	10,165	2,870
61.	2,368	698	5,967	1,685	5,967	1,685
62.	1,829	539	4,643	1,311	4,643	1,311
63.	3,651	1,075	10,434	2,947	10,434	2,947
64.	5,038	1,484	14,399	4,066	14,399	4,066
65.	5,734	1,689	16,390	4,628	16,390	4,628
66.	-	-	-	-	-	-
Total	64,276	18,931	183,697	51,874	183,697	51,874
Grand-Total	1,110,818	102,414	3,263,697	273,874	3,263,697	273,874

5-6 Estimation of Vehicle Trip Generation of Goods Vehicles

The validity of the goods flow volume estimated for 1976 is checked in section 5-4-3 (8) and it is verified that the estimated future goods flow and its method can be adopted for future forecast purpose.

5-6-1 Forecast of Future Goods Flow between Jakarta and Other Regions by Modes of Transport

From analysis of past statistical data, it is seen that the goods flow between Jakarta and other regions correlates well with the per capita GRDP, and a generation model based on relation between goods flow and per capita is used for forecast of future goods flow. As for goods flow by modes of transport, the flow through the port is determined from the masterplan for Tg. Priok, by deducting 4% of the volume as intraport transfer volume and adding 10% thereof as flow volume through other ports. The share of air cargo is extremely small and is overlooked as negligible. The volume of rail flow is assured to grow proportional to the growth in per capita GRDP. The truck flow volume is determined by deducting the volume by sea and by rail from the total goods flow volume.

The resultant goods flow by modes of transport are as follows:

Table 5-20 Forecast of Future Goods Flow by Modes of Transport

Year	By sea	By truck	By rail	Total
1985	19,679	40,005	1,770	61,454
1990	25,661	65,487	2,120	93,268
2000	35,482	144,637	2,862	182,981

(unit: 1,000 tons/year)

5-6-2 Forecast of Future Goods Flow Volume from Production and Consumption of Major Commodity Items

It is assumed that the commodity items not produced in Jakarta in 1973 will remain not to be produced in future.

(1) Intra-regional goods flow

1) The intra-regional goods flow of food farm crops, livestocks and dairy products is determined by production in Jakarta and that of fertilizers determined by consumption in Jakarta.

The production of the above items has been on a decrease, and taking an index of 100 for the year 1973, it is assumed that for the years 1985, 1990 and 2000 the indices will drop to 90, 70 and 30, respectively.

2) The intra-regional flow of fresh fish and meat is determined by production in Jakarta and that of textile, apparels and other household wares by consumption. The volume of flow is calculated as a growth from 1973 proportional to the growth in population.

3) Goods flow between Tg. Priok and Jakarta (Reference: Section 5-4-3, (6)).

Assuming as goods flow by rail between Tg. Priok and Jakarta, the future volume handled at the port is divided into that between the port and Jakarta and that between the port and other regions in the same proportion as that for 1973.

(2) Goods flow between Tg. Priok and other regions (unadjusted)
The volume of flow between Tg. Priok and other regions is obtained by deducting the volume between the port and Jakarta from the total volume. However, adjustment will be subsequently made for the volume by rail.

(3) "Through" truck traffic volume
The future through truck traffic volume is determined as growing from the 1973 volume in proportion to the GRDP of Jakarta and the 1973 volume is calculated as growing from the 1972 volume obtained through B/M O-D, in proportion to the growth of truck traffic

across the Jakarta boundary from 1972 to 1973.

(4) Goods flow between Jakarta and other regions (unadjusted)
From the total volume of flow by truck and by rail in Table 5-20, the flow between Tg. Priok and other regions determined in Step (3) and two fold of the through volume determined in Step (4) are deducted to obtain the unadjusted total and subsequent adjustment for flow by rail is made to obtain the final volume.

(5) Adjusted goods flow between Tg. Priok and other regions
The volume of flow between Tg. Priok and other regions by rail is obtained by multiplying future total rail flow volume as shown in Table 5-20, by the percentage obtained from the proportion of the flow between Tg. Priok and other regions as established in (3) and the flow between Jakarta and other regions as established in (5). The rail flow volume is deducted from the total volume between Tg. Priok and other regions to obtain the adjusted total flow by truck.

(6) Adjusted goods flow between Jakarta and other regions
In the same manner as in Step (6), the rail flow volume is determined and the adjusted volume of flow by truck is obtained by deducting the rail flow portion from the total goods flow between Jakarta and other regions.

Based on the above-mentioned method, the volume of goods flow by truck is established as shown in Table 5-21. However, it is assumed that 50% of the goods flow for intra-region, as well as that between Tg. Priok and Jakarta and that between Tg. Priok and other regions, stop by the urban area of Jakarta and 30% of the flow between Jakarta and other regions stop by Jakarta.

Table 5-21 Forecast of Future Cargo Movement by Truck

(Unit: 1000 ton/year)

	1973	1985	1990	2000
IN - OUT	4,868	28,145	49,913	122,195
Tg. Priok - OUT	3,643	9,210	12,162	17,038
A Sub total	8,511	37,355	62,075	139,233
THROUGH	97	277	407	801
B Cargo movement between Inside & Outside JKT	8,705	37,909	62,889	140,835
(IN - IN) x 1.5	(3,544) 5,316	(8,752) 13,128	(12,357) 18,536	(23,275) 34,913
(Tg.Priok-IN) x 1.5	(4,278) 6,417	(10,036) 15,054	(13,087) 19,631	(18,096) 27,144
(IN - OUT) x 30%	1,460	8,444	14,974	36,659
(Tg.Priok-OUT) x 50%	1,822	4,605	6,081	8,519
C Intra JKT Cargo movement	15,015	41,231	59,222	107,235
D C x 2	30,030	82,462	118,444	214,470
E A + D	38,541	119,817	180,519	353,703
F A + B + D	47,246	157,726	243,408	494,538

Note: 1) "IN" means cargo movement to and from inside D.K.I. Jakarta but exclusive of Tg. Priok.

2) "OUT" means cargo movement to and from outside D.K.I. Jakarta.

3) "THROUGH" means cargo movement passing through D.K.I. Jakarta.

4) The figures in parentheses show cargo movement regardless of any stop inside D.K.I. Jakarta.

5-6-3 Average Load of Trucks

The results of B/M surveys for trucks carried out at Tangerang, Cibinong and Bekasi are as listed below.

Table 5-22 Truck Traffic Observed at Tangerang, Cibinong and Bekasi

(unit: Veh/day)

Year	Tangerang	Cibinong	Bekasi	Total
1971	1,442	1,351	3,041	5,834
1972	2,500	2,828	4,002	9,330
1973	2,548	3,779	4,089	10,416
1974	3,203	6,090	6,518	15,811
1975	3,225	6,900	6,592	16,717

On the other hand, the statistical data by Jakarta on the surveyed volume of goods flow through the three survey points of Kalideres, Pasar Rebo and Bekasi are available as follows.

Table 5-23 Goods Flow by Trucks

(unit: ton/year)

Year	Kalideres	Pasar Rebo	Bekasi	Total
1971	542,825	678,096	559,504	1,780,425
1972	563,055	972,380	1,141,694	2,677,129
1973	753,142	1,274,750	1,677,193	3,705,085
1974	844,276	1,475,844	1,529,419	3,849,539
1975	1,002,283	1,574,354	1,986,017	4,562,654

Source: Statistical Year Book of Jakarta, 1976.

Taking the three similar locations for the above surveys to be the same, and assuming 250 working days in a year for trucks, the average tonnage of goods on board per truck is as follows:

Table 5-24 Daily Average Goods Tonnage by Truck

(unit: ton/veh. day)

Year	Tangerang	Cibinong	Bekasi	Average
1971	1.506	2.008	0.736	1.221
1972	0.901	1.375	1.141	1.148
1973	1.182	1.349	1.641	1.423
1974	1.054	0.969	0.939	0.974
1975	1.243	0.913	1.205	1.092

The general trend of tonnage per truck may be said to be on the increase although it fell in 1974 before resuming an increasing trend.

In the forecast of future load per truck, the following points have to be taken into consideration.

(1) The improvement of the capability of trucks.

(2) The relaxation of load restriction due to improvement of bridges and roads.

(3) A reduction in the rate of empty vehicles due to increase in goods flow.

(4) The trend of reduction in vehicle size in the urban area due to restriction, and an increase in size as well as containerization of inter-regional trucks.

With full consideration of the above factors, the trend of changes in load of the trucks may be summarized as follows:

(1) For inter-regional transport, the truck will increase in size and will have a decrease in rate of empty vehicles so that the average load per vehicle will maintain an increasing trend.

(2) For urban transport, the vehicle size tends to be reduced, but this is offset by a reduction in rate of empty vehicles so that the average load will remain almost unchanged.

The average load per truck for the key years are therefore assumed as follows taking also in consideration the rate of empty vehicles.

Table 5-25 Forecast Future Goods Tonnage by Truck

(unit: tons/vehicle)

Year	Intra-urban	Inter-regional
1973	1.80	2.00
1985	2.20	2.70
1990	2.20	3.00
2000	2.20	3.50

Without consideration on the planning of cargo terminals, the daily average truck trips and trip ends are calculated as follows:

Table 5-26 Daily Average Truck Trips

(unit: trip/day)

	1973	1985	1990	2000
Intra-regional	33,367	74,965	107,676	194,973
Between Jakarta & other regions	17,022	55,341	82,767	159,123
Subtotal	50,389	130,306	109,443	354,096
Through traffic	194	410	543	915
Total	50,583	130,716	190,986	355,011

Table 5-27 Daily Average Truck Trip Ends

(unit: veh/day)

	1973	1985	1990	2000
Total trip ends within Jakarta	83,756	205,271	298,119	549,069
Total trip ends in whole area	101,166	261,432	381,972	710,022

5-6-4 Goods Trips that Utilize Cargo Terminal

The rate of usage of cargo terminal is assumed as follows:

Table 5-28 Rate of Utilization of Cargo Terminal

	Rate of stop within Jakarta	Rate of utilization of cargo terminal		
		1985	1990	2000
Between Jakarta & other regions	30 %	10%	15%	20%
Between Tg. Priok & Jakarta	50 %	5%	10%	15%
Between Tg. Priok & other regions	50 %	10%	15%	20%
Through traffic	-	25%	25%	25%

From the above table, the volume of cargo handled at the cargo terminal is calculated as follows:

Table 5-29 Volume of Cargo Stopping at Cargo Terminal

(unit: 1,000 tons/year)

	1985	1990	2000
Between Jakarta & other regions	844	2,246	7,332
Between Tg. Priok & Jakarta	251	654	1,357
Between Tg. Priok & other regions	461	912	1,704
Through traffic	69	102	200
Total	1,625	3,914	10,953
Air terminal utilization rate in total truck flow	2.06%	3.22%	4.28%

Therefore, taking into consideration the use of cargo terminal, the annual cargo trip end is summarized as shown in Table 5-30 and Table 5-31.

The truck trip ends of the port facilities of Tg. Priok are divided into zone 66 and Zone 6, and the trip ends for Zone 6 is assumed at one-tenth of that for Zone 66.

Table 5-30 *Distribution of Cargo Movement to and from Cargo Terminal*

(unit: 1,000 ton/year)

	1985		1990		2000	
IN - OUT		28,145		49,913		122,195
IN - IN	27%	7,599	25.5%	12,728	24%	29,327
IN - Terminal	3%	844	4.5%	2,246	6%	7,332
IN - OUT	97%	27,301	95.5%	47,667	94%	114,863
Terminal - OUT	3%	844	4.5%	2,246	6%	7,332
Tg. Priok - OUT		9,210		12,162		17,038
Tg. Priok - IN	45%	4,145	42.5%	5,169	40%	6,815
Tg. Priok - Terminal	5%	461	7.5%	912	10%	1,704
Tg. Priok - OUT	95%	8,750	92.5%	11,250	90%	15,344
Terminal - OUT	5%	461	7.5%	912	10%	1,704
THROUGH		277		407		801
OUT - OUT	75%	208	75%	305	75%	601
OUT - Terminal	25%	69	25%	102	25%	200
Terminal - OUT	25%	69	25%	102	25%	200
Tg. Priok - IN		10,036		13,087		18,096
Tg. Priok - IN	147.5%	14,803	145%	18,976	142.5%	25,787
Tg. Priok - Terminal	2.5%	251	5%	654	7.5%	1,357
Terminal - IN	2.5%	251	5%	654	7.5%	1,357
IN - IN	47.5%	4,767	45%	5,889	42.5%	7,691
IN - IN		8,752		12,357		23,275
IN - IN	150%	13,128	150%	18,536	150%	34,913

Table 5-31 Total Trip Ends of Cargo Terminal And Other Areas

(unit: 1000ton/year)

	1985	1990	2000
IN-IN	25,494	37,153	71,931
Tg. Priok-IN	18,948	24,145	32,602
Tg. Terminal	712	1,566	3,061
IN-Terminal	1,095	2,900	8,689
Sub total	46,249	65,764	116,283
Tg Priok-OUT	8,750	11,250	15,344
IN-OUT	27,301	47,667	114,863
Terminal-OUT	1,443	3,362	9,436
Sub total	37,494	62,279	139,643
THROUGH	208	305	601
Sub total	208	305	601
Grand Total	83,951	128,348	256,527

Table 5-32 Future Trip Volume of Trucks

	1985		1990		2000	
	ton/veh	veh/day	ton/veh	veh/day	ton/veh	veh/day
Intra-regional	2.2	46,348	2.2	67,554	2.2	130,771
Between Tg. Priok and Jakarta	2.2	34,447	2.2	43,896	2.2	59,270
Between Tg. Priok and Terminal	2.2	1,942	2.2	4,270	2.2	8,347
Between Jakarta and Terminal	2.2	2,986	2.2	7,908	2.2	23,695
Sub Total A		85,723		123,618		222,083
Between Tg. Priok and other regions	2.7	12,963	3.0	15,000	3.5	17,536
Between Jakarta and other regions	2.7	40,446	3.0	63,556	3.5	131,272
Between terminal and other regions	2.7	3,206	3.0	6,724	3.5	16,173
Sub Total B		56,615		85,280		164,981
Through traffic	2.7	308	3.0	407	3.5	687
TOTAL		142,646		209,305		387,751

The total trip end by districts is therefore summarized as follows:

Table 5-33 Distribution of Truck Trip Ends by District

(unit: veh/day)

District	1985	1990	2000
Tg. Priok (Zone 66)	44,865	57,424	77,412
Tg. Priok (Zone 6)	4,487	5,742	7,741
Terminal-1, (Zone 41)	8,134	9,451	16,072
Terminal-2 (Zone 31)	-	9,451	16,072
Terminal-3 (Zone 16)	-	-	16,071
Intra-region (Zones 1 ∿ 41)	170,575	250,448	475,779
Out of DKI Jakarta (including through traffic)	57,231	86,094	166,355
Through traffic	616 (308)	814 (407)	1,374 (687)
*Total trip ends within Jakarta	228,061	332,516	609,147
Grand Total	285,292	418,610	775,502

* 2 x A + B

It is assumed that a cargo terminal will be constructed in Zone 45 by the year 1985, another in Zone 31 by 1990 and a third one in Zone 16 by 2000, and the cargo to be handled by cargo terminals is equally allocated to the terminals.

5-6-5 Truck Generated Volume by Zone

In splitting the total truck generated volume into individual zones, it is assumed that 40% of the inter-regional trips are divided in proportion to the population of the zones and the remaining 60% divided proportionally to each of industrial areas in the zones.

Table 5-34 Generation of Truck Trip Ends by Zone

(unit: veh./day)

	1985 Base T.E.	1985 Facilities T.E.	1985 Total	2000 Base T.E.	2000 Facilities T.E.	2000 Total
1	1,569		1,569	2,284		2,284
2	3,685		3,685	5,234		5,234
3	4,946		4,946	8,660		8,660
4	3,104		3,104	5,329		5,329
5	2,558		2,558	3,616		3,616
6	8,017	4,487	12,504	15,510	7,741	23,251
7	8,051		8,051	19,411		19,411
8	12,213		12,213	30,545		30,545
9	5,936		5,936	19,792		19,792
10	8,187		8,187	27,881		27,881
11	205		205	1,332		1,332
12	7,506		7,506	14,178		14,178
13	1,876		1,876	3,806		3,806
14	887		887	3,712		3,712
15	819		819	3,045		3,045
16	751		751	4,568	16,071	20,639
17	11,156		11,156	38,253		38,253
18	1,228		1,228	5,709		5,709
19	1,092		1,092	3,235		3,235
20	5,833		5,833	11,038		11,038
21	6,482		6,482	17,223		17,223
22	3,753		3,753	9,991		9,991
23	2,900		2,900	7,993		7,993
24	341		341	2,284		2,284
25	478		478	3,045		3,045
26	546		546	2,855		2,855
27	887		887	5,329		5,329
28	546		546	3,426		3,426
29	648		648	2,284		2,284
30	1,911		1,911	8,469		8,469
31	7,813		7,813	16,176	16,072	32,248
32	4,162		4,162	6,851		6,851
33	1,603		1,603	4,091		4,091
34	921		921	2,188		2,188
35	409		409	1,903		1,903
36	478		478	1,903		1,903
37	4,981		4,981	12,846		12,846
38	546		546	2,093		2,093
39	3,753		3,753	16,843		16,843
40	22,584		22,584	70,511		70,511
41	15,215	8,134	23,349	50,337	16,072	66,409
Total	170,575	4,487	175,062	475,779	39,884	515,663

(to be continued)

	Base T.E.	1985 Facilities T.E.	Total	Base T.E.	2000 Facilities T.E.	Total
42	1,416		1,416	4,455		4,455
43	1,019		1,019	3,630		3,630
44	1,019		1,019	3,464		3,464
45	962		962	2,474		2,474
46	962		962	2,474		2,474
47	1,133		1,133	2,640		2,640
48	849		849	1,980		1,980
49	3,057		3,057	9,404		9,404
50	397		397	1,485		1,485
51	680		680	2,474		2,474
52	792		792	2,640		2,640
53	170		170	495		495
54	2,661		2,661	7,094		7,094
55	1,642		1,642	4,620		4,620
56	1,245		1,245	3,135		3,135
57	1,133		1,133	3,960		3,960
58	680		680	2,640		2,640
59	226		226	495		495
60	1,811		1,811	5,279		5,279
61	1,302		1,302	3,135		3,135
62	1,019		1,019	2,474		2,474
63	3,341		3,341	9,734		9,734
64	7,983		7,983	23,262		23,262
65	21,116		21,116	61,538		61,538
66	–	44,865	44,865	–	77,412	77,412
Total	56,615	52,999	109,614	164,981	93,484	258,465
Grand Total	227,190	57,486	284,676	640,760	133,368	774,128

2000/1985 = 2.72

5.7 Estimation of Traffic Distribution

5-7-1 Method of Estimation of Traffic Distribution

In estimating the traffic distribution for the passenger vehicles, the gravity model method which is capable of reflecting the changes in travel time between zones due to changes in future road network is adopted. In estimating goods vehicles sufficient attention is paid on the major cargo handling facilities such as port, cargo terminal etc., and also on the connection between the urban Jakarta and other regions. The movement of cargo within Jakarta City, excluding the flow between the port and the city, is estimated with the gravity model method, in the same way as the passenger vehicle traffic.

5-7-2 Estimation of Future O-D Matrices

(1) The situation of the O-D matrices

In the calculation of the trip generation, particularly for the passenger vehicle traffic, it has been described in Section 5-5 that studies are made on the two patterns of landuse, namely the one is of concentration of business and commercial area at one point and the other is of dispersal to the periphery. However, from the points of improvement situation of the roads surrounding the CBD and also of the railway, it has been argued that in future it will be difficult to maintain a one point concentrated development pattern. The O-D matrices are therefore estimated based on the landuse pattern of dispersal to the periphery.

(2) Gravity model

The traffic distribution is performed by the Gravity Model and the parameters are obtained through an analysis of existing traffic data whereas the inter-zonal travel time is obtained by route search taking into consideration future changes in road network.

Gravity model:

$$Tij = Ti \times Tj \times \frac{k}{Dij^n}$$

where, Tij = distributed traffic between zone i and zone j.

Ti = generated traffic of zone i.

Tj = generated traffic of zone j.

Dij = required travel time between zone i and zone j.

n and k = coefficient varying with vehicle type as follows:

Vehicle type:	n	k
Passenger vehicle	1.00	$1,047 \times 10^{-6}$
Good vehicle	1.09	$8,128 \times 10^{-5}$

(3) Converging calculation

The converging calculation is performed to adjust the calculated total traffic distribution to agree with the generated traffic volume of the zones, and the O-D matrices of passenger car, bus and truck are determined separately after the converging process.

5-8 Traffic Assignment Calculation

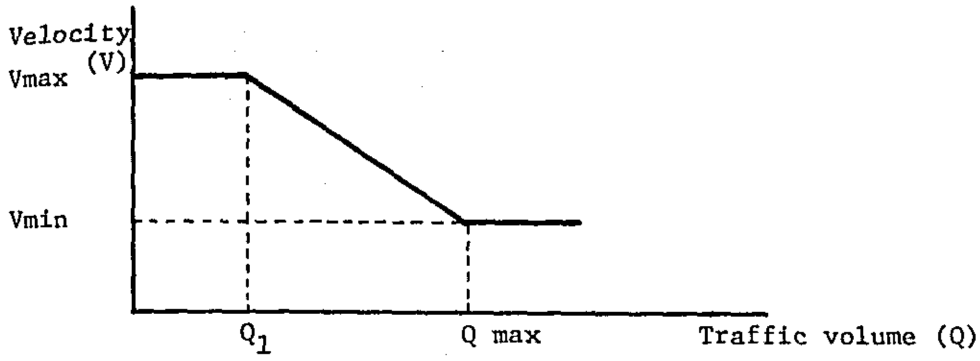
5-8-1 Method of Assignment

Estimation of future traffic assignment is performed to obtain the estimated traffic volume that will utilize each section of the established road network and to make the necessary evaluation of the suitability of road network allocation, the capacity of the road network, and the balance of traffic volume. As described in section 5-1, in the traffic assignment for Jakarta City, if calculation is made for all combinations of alternative conditions in target years, road operation system, toll system and toll collection system, the number of cases will be too numerous in relation to the number of zones and the size of the road network, so that in the calculation by the computer, the following basic assignment method is used.

(1) Demand assignment
This is the assignment of all the zone-pair traffic volumes to the shortest route between two zones, and the results will be the desired traffic volume, or the volume of traffic demand on each road link.

(2) Actual assignment
The actual assignment is by a method that better represents the traffic situation than the demand assignment method. That is, the method takes into consideration the degree of traffic congestion on each link and allows for reduction in travel speed due to restriction in traffic capacity of the link. The concept of the traffic capacity limitation method (Q - V method) of traffic assignment is as shown in the following figure.

Traffic Capacity Limitation Method (Q - V method)



When the traffic volume is below Q1, a vehicle may be able to travel at the maximum travel speed (Vmax), which is about 80% of the design speed of the road. When the traffic volume exceeds travel speed gradually decreases in pace with traffic volume increase until the volume reaches Qmax when the travel speed drops to the minimum speed Vmin. In this study, based on the results of travel speed survey and the results of traffic count, the traffic capacity limitation conditions of the road network are divided into 20 different road type classifications as shown in Table 5-35.

In actual assignment, the assignment to the shortest route is done in the same way as in the demand assignment method and according to the case of the assignment, the traffic volume of the O-D matrices is divided into 5, 10 or 15 equal lots for assignment. In equal lotting, the traffic volume Tij of a zone pair is divided into equal parts so that the volume of each zone pair is $\frac{1}{n} \cdot Tij$. This volume is the assignment to the shortest route between the zones based on the travel speed on each link according to the conditions shown in Table 5-35. The next assignment is made according to modified Q-V conditions based on the results of the previously assigned traffic volumes on the shortest route. The shortest route is defined as the shortest time, including the toll converted into time for the zone pair.

Table 5-35 Traffic Capacity Limitation of Roads in Q-V Traffic Assignment

No.	Type of Road	Location	No.of Lanes	Km/h V_1	Veh/day Q_1	Km/h V_2	Veh/day Q_2
1.	Ordinary road	Urban	2	40	3,500	5	10,000
2.	"	"	4	40	22,000	10	47,000
3.	"	"	6	45	35,000	20	72,000
4.	"	Sub-urban	2	45	4,000	10	12,000
5.	"	"	4	50	25,000	20	50,000
6.	"	"	6	60	36,000	20	80,000
7.	Town planning road (improvement)	Urban	2	50	4,000	10	11,000
8.	"	"	4	60	24,000	15	48,000
9.	"	"	6	60	36,000	20	75,000
10.	"	Sub-urban	2	60	4,500	10	13,000
11.	"	"	4	70	26,000	20	52,000
12.	"	"	6	70	37,000	20	82,000
13.	Inter-city expressway		4	90	32,000	20	64,000
14.	"	"	6	90	49,000	20	98,000
15.	Ring Road	Type A	4	80	31,000	20	62,000
16.	"	Type B	4	90	32,000	20	64,000
17.	"	Type C	6	70	47,000	20	94,000
18.	"	Type D	6	80	48,000	30	96,000
19.	Ramp	Type A	2	40	12,000	15	24,000
20.	Ramp	Type B	2	60	12,000	20	24,000

Note: V_1 indicates highest speed
V_2 indicates lowest speed
Q_2 indicates traffic capacity

(3) Items of calculation and compilation

The following items are the output after the traffic assignment by computer.

1) Required travel time for each link.
2) Travel speed for each link.
3) The assigned traffic volume after the assignment for each link.
4) The accumulated assigned traffic volume of assignments for each link.
5) Ring Road traffic volume between ramps.
6) Intra urban road traffic volume between ramps.
7) The breakdown list of O-D pairs using the major links.
8) Traffic volumes by directions at major intersections.
9) Travel route and required travel time for all zone pairs

The target years for traffic assignment are 1985 and 2000 and the vehicle types are passenger car, bus and truck.

5-8-2 Determination of Road Network for Traffic Assignment

(1) Town planning roads of Jakarta City

Besides the trunk road network described in section 2-4, there are also town planning roads planned in Jakarta City for the future road network. The road network for the purpose of traffic assignment basically includes all the trunk roads and the major town planning roads.

(2) Completion of the road network for traffic assignment

All section between intersections in the road network established in (1) above, is given link numbers and all intersections are given node numbers. The total links for the whole network is summarized in the table below and the map of the network is shown in Fig. 5-13.

Fig.5-12 FUTURE ROAD NETWORK

Table 5-36 Summary of Links by Road Type

	Road type	Link Number	Number of links	Total link length
1.	Toll roads	No.1 to No.77	77	219.4 km
2.	Existing roads in Jakarta	No.101 to No.254	154	305.7
3.	Planned roads in Jakarta	No.301 to No.339	39	115.4
4.	Roads outside Jakarta	No.401 to No.449	49	644.3
	Total		319	1,284.8 km

The road network by target year is determined for 1985 and 2000 according to the road improvement program described in Section 2-4-3.

5-8-3 Toll and Conditions

(1) Toll road

In the road network under analysis, 5 toll roads are included, and the toll roads included for traffic assignment are as follows:

Table 5-37 Toll Roads for Traffic Assignment

Name of toll road	Number of links	Total length of links
Ring Road	11	46.8 km
Inter-urban Expressway	15	30.1
Jakarta-Tangerang Highway	4	25.7
Jagorawi Highway	6	40.3
Jakarta Cikampek Highway	7	49.2
Total	42	192.1

(2) Toll rates for toll roads

The toll rate and toll system of the toll roads under analysis are determined as in Table 5-38 according to the analysis of benefits in Section 9-6. The toll for the section is converted into time and added to the travel time in the search for the

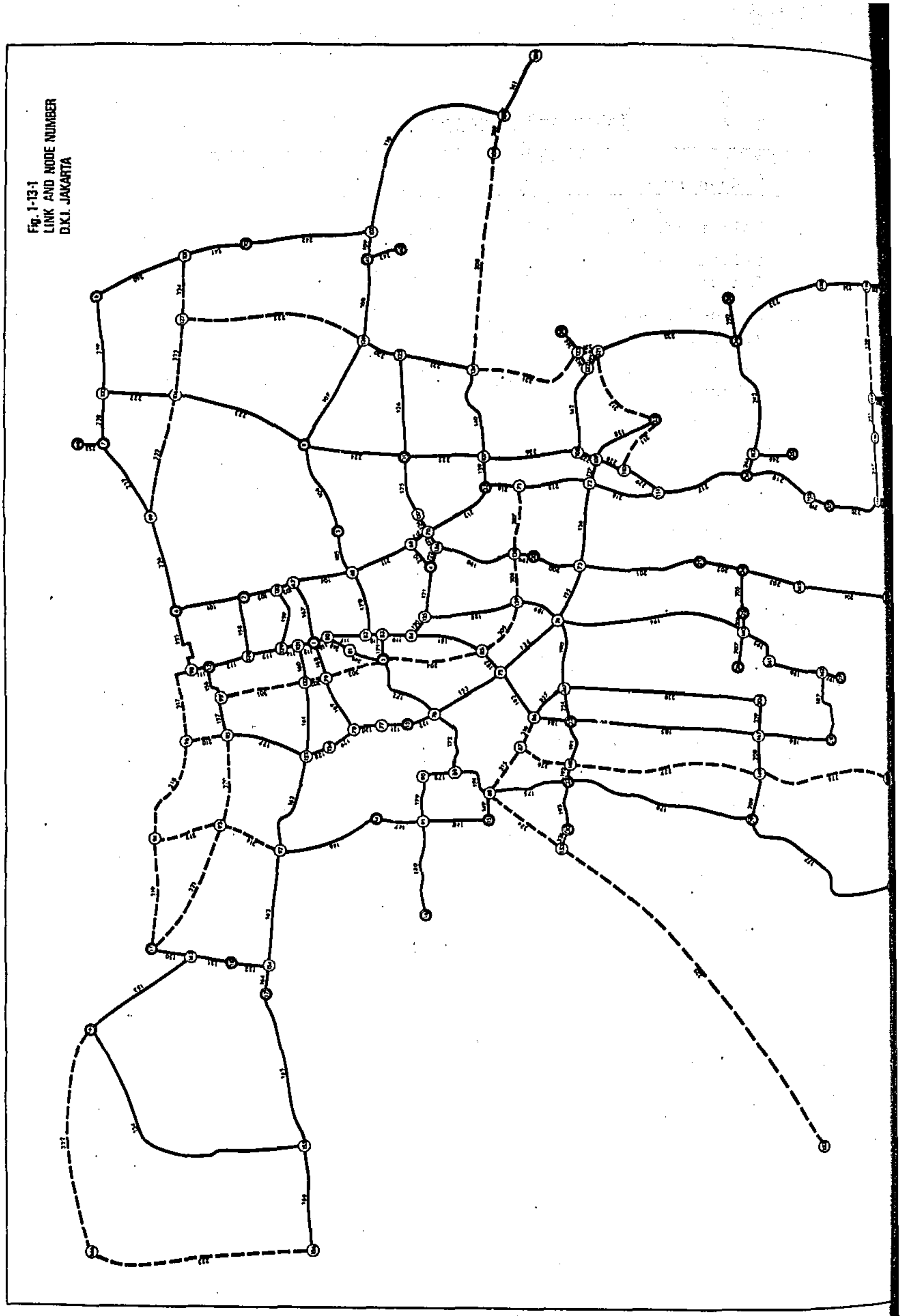


Fig. 1-13-1
LINK AND NODE NUMBER
D.K.I. JAKARTA

Fig. 1-13-2
LINK AND NODE NUMBER
HIGHWAY