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REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF HIGHWAYS

FEASIBILITY STUDY ON JAKARTA HARBOUR ROAD PROJECT

FINAL REPORT

MAIN REPORT

November 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF HIGHWAYS

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PREFACE

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

The JICA sent to Indonesia a preliminary study team headed by Mr. Ichiro Tanahashi in February, 1980 and a full scale study team headed by Mr. Nobuwaka Yamakawa in August, 1980.

The team exchanged views with the officials concerned of the Government of Indonesia over the project and conducted a field survey in Indonesia.

After the team returned to Japan, further studies were made and the present report has been prepared.

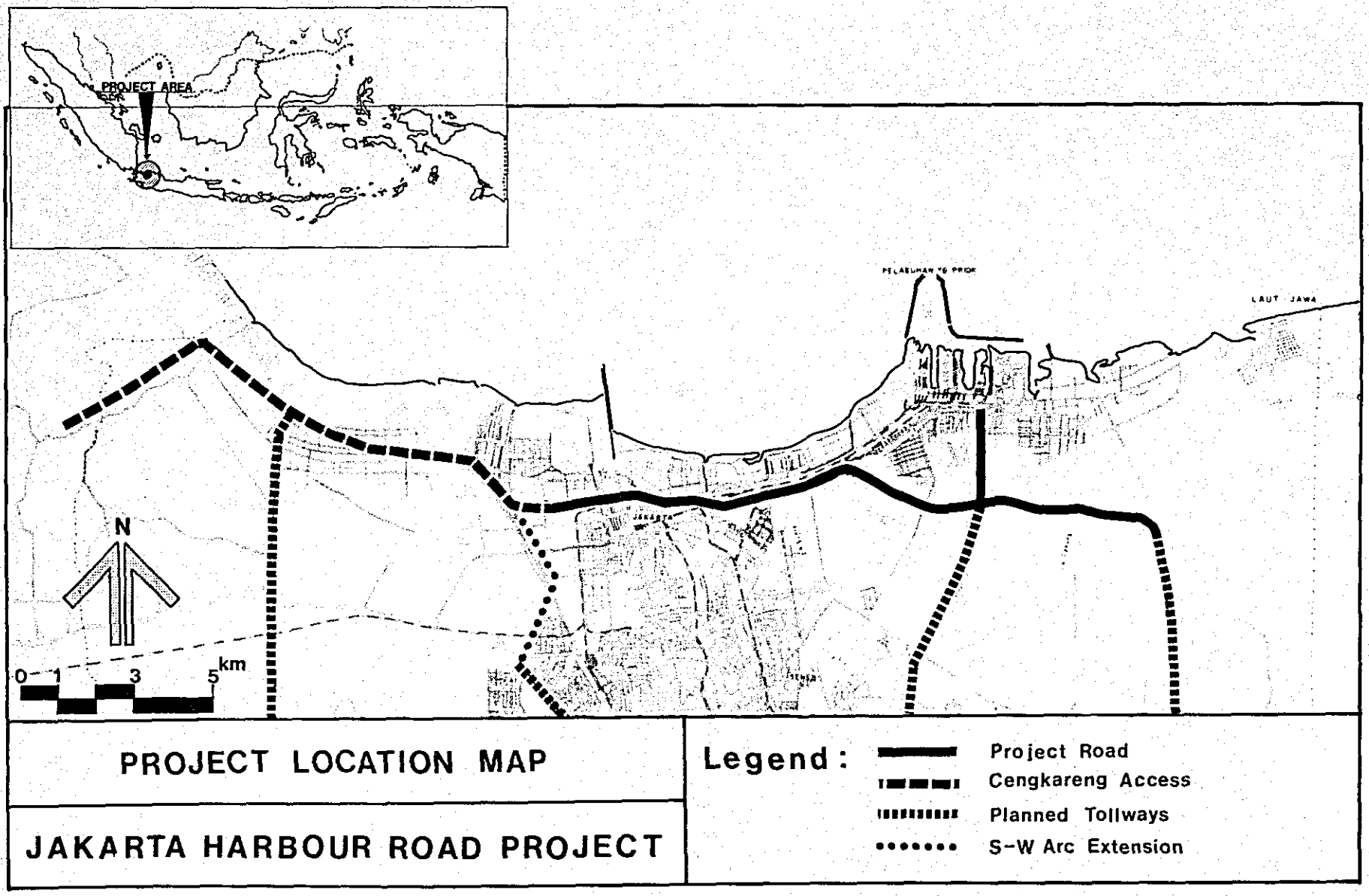
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

November, 1981

Keisuke Arita

President
Japan International Cooperation Agency


PROJECT AREA
PELABUHAN TG PRIOK
LAUT JAWA
N
0 1 3 5 km
PROJECT LOCATION MAP
JAKARTA HARBOUR ROAD PROJECT
Legend :
Project Road
Cengkareng Access
Planned Tollways
S-W Arc Extension

SUMMARY

SUMMARY

This summary contains the major findings and results of the Study made by the JICA Study Team which started their work together with Indonesian counterparts in August, 1980 in Indonesia.

1. Situation of DKI Jakarta in 1980

DKI Jakarta and its surroundings is the most developed area in Indonesia. Jakarta Harbour Road forms a principal connection from east to west in the northern area of DKI Jakarta, linking the Tg. Priok Port and Kota area, where the former functions for overseas trade and the latter is a center of commercial and trading business.

(1) The traffic situation in DKI Jakarta, 1980

Based on the several traffic surveys conducted by the Study Team in 1980, the characteristics of person trips in Jakarta in 1980 were found to be as follows:

1) Person Trips per Person: 2.09 trips/day

2) Modal split in DKI Jakarta, 1980 (Excluding intra-zonal trips)

	Person Trips (x1000)	Person Trips (%)		Vehicle Trips (x1000)	Vehicle Trips (%)
Mass Transit:	2,334	(57.8)	(51.5)	166.7	(14.5)
Bus	2,312	(57.3)	(51.0)	166.7	(14.5)
Railway	22	(0.5)	(0.5)		(-)
Private:	1,701	(42.2)	(37.6)	831.6	(72.3)
Motorcycle	462	(11.5)	(10.2)	332.2	(28.9)
Sedan	1,239	(30.7)	(27.4)	499.4	(43.4)
Sub-total:	4,035	(100.0)	(89.1)	998.3	(86.8)
Truck:	493	(-)	(10.9)	151.3	(13.2)
Total:	4,528	(-)	(100.0)	1,149.6	(100.0)

3) Number of Trips[1] and Trip Characteristics in DKI Jakarta, 1980

	Generated	Attracted
a. All day all purpose (10^3 P.T.)	4,504.8	4,552.5
b. Peak hour* all purpose(")	685.0	707.5
c. All day work trips** (")	959.4	1,019.0
d. Peak hour* work trips (")	494.1	524.8
Peak hour* ratio (b/a)	0.152	0.155
Peak hour* work trip ratio (d/b)	0.721	0.742
Work trips peak hour ratio (d/c)	0.515	0.515

Note: 1] Excluding intra-zonal person trips
* 7:00 - 9:00 a.m.
** Trips from home to work

4) Vehicle Trip Generation in DKI Jakarta, 1980

	Generated Trips* ($\times 10^3$ veh. trips/day)	Vehicle Ownership ($\times 10^3$ veh.)	Motorization (Estimated) (veh./1000 persons)	Generation Factor per Car-ownership (trips/veh.)
Motorcycle	332.2	436.1	66.5	0.76
Sedan	499.4	221.6	33.8	2.25
Truck	151.2	68.5	10.4	2.21
Bus	166.7	22.8	3.5	7.31
Total	1,149.5	749.0	114.2	1.53

Note: * Excluding intra-zonal vehicle trips.

(2) The Socio-Economic Situation in DKI Jakarta

1) Population Trend

The population in DKI Jakarta was about 4.5% of that in all Indonesia and the population density was 95 persons per hectare, while that in Indonesia was 0.7 persons per hectare in 1978.

The annual growth rate of the population in DKI Jakarta is 3.5%, while that in Indonesia is 1.9%. This indicates that the population in DKI Jakarta is still growing with a large number of immigrants, although this immigration has definitely been decreasing.

As a target for the master plan, the immigration will stop in the future and the population of DKI Jakarta will stabilize at about eleven million by the year 2010.

2) Economic Development and Car-Ownership in DKI Jakarta

The regional income in DKI Jakarta reached 2.5 trillion Rupiah and about 400 thousand Rupiah per capita in 1979. The growth rate of the gross regional domestic product shows a high rate of increase of 10.2% per annum.

The major business sectors in DKI Jakarta are the wholesale and retail trade, manufacturing and public administration. These sectors are indicative of the characteristics of the economic activities in DKI Jakarta.

Since the per capita income has grown, car-ownership and its rate in DKI Jakarta has grown with a moderate increase of 8.8% per annum and it reached 111.0 vehicles per one thousand population in 1979.

More than 50% of the share of vehicles is taken by the motorcycle and this share has been steady for this decade, which is very common in all of Indonesia. In general, however, it is expected that this situation will be changed in the future, if the public transport sector and road density are both strengthened.

2. Plan of the Project Road

The "Jakarta-West Java Tollway System" was proposed in 1975 after the "Jakarta Metropolitan Area Transportation Study" in 1974. In this system the Jakarta Harbour Road is expected to be located along the coastal area of the Java Sea and to form a link with the Jakarta Intra Urban Tollway and Jakarta Ring Road as well. Jakarta Harbour Road (L = 17.4 km) and Cengkareng Access (L = 15.0 km) will be connected in Pluit and run from Cengkareng to Cilincing.

Along Cengkareng Access and Harbour Road, there are several development plans as mentioned below which are expected to influence the future generation of traffic along the Harbour Road corridor.

- Tg. Priok Port Improvement Plan;
- Other Ports Development Plans (Kali Baru, Marunda, Sunda Kelapa)
- Pasar Ikan Fishery Port;
- Jakarta Airport Cengkareng;
- Ancol Project;
- Sunter Development Project;
- Redevelopment Plan in Kota Area;
- Railway Improvement Plan; and
- Construction of Related Tollways.

Considering the development plans and the tollway system as shown in Fig. 1, the alignment of Harbour Road is proposed as shown in Fig. 2. Junctions and interchanges with tollways and arterial roads are also proposed for the Project Road. They are Cilincing Junction with Jakarta Ring Road and Tg. Priok junction with the Intra Urban Tollway (N-S Link) and six interchanges within the 17.4 km long throughway.

Right-of-way for frontage road is planned to be acquired for almost all sections of the Project Road. The construction of these roads, however, is planned only for the Pluit-Kota and Sunter-Jakarta Bypass sections.

The study covered the facilities necessary for the Project Road (Harbour Road, Tg. Priod Access, Junctions/Interchanges) and the facilities necessary to maintain the function of existing facilities influenced by the Project Road (Improvement of arterial streets, intersections, construction of frontage roads, relocation of existing roads, waterways, etc.)

3. Traffic Volume Estimated on the Project Road

(1) Future Traffic Generation in DKI Jakarta

The future person trips in DKI Jakarta and the surrounding area are estimated to be 11 million per day by the year 2010. These trips are limited to only inter-zonal trips excluding intra-zonal trips.

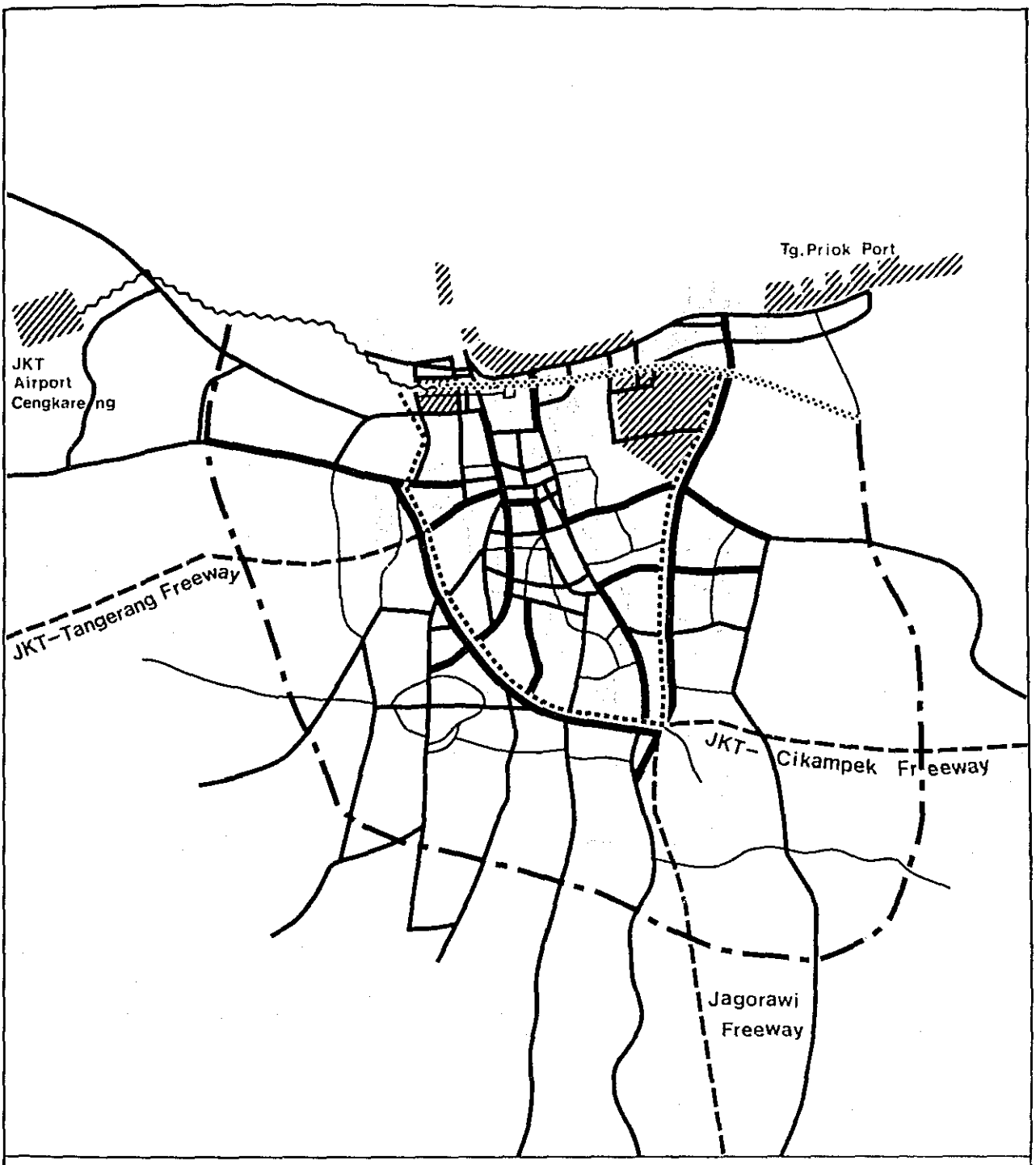


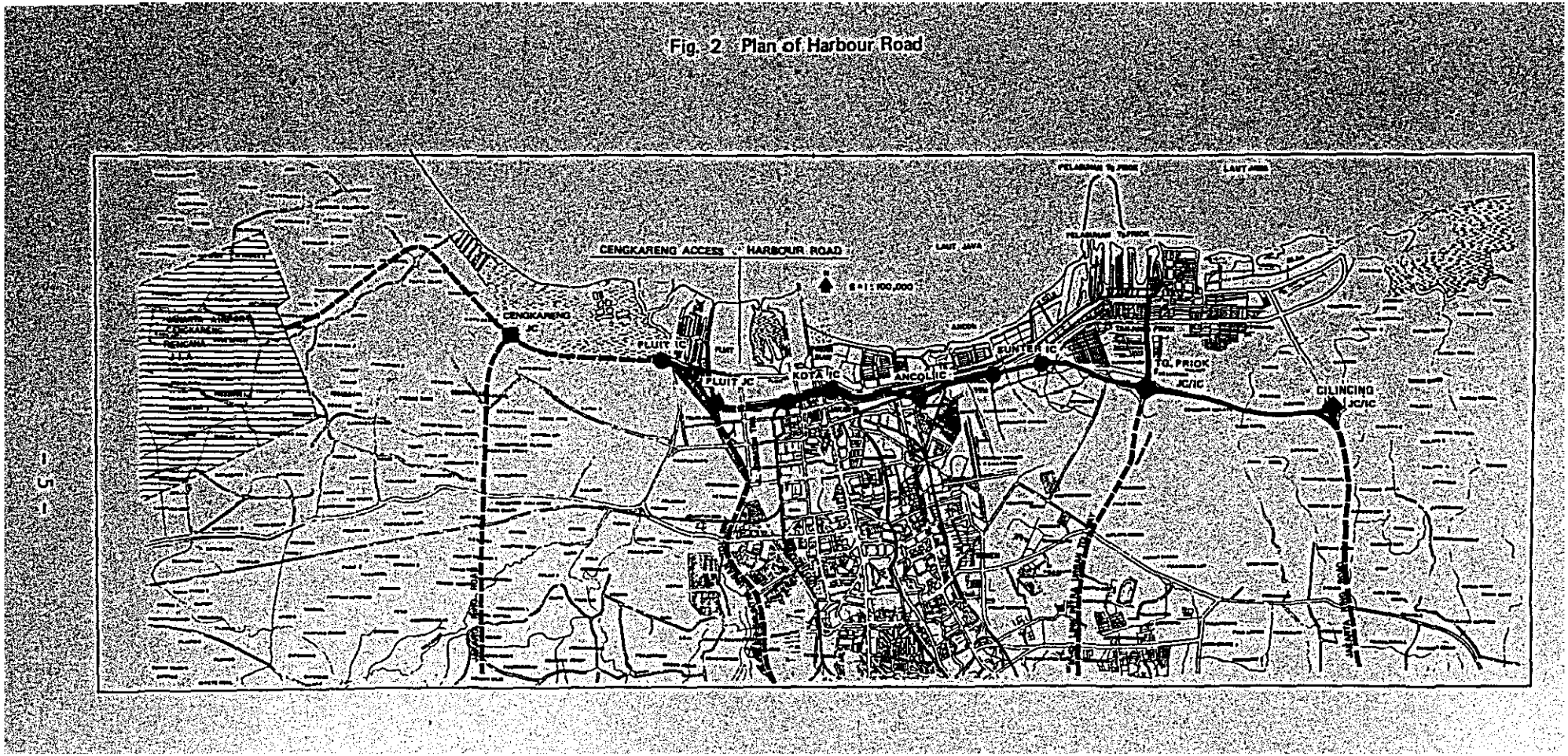
Fig.1 FUTURE DEVELOPMENT PLAN AND ROAD NETWORK IN DKI JAKARTA IN THE YEAR 2000, 2010

Legend:

Harbour Road	Jakarta Ring Road	4 Lanes
Cengkareng Access	Inter-Regional Freeway	2 Lanes
Intra Urban Tollway	6 Lanes & Over	Development Plan

JAKARTA HARBOUR ROAD PROJECT

Fig. 2 Plan of Harbour Road



Modal Split Estimated for the Year 2010

Transport Mode	Person Trips*/Day	Comp. Rate
Mass Transit:	6,785 thousand trips/day	(61.2%)
Bus	5,241 thousand trips/day	(47.3%)
Railway	1,544 thousand trips/day	(13.9%)
Private:	4,291 thousand trips/day	(38.8%)
Motorcycle	574 thousand trips/day	(5.2%)
Sedan	3,717 thousand trips/day	(33.6%)
Total:	11,076 thousand trips/day	(100.0%)

Note: * Excluding intra-zonal trips.

This estimate indicates that a large effort to improve public transport in the area should be anticipated and without this effort the traffic problems in DKI Jakarta will not be solved.

The future vehicle trips estimated to be generated as inter-zonal are as follows:

Vehicle Trip Generation in DKI Jakarta

(10^3 Veh. trips/day)

Vehicle \ Year	1980	1990	2000	2010
Motorcycle	332	376	397	416
Sedan	500	899	1,307	1,554
Truck	151	235	317	396
Bus	167	202	235	297
Total	1,150	1,712	2,256	2,663

(2) Traffic Volume on the Project Road

Future traffic volume on the Project Road has been estimated and is represented by the characteristics shown in the following table.

For these simulation of traffic flows, the toll rate was assumed to be 400 Rp/trip/sedan (at 1980 prices), if the road is operated by a flat tariff and 30 Rp/km/sedan in case the road is operated by a distance proportional tariff.

The users of Jakarta Harbour Road will make about 190 thousand trips per day in the year 2010. Other trip characteristics for the Project Road are shown below:

Trip Characteristics on Harbour Road in the Year 2010

Toll Levy Systems	Daily Harbour Road User Trips (veh. trips)	Vehicle-kilometers per day (x 1000)	Average Trip Length (km)	Average Cross-sectional Traffic Volume (vehicle/day)
Case 1	192,948	1,533.1	7.9	88,600
Case 2	201,693	1,319.4	6.5	76,270
Case 3	188,544	1,558.6	8.3	90,100

Note: Case 1 is a flat tariff applied to both Harbour Road and Intra Urban Tollway and another flat tariff is applied to Cengkareng Access.

Case 2 is a distance proportional tariff applied to Harbour Road and Cengkareng Access but a flat tariff system is applied to Intra Urban Tollway.

Case 3 is a single flat tariff applied to Harbour Road, Intra Urban Tollway and Cengkareng Access as well.

4. Tollway Design and Toll Levy System

(1) Tollway Design

The design speed for the Harbour Road is 80 km/h and it is shown in Fig. 3 in comparison with those of related tollways and freeways. The Project Road was designed as a 6-lane highway for the major portion of the stretch based on the results of the future traffic forecast.

Fig. 3 Design Speed of Related Tollways/Freeways

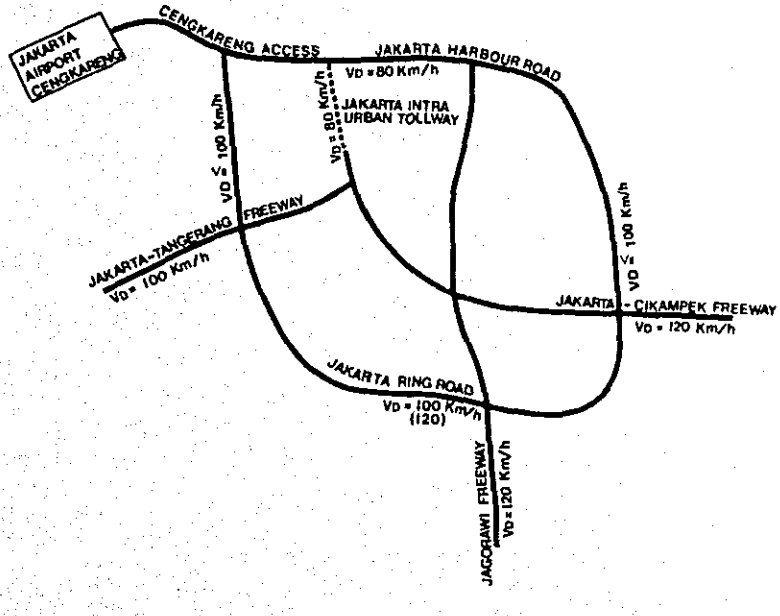
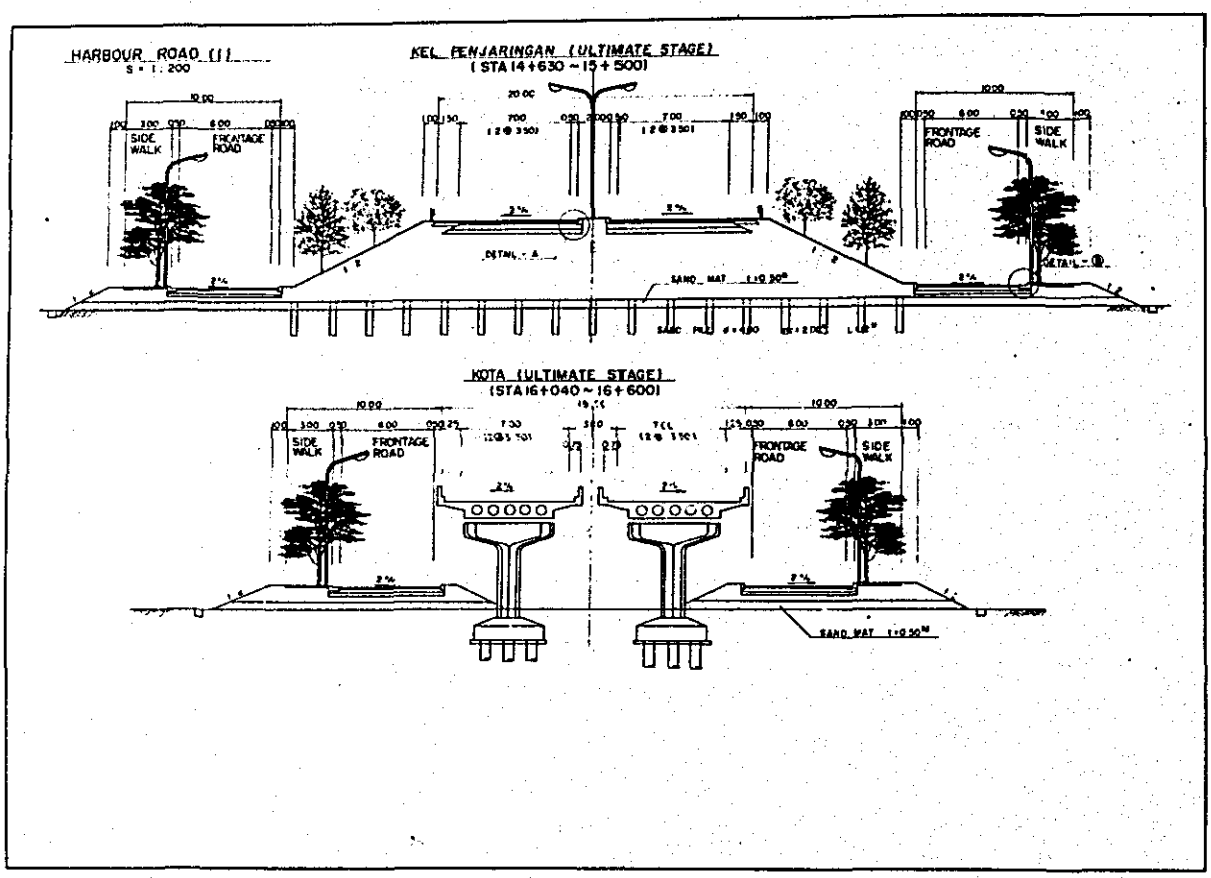
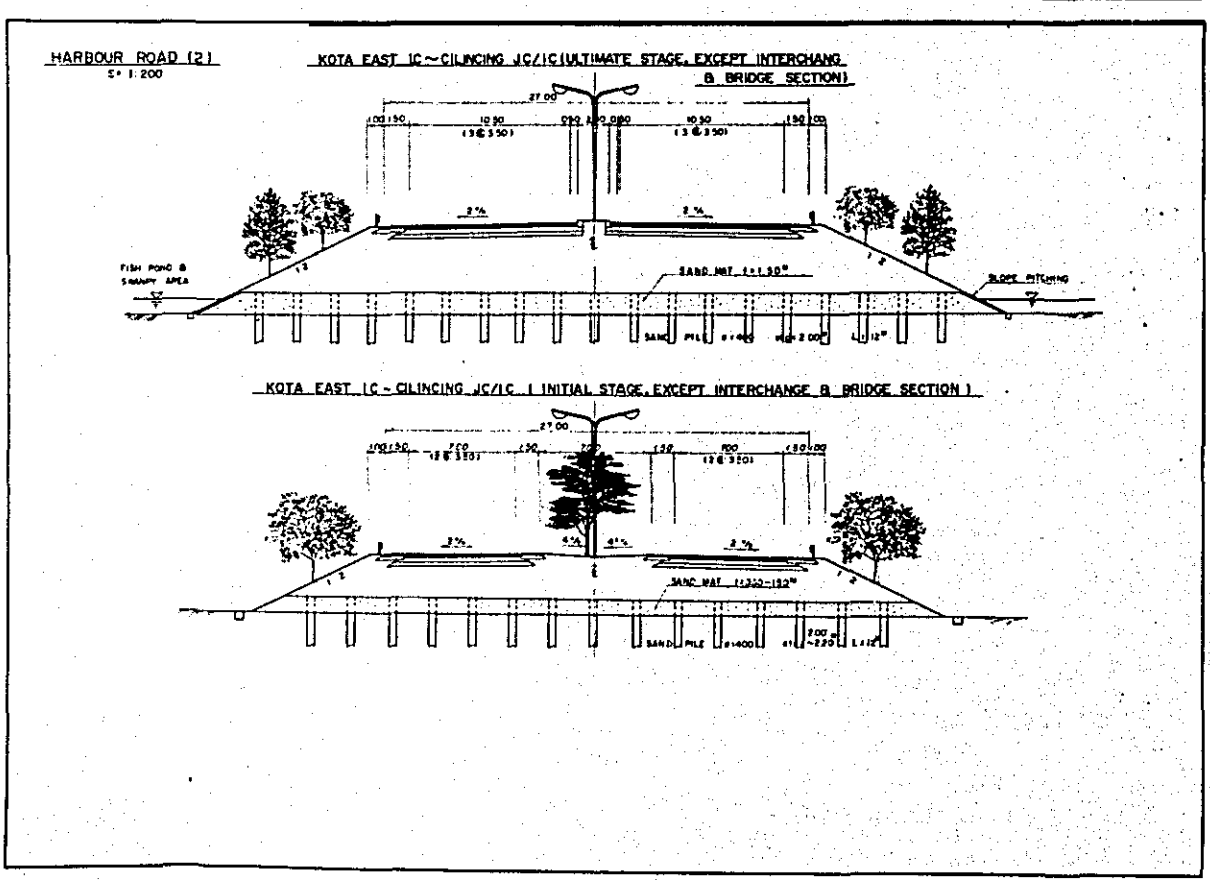


Fig. 4 Typical Cross Section of Harbour Road





The geometric design standard was established with reference to the Indonesian standard, the AASHTO* standard and the Japanese standard.

Based on these standards, the right-of-way width for the road is required to be 50 m to 80 m and the typical cross-section of the planned road is as shown in Fig. 4.

* American Association of State Highway and Transportation Officials.

Based on the results of the preliminary engineering and design studies, the major findings are as follows:

1) 15 bridges with a total length of 4.0 kilometers will be constructed, while the embankment section for the Project Road is 13.4 kilometers long.

2) A viaduct 3.3 kilometers long is designed to pass the busy area of Kelurahan Pinangsia of the Kota district and Ancol Canal, both of which are located in the old Ciliwung River bed.

3) Soft ground treatment such as sand drain pile and/or sand mat is required in order to construct the road.

4) In some portions, the drainage facilities must be designed to minimize effects from floods.

5) For the Tg. Priok Access, improvement of the existing road and the construction of two flyover bridges for the intersection is planned.

(2) Toll Levy System Alternatives

For the toll levy system, the following three alternatives were defined and compared in the subsequent part of the study.

Case - 1 : Flat tariff (open system) is applied to both Harbour Road and Jakarta Intra Urban Tollway, while another flat tariff is applied to Cengkareng Access.

Case - 2 : Distance proportional tariff (closed system) is applied to Harbour Road, Cengkareng Access and other regional freeways, while a flat tariff (open system) is applied to the Intra Urban Tollway.

Case - 3 : Single flat tariff (open system) is applied to Harbour Road, Cengkareng Access and Jakarta Intra Urban Tollway as well.

5. Construction Costs of the Project Road

(1) Construction Segment and Stage Construction

The project road is divided into twenty segments including the segment of Tg. Priok Access for purposes of the engineering study. These twenty segments are separated into four construction sections plus the Tg. Priok Access, as shown in Fig. 5.

With regard to the staged construction of the road, referring to the traffic forecast, some portion of pavement would be completed for four lanes out of six lanes initially, but the viaduct/bridge section would be constructed completely to its ultimate requirement.

The priorities for the construction sections have been studied based mainly on the traffic demand.

It has been concluded that the following priority should be established: - Section III, I, II and IV in that order.

(2) Implementation Schedule

For the construction of the Project Road, the stage construction method is adopted for the pavement, but not for the viaduct and bridges.

Two phases have been considered in the schedule, namely, Phase I and Phase II, where Phase II is the overlay and the pavement expansion from 4-lane width to 6-lane width.

In the schedule for Phase I, the initial implementation, three alternatives were considered, namely Case-A, Case-B, and Case-C, where in Case-A all work is completed by 1990 and in Case-B all work is completed by 1993 and in Case-C section I and II are combined and all work is completed by 1990 much more intensively than Case-A.

The implementation schedule Case-B is recommended as shown in Fig. 6 to avoid the influence caused by an intensive capital investment to a specific district.

(3) Construction Costs

The estimated construction costs (in 1980 prices) excluding land acquisition and compensation costs are as follows:

(in Million Rupiah)

Foreign Component	Local Component	Total	F.C. Ratio
91,588	84,140	175,728	52.1%

The above costs were estimated for an alternative toll levy system (Case 1). However, the cost difference for the other alternatives is not significant.

Fig. 5 Construction Segments & Sections

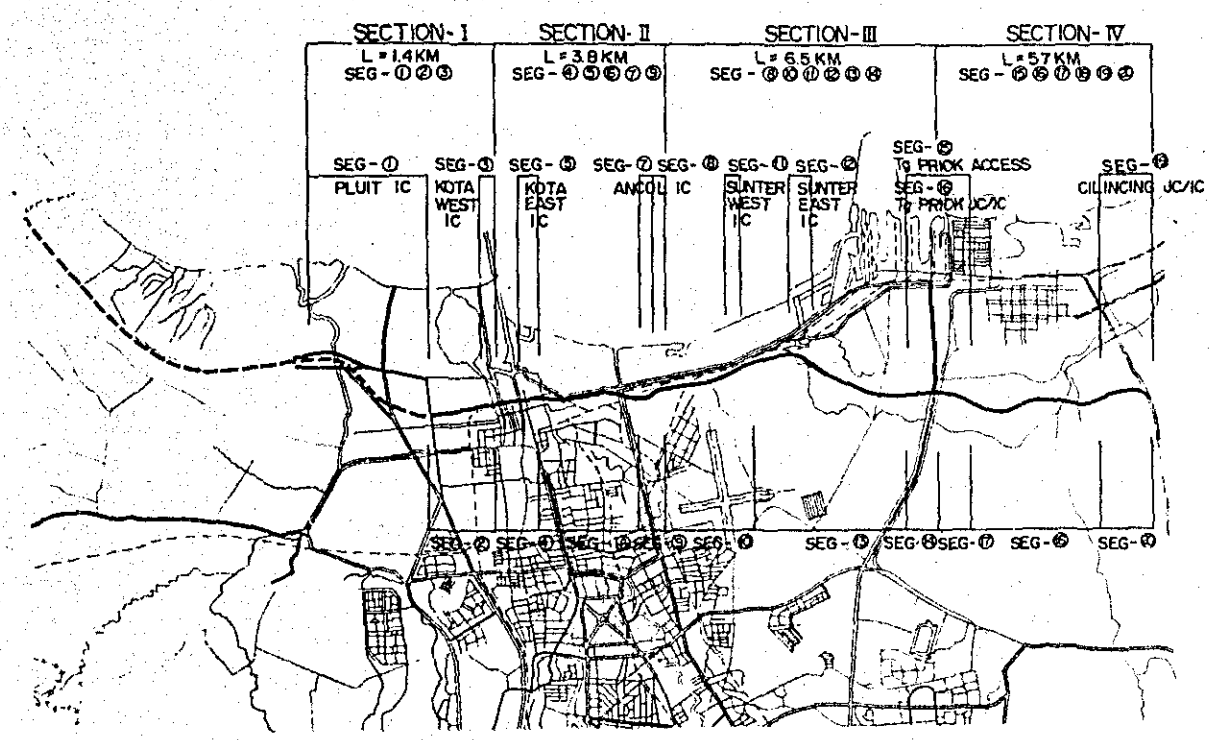


Fig. 6 Overall Implementation Schedule

CASE-B

CONST. SECTION	WORK ITEM	PHASE-I 1982	83	84	85	86	87	88	89	90	91	92	93	PHASE-II 98	99	2000
I	DETAIL DESIGN L=2.2(1.4)km															
	LAND ACQUISITION & COMPENSATION															
	CONSTRUCTION & SUPERVISION															
II	DETAIL DESIGN L=4.2(3.8)km															
	LAND ACQUISITION & COMPENSATION															
	CONSTRUCTION & SUPERVISION															
III	DETAIL DESIGN L=7.7(6.5)km															
	LAND ACQUISITION & COMPENSATION															
	CONSTRUCTION & SUPERVISION															
IV	DETAIL DESIGN L=9.0(5.7)km															
	LAND ACQUISITION & COMPENSATION															
	CONSTRUCTION & SUPERVISION															

Note: The figures in brackets show the length of the section and the figures without brackt show the converted length of the section including tampways.

The project costs have also been estimated with the escalation allowance using rates of 7% p.a. and 12% p.a. for the foreign currency portion and the local currency portion respectively, referring to the construction schedule and are as follows:

(in Million Rupiah)

Foreign Component	Local Component	Land Acq. Cost in Local Comp.	Total
156,314	301,958	98,171	458,272

The total project cost including price contingency and land acquisition is 458.3 billion Rupiah at current prices as shown above.

6. Economic Evaluation

With respect to the economic evaluation, the benefit-cost analyses including the calculation of internal rate of return for the project have been carried out based on the implementation schedule and the cost estimate made.

The analyses were carried out based on the alternative implementation schedules, Case-A and Case-B and also for the alternative cases for the toll levy system, namely Cases 1, 2 and 3.

The benefits were calculated for the vehicle operating cost savings (A) and the time cost savings (B). Since there is no established time value reflecting the Indonesian local conditions, the sensitivity analysis of time cost saving was carried out changing the value of time to calculate the benefit of time cost saving for only four cases namely, A, A+0.3B, A+0.5B and A+B.

If the benefits stand only for the operation cost saving (A) and the implementation schedule is Case-A, then the internal rates of returns (IRRs) become about 10 percent p.a. and the toll levy system Case 1 shows the highest value as indicated below for the alternative cases of the toll levy system.

	Case 1	Case 2	Case 3
IRR (%)	10.95	10.57	9.39

If the time cost savings (B) is added to the other benefits, then the sensitivity of the evaluation for Case 1 is as follows:

Benefits	IRR (%)
A	10.95
A+0.3B	15.11
A+0.5B	17.41
A+B	22.13

The results shown above indicate that even if the time cost savings is evaluated to be 30% of the original estimate, the IRR becomes over 15%.

The Project is, therefore, considered economically feasibile and the toll levy system Case 1 is recommended to be the most suitable from the economic point of view.

7. Financial Evaluation

With regard to the financial evaluation, the financial viability of the tollway operation of the Project Road was studied.

(1) Toll Levy System and Financial Rate of Return

The toll revenue has been calculated based on the conditions of the alternative toll levy systems, Case 1, 2 and 3, and also the traffic assignment results for the respective cases.

The total revenue collected from tollways of a flat tariff system has been allotted to the individual tollways proportionally to their assigned vehicle-kms.

Comparison of the revenue for the alternative cases indicated that Case 1 produced the highest revenue for Harbour Road and also for the total of three tollways, namely, Harbour Road, Intra Urban Tollway and Cengkareng Access.

The toll revenue was compared with the construction cost for the respective alternatives for a toll levy system, and the results are as shwon below:

Comparison of Project Cost and Revenue

Toll Levy Systems	Discounted at 10%			Discounted at 15%			Financial IRR (%)
	Revenue (10^6 Rp.)	Cost (10^6 Rp.)	R/C	Revenue (10^6 Rp.)	Cost (10^6 Rp)	R/C	
Case 1	450,858	323,607	1.4	155,122	201,240	0.8	12.8
Case 2	361,139	333,906	1.1	125,998	201,612	0.6	10.7
Case 3	406,800	313,087	1.3	139,722	196,602	0.7	12.1

As can be seen in the above table, Case 1 brings about the highest financial rate of return of 12.8% in the alternative cases.

(2) Repayment Program

The total required capital costs were divided into financial sources referring to on-going projects and other experiences in Indonesia. The repayment program was studied for the cases of financial conditions difined as follows:

1) The implementation schedule applies Case-A from 1982 to 1990, and price escalation rates of 7% p.a. for foreign currency portion and 12% p.a. for local currency portion were assumed.

2) Financial plan was assumed as shown in the table below:

	International Finance (Foreign Currency Portion)			Domestic Finance (Local Currency Portion)		
	Agency (A)	Agency (B)	Bond (A)	Bond (A)	Bond (B)	Government
Section I	F/E*+70%	30%	-	60%	-	F/E+L.A.**+40%
Section II	F/E +50%	30%	20%	40%	20%	F/E+L.A. +40%
Section III	F/E +70%	30%	-	60%	-	F/E+L.A. +40%
Section IV	F/E +50%	30%	20%	40%	20%	F/E+L.A. +40%

Notes: * Final engineering costs.
** Land acquisition/compensation costs and physical contingency of 15%.

3) Loan conditions and repayment methods for respective financial sources were as shown in the table below:

	International Finance (Foreign Currency Portion)			Domestic Finance (Local Currency Portion)		
	Agency (A)	Agency (B)	Bond (A)	Bond (A)	Bond (B)	Government**
Grace Period* (Yrs)	10	7	7	7	7	-
Interest Rate*** (% p.a.)	2.75	6.5	15.5	15.5	10.0	-
Repayment Method	20-year equal repayment of the principal	15-year equal repayment of the principal	10-year equal repayment of the principal and interest	10-year equal repayment of the principal and interest	15-year equal repayment of the principal	No repayment

Notes: * : For international financing agencies, a grace period is assumed to start from the year when a loan agreement is made between the borrower and the lender. The year of loan agreement is defined to be the year before the time when an actual capital requirement accures.

** : The amount which the Government finances for the Project is regarded as an investment or subsidy which does not require a return in the form of interest but tax.

*** : The interest is due even in the grace period.

4) The Government subrogates the interest repayment during the grace periods for the international loans.

5) The Government subsidizes the capital investment for Phase II construction.

6) 30% tax is imposed on annual profit after annual redemption of loans and bonds.

7) An interest rate of temporary loan is 13.5% p.a.

The alternative conditions for the financial analysis of the Project have been studied and the results were presented in section 12.2 of this report. The above set of conditions is equivalent to Case 14 in the report which is considered to be one of the most likely cases and within the range of practicality.

The results of the financial analysis were as follows:

a) The proportion of soft loan (interest rate of 2.75% p.a.) accounts for 58% or about 90 billion Rupiah at current prices of the total international finance and the proportion of Government investment (excluding land acquisition/compensation and physical contingency) accounts for 28% or 84 billion Rupiah at current prices of the total domestic finance.

   The proportion of soft loan is realistic and practical based on the experiences in Indonesia.

b) The maximum temporary loan amounts to 160 billion Rupiah at current prices in 1994, which can be equivalent to 32.7 billion Rupiah at 1980 present value using a discount rate of 12% p.a.

   The maximum temporary loan is not so large and it comes in the 4th year after operations, so that the burden of the temporary loan will be diminished at an early stage.

c) The break-even point (the first year of accumulated surplus) is attained in 2003, 13 years after the commencement of tollway operations.

   This is not considered a long period for such public works.

d) The accumulated Government's income from the tax is nearly equal to the total of Government expenditure (including the investment to the Phase II construction but excluding land acquisition costs) in terms of 1980 present value.

e) The total accumulated net profit for the operating body and accumulated Government income from tax amounts to 82% of the initial investment costs excluding land acquisition costs in terms of 1980 present value.

The results of the financial case studies indicate that the introduction of higher proportion of soft loan and/or the equity financed in the pre-operation period would help the operating body greatly to attain the break-even point and to establish a sound financial condition as early as possible.

8. Conclusions and Recommendations

1) The Project is considered technically feasible with a scope including the preparation of a 6-lane and partial 4-lane tollway 17.4 km long including a 3.3 km viaduct.

2) The Project is considered economically feasible anticipating over 17% p.a. internal rate of return to the development of economy in DKI Jakarta and Indonesia as a whole.

3) The Project is financially viable based on appropriate arrangements for soft loan and the application of toll rate at 400 Rupiah/sedan-trip at 1980 prices.

4) Inclusion of the Project Road as a component of the urban tollway system has been established as a result of the study and a flat tariff applied to both Harbour Road and Jakarta Intra Urban Tollway is recommended for the toll levy system eventually.

5) Aside from the tollway construction of Jakarta Harbour Road, Tg. Priok Access is recommended to be planned as an improvement of the arterial street.

   It was planned to be 6 lanes with frontage roads including two flyover bridges for the existing intersections.

6) In order to reduce the initial investment costs it is recommended that staged construction be adopted for pavement width, overlay and grade separation of Ancol Intersection.

7) A comparison was made for the implementation schedules, considering various alternatives: Case-A (from 1982 to 1990), Case-B (from 1983 to 1993) and Case-C (from 1982 to 1990). Case-B is recommended in order to avoid the intensive capital investment in the specific district and to encourage the development of the Project Corridor.

   In addition, the cost difference between Cases-A, B and C does not sensitively influence the financial viability of the Project.

8) The required land for the Project Road should be acquired by the Government at an early stage in the preparation for the Project.

9) One of the major sensitive factors affecting the financial condition of the tollway operation is the loan conditions from financial sources. It is imperative, therefore, to apply long term loans with a lower rate of interest to the Project financing as much as possible.

10) Since the Project Road functions as an urban trunk road, the study of this Project should be carefully reviewed prior to the Project execution in order to cope with future changes in the development of the Project area.

TABLE OF CONTENTS

FEASIBILITY STUDY ON JAKARTA HARBOUR ROAD
FINAL REPORT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 6:

CHAPTER 7:

CHAPTER 13:

CHAPTER 1

INTRODUCTION

Chapter 1 INTRODUCTION

1.1 Background of the Study

1.1.1 General

The Government of Japan, in compliance with the request of the Government of the Republic of Indonesia, has agreed to undertake a Feasibility Study for the Jakarta Harbour Road Project.

Based on this decision, the Japan International Cooperation Agency (hereinafter called "JICA"), an official agency responsible for the execution of the technical cooperation programs of the Japanese Government, was assigned to carry out the Study.

In February 1980, JICA despatched a mission headed by Mr.Ichiro TANAHASHI to Jakarta for the preliminary survey as well as discussion on the scope of work of the forthcoming feasibility study.

Following this process, the JICA Study Team, headed by Mr. Nobuwaka YAMAKAWA mobilized to Jakarta on August 20, 1980 together with the Japanese Supervisory Committee for the Study. The Team commenced their activities after the submission of the Inception Report. Meetings with the Indonesian government were held in order to confirm the scope of work agreed upon by both the Government of Indonesia and the Government of Japan and to discuss the schedule for the Study.

The Team carried out their activities with Indonesian counterparts and prepared a Progress Report in November, 1980 and the Interim Report in March, 1981.

The Team continued the study in Japan and completed the Summary Draft Final Report in June 1981, a Draft Final Report of the Study in August, 1981. The final Report is now being issued in October 1981.

1.1.2 Necessity for the Study

Jakarta City the capital of Indonesia had a area of 650 square kilometers in 1980, which is about 0.03 percent of the total land area of the Republic of Indonesia.

The population of Jakarta City was six million in 1980 and its population growth is at a very high rate of 5.0 percent per annum compared with the national average of 2.3 percent per annum.

The rapid population growth in Jakarta from migration is considered to be due to greater opportunity for employment and to higher levels of cultural and educational facilities.

CHAPTER 2

OUTLINE OF THE STUDY AREA

Chapter 2 OUTLINE OF THE STUDY AREA AND PROJECT ROAD

2.1 Physical and Socio-economic Conditions

2.1.1 Physical Conditions

(1) Geography

The Study area is situated in the northwest region of Java Island, and its northern side facing the Java Sea is a flat plain. Towards the south it gradually rises to form the Prancak Plateau, from which many rivers flow to the sea forming an alluvial plain of very wide rice fields.

Jakarta City is situated near the Equator, being 6° in the south latitude and 107° in the east longitude. It is located partly on the alluvial plain at the mouth of the Chiliwung River and partly on the diluvium plateau of the southern Jakarta.

Since the 17th century, the river banks have been constructed or improved and canals excavated to keep the river flowing smoothly.

(2) Climate

The climate is described as tropical. Average monthly temperature varies only from 26.2°C to 27.4°C and the hourly fluctuation is much greater than that during the month.

The average yearly rainfall varies from about 2,000 mm near the coast to about 4,000 mm in the mountains. The greater part (approx. 80%) of the yearly rainfall takes place during the wet season, generally from November 1 until May 31, with predominantly north-westerly winds. January, generally is the wettest month with about 25% of the annual precipitation. The five months of the dry season, with predominantly north-easterly winds, are characterized by long dry spells, with the month of August on an average, receiving the minimum monthly rainfall (±3.5% of the yearly total).

The rainfall is characterized by high intensities and low occurrence probability, or in other words: heavy storms interspaced with long dry periods even in the wet season. The very high rainfall intensities during thunderstorms often are sharply localized. It has been observed that rainfall is generally concentrated in the afternoons and evenings, with 60 to 80% falling between 14:00 and 21:00 hours at some stations.

(3) Hydrological Situation in the Project Area

Starting from Mt. Pangrunggo (3,019 m) in the southern range, the Ciliwung River and several other rivers flow into the Java Sea affecting the project area.

According to the historical trend, once every two years a flood occurs, when rainfall exceeds 115 mm per day. The reasons for the floods are as follows:

1) Compared with the size of the catchment area and the rainfall volume, the discharge capacity of the rivers is quite small.

2) River slopes are very flat and the rivers meander.

3) Each river is affected by tidal rises at the river-mouth.

This flooding problem in DKI Jakarta is common at a river mouth in an alluvium plain. Therefore, related rivers and canals to the Project Road are developed requiring river bank improvement within the city area. The discharge capacities, however, are greatly hindered in the suburbs by the meandering nature of the rivers.

2.1.2 Population and Employment Situation

(1) Administrative Regency in DKI Jakarta

DKI Jakarta is the capital of the Republic of Indonesia and the center of social and economic activities for the country.

It is divided into 5 wilayah (cities) and these cities are further divided into 30 Kecamatan which are in turn subdivided into 237 Kelurahan.

(2) Population

DKI Jakarta had a population of 6.1 million in 1978 which is 4.5% of the national figure. The growth rate of population for DKI Jakarta is about 3.5% per annum where 1.5% is considered to be brought about by the migration into Jakarta. The rate of growth for the nation was 1.9% per annum between 1973 and 1978. The gross population density shows a high rate of 95 persons per hectare, which is about 134 times higher than that of the nation.

During the years 1973 to 1978, the population growth rates for BoTaBek (Kabupatens of Bogor, Tangerang and Bekasi, and Kotamadya Bogor) and JaBoTaBek (DKI Jakarta and BoTaBek) were recorded to be 2.2%/yr. and 3.2%/yr.

Table 2.1 Population Development in DKI Jakarta

YEAR	AREA 1/ (KM^2)	CENSUS POPULATION 2/ (1,000 Persons)	ADJUSTED POPULATION 3/ (1,000 Persons)	GROWTH RATE (%/Yr.)	DENSITY 4/ (Persons/Ha)
1973	576.41	4,973	5,142	-	80.1
1974	578.41	5,183	5,336	3.8	83.1
1975	578.41	5,404	5,554	9.1	86.5
1976	682.23	5,702	5,856	5.4	91.2
1977	637.10	5,925	5,959	1.8	92.8
1978	642.06	6,082	6,094	2.3	94.9

Notes: 1/ "Statistical Year Book of DKI Jakarta, 1974-1979".

2/ "Statistical Year Book of DKI Jakarta, 1974-1979".

3/ The population added to DKI Jakarta by border change is taken from data provided by DKI Municipal Office, and the census population for each year is adjusted for the population figure for the city limits in 1978.

4/ Adjusted Population/Area (1978).

Table 2.2 Population in Indonesia and DKI Jakarta

	1973	1974	1975	1976	1977	1978
Population in Indonesia (in mil)	124.6 (95.4)	127.6 (97.7)	130.6 (100)	131.9 (102.5)	133.9 (102.5)	136.6 (104.6)
Population* In DKI Jakarta (in thousand)	5,142 (92.6)	5,336 (96.1)	5,554 (100)	5,856 (105.4)	5,959 (107.3)	6,094 (109.7)

Source: Statistical Year Book of Indonesia, 1973 - 1978. Biro Pusat Statistik, Jakarta

Note *: Population in DKI Jakarta is adjusted to the present DKI administrative boundary

Table 2.3 Area and Population Density in Indonesia and DKI Jakarta, 1978

	Indonesia	DKI Jakarta
Population (x 10^3)	136,631 (100)	6,094 (4.5)
Area (KM^2)	1,919,443 (100)	642 (0.03)
Population Density (persons/KM^2)	71 (100)	9,492 (134)

(3) Employment Situation

According to "Sensus Penduduk, 1971", the economically active population is defined as:

> "the portion of population of 10 years of age and over excluding students, home-makers, income recepients, etc."

At the same time, occupations are classified into nine categories and they are grouped into three sectors as in the following table.

Sectoral Classification of Occupations

Classification of Occupations in "SENSUS PENDUDUK, 1971"	Classification
Agriculture	I
Mining and Quarrying	II
Manufacturing	II
Electricity, Gas and Water	III
Construction	II
Trade, Restaurant and Hotels	III
Transport, Storage and Communication	III
Financing, Insurance, etc.	III
Activity not adequately defined	III

The employment activity rate*) and industrial classification found in "Labour Force Situation in Indonesia, 1977". Biro Pusat Statistik, 1979" are listed in the table.

Note: *) Employment Activity Rate: The rate between the employed population and residential population.

Table 2.4 Employment Activity Rate by "Labour Force Situation in Indonesia, 1977"

(unit: %)

	DKI	BoTaBek	JaBoTaBek
Employment Activity Rate	25.9	32.0	28.5
Sector I	1.3	67.0	32.7
Sector II	22.3	25.0	24.0
Sector III	76.4	7.2	43.3

The existing employment rate *)-1 and the sectoral composition of the employed population was estimated based on figures adopted by "JMDP" - "EXISTING EMPLOYMENT AT THE KECAMATAN (ZONE) LEVEL IN BOTABEK, 1978". Because, the analysis of Home Interview survey conducted by the Study Team in November, 1980 showed a very similar rate of employment, 32.09%, in comparison with 31.11% of "JMDP" in 1978.

Table 2.5 "Existing Employment at the Kecamatan Level in Botabek, 1978" ("JMDP")

	DKI JAKARTA	BOTABEK	JABOTABEK
Rate of Employment 1/	31.1	29.4	27.4
Sector I 2/	3.0	61.4	28.9
Sector II 3/	97.0	38.6	76.4
Sector III 4/			

Note: 1/ Employed population/Residential population

2/ In "JMDP", refered as Agriculture and Mining

3/ In "JMDP", as refered as Large & Medium/Small & cottage Manufacturing Industry

4/ In "JMDP", refered as Government/Trade, Services others.

2.1.3 Economic Development and Car-ownership

(1) Economic Development

DKI Jakarta shows a Rp 281,000 per capita income, which is more than twofold the national average of Rp 137,000.

Real growth of the economy in DKI Jakarta has developed at a high rate of 10.2% p.a. and nominal growth is about 29.2% p.a., while real growth of the national economy is 6.8% p.a.

Table 2.6 Economic Development in DKI Jakarta

	1975	1976	1977	1978	1979
Regional Income 1/ (in Billion Rupiah)	880	1,180	1,446	1,645	2,449
Per capita income 1/ (in thousand Rupiah)	166	213	249	281	392
Gross Regional Domestic Product 2/ (in Billion Rupiah)	1,037 (100%)	1,152 (100%)	1,260 (100%)	1,344 (100%)	1,527 (100%)
1. Agriculture	(2.09)	(1.52)	(2.23)	(1.94)	(1.73)
2. Mining and Quarrying	-	-	-	-	-
3. Manufacturing	(11.12)	(13.23)	(12.38)	(11.91)	(12.40)
4. Construction	(4.42)	(4.98)	(5.18)	(5.38)	(5.25)
5. Electricity, Gas & Sanitary water	(1.81)	(1.55)	(1.59)	(2.53)	(2.67)
6. Transport & Communication	(7.58)	(7.71)	(7.53)	(7.51)	(7.93)
7. Wholesale & Retail Trade	(47.76)	(48.81)	(48.17)	(48.35)	(46.95)
8. Banking & Other Financial Institution	(9.13)	(6.98)	(7.80)	(7.72)	(8.45)
9. Ownership of Dwellings	(2.89)	(2.74)	(2.61)	(2.51)	(2.28)
10. Public Administration	(10.16)	(9.50)	(9.64)	(9.24)	(9.28)
11. Services	(3.04)	(2.95)	(2.87)	(2.89)	(2.52)

Source: Regional Income of Jakarta 1975-1979, Jakarta Statistical office.

Note: 1/ at current prices

2/ at 1975 constant prices

The Characteristics of industrial sectors of the gross regional domestic product (GRDP) in DKI Jakarta are as follows:

1) Sector of wholesale and retail trade is, creeping a share of 47 to 48% of GRDP.

2) Sector of manufacturing has been fluctuating between 11% and 13% of GRDP.

3) Sector of construction accounts for about 5% of GRDP. shows gradual increase but 1979.

4) Agricaltural sector occupies only 2% of GRDP and tends to decline.

Table 2.7 Economic Development in Indonesia

	1973	1974	1975	1976	1977	1978
GDP 1/ (in Billion Rp)	6,753 (88.5)	7,269 (95.3)	7,631 (100)	8,156 (106.9)	8,761 (114.8)	9,392 (123.1)
National Income 1/ (in Billion Rp)	5,740 (89.6)	6,076 (94.9)	6,404 (100)	6,860 (107.1)	7,343 (114.7)	7,839 (122.4)
Per Capita Income 1/ (in Rp)	46,073 (94.0)	47,616 (97.1)	49,035 (100)	52,009 (106.1)	54,835 (144.9)	57,375 (165.9)
Per Capita Income at current prices	46,073 (56.0)	70,987 (86.3)	82,280 (100)	101,120 (122.9)	119,223 (144.9)	136,509 (165.9)
Export (x1000 tons)	77,763 (106.2)	80,892 (110.5)	73,215 (100)	83,722 (114.4)	95,302 (130.2)	101,267 (138.3)
F.O.B. value in million US $	3,211	7,421	7,103	8,547	10,853	11,643
Import (x1000 tons)	9,954 (95.7)	10,458 (100.6)	10,397 (100)	12,056 (116.0)	13,925 (133.9)	13,349 (128.4)
C.I.F. value in million US $	2,729	3,842	4,770	5,673	6,230	6,690

Note: Figures in parentheses show index over the year 1975.

1/ at 1973 constant prices

Sourse: STATISTICAL YEARBOOK OF INDONESIA - Biro Pusat Statistik, Jakarta

(2) Car-Ownership

In DKI Jakarta, about 700 thousand motor vehicles were registered in 1979, of which about 60% are motorcycles and 30% sedans, while in Indonesia 70% of the vehicles are motorcycles and about 20% sedans. The annual growth rates of registered motor vehicles are 8.4% and 14.8% on an average in DKI Jakarta and in Indonesia respectively.

The rates of car ownership are 104 and 21 vehicles per one thousand persons, while in Japan the rate is about 300 including motorcycles. The rates of sedan ownership are 31.3 and 3.9 per one thousand persons in DKI Jakarta and Indonesia respectively, while in Japan the rate is 185.

Table 2.8 Number of Registered Motor Vehicles

		INDONESIA	DKI JAKARTA	WEST JAVA
1977	Total	2,511,367	583,716	355,332
	Sedan	479,335	177,847	85,941
	Bus	48,089	13,444	4,701
	Truck	278,979	52,791	50,559
	Motorcycle	1,704,964	339,634	214,131
	Car-ownership Rate	18.7	98.0	14.6
1978	Total	2,882,559	635,575	403,461
	Sedan	532,299	190,566	96,774
	Bus	58,365	17,132	6,100
	Truck	331,658	58,449	59,226
	Motorcycle	1,960,237	369,428	241,361
	Car-ownership Rate	21.1	104.3	16.3
1979	Total	3,181,874	692,817	-
	Sedan	-	202,781	-
	Bus	-	21,655	-
	Truck	-	64,713	-
	Motorcycle	-	403,668	-
	Car-ownership Rate	-	111.0	-

Source: VEHICLES AND LENGTH OF ROAD STATISTICS, 1979 - Biro Pusat Statistik, Jakarta

Note *: Car-ownership per 1000 persons

Table 2.9 Economic Development & Car-Ownership in DKI Jakarta

	1970	1971	1972	1973	1974	1975	1976
Residential Pop. 1/ (1,000 Persons)	4,299	4,559	4,766	4,973	5,183	5,404	5,745
2/ Per Capita Regional income at 1969 Price (1,000 Rp)	46.0	48.0	50.1	54.1	57.7	62.2	63.0
3/ Car-Ownership (1,000 Vehicles) (%)							
Sedan	86.1 (39)	95.1 (38)	103.2 (36)	113.5 (34)	131.6 (32)	152.5 (31)	170.3 (31)
Truck	19.7 (9)	21.9 (9)	24.9 (9)	29.0 (9)	37.4 (9)	44.7 (9)	48.4 (9)
Bus	5.0 (2)	5.8 (2)	6.7 (2)	7.6 (2)	8.6 (2)	9.8 (2)	11.0 (2)
Sub-Total	110.8	122.8	134.8	150.1	177.6	207.0	229.7
Motorcycle	111.0 (50)	129.5 (51)	153.1 (53)	186.3 (55)	237.1 (57)	281.7 (58)	313.6 (58)
Total	221.8 (100)	252.3 (100)	287.9 (100)	336.4 (100)	414.7 (100)	488.7 (100)	543.2 (100)
Car-ownership Rate 4/	51.6	55.3	60.4	67.6	80.0	90.4	94.6

Source: 1/, 2/ "Regional Income of Jakarta, 1969-1976", Census and Statistical Office, Jakarta

3/ "Statistical Year Book of Jakarta, 1978", Census and Statistical Office, Jakarta

Note: 4/ Motor vehicles per 1000 persons

2.1.4 Present Landuse in DKI Jakarta

The landuse map prepared by the DKI Office, "DAERAH KHUSUS IBUKOTA JAKARTA 1973, SCALA 1:20,000", is now in the process of being updated based on recent aerial photography. An intermediate product titled "DINAS TATA KOTA, SCALA 1:5,000" was provided by the DKI Office. A new landuse map was produced from the above two maps reclassifying the landuses for the purpose of the later study, "Zonal Planning Parameters". The landuse at present is measured thereon.

Table 2.10 DKI Jakarta Landuse, 1977

(Unit: Ha)

Landuse Measured on Maps of "DAERAH KHUSUS IBUKOTA JAKARTA by DINAS TATAKOTA"		LANDUSE CLASSIFIED FOR ALLOCATION OF ZONAL PLANNING PARAMETERS	
LANDUSE	AREA	LANDUSE	AREA
Commercial Mixed Use Public Facilities	784 858 1,854	Commercial/ Administrative	3,496
Ware House Manufacturing	246 1,297	Industrial	1,543
Residential	19,899	Residential outside Kampungs Kampungs	12,061 7,838
Green Recreational Lake, Swamp	39,380 211 877	Agricultural Green	28,101 12,367
Total	65,406	Total	65,406

Commercial and administrative areas in 1977 amount to about 5.4% of the total DKI Jakarta area and they are concentrated in the Central Business District (CBD). Elsewhere, they are now beginning to appear along major arterials, Jl. Gatot Subroto, Jl. Sudirman, Jakarta By-Pass etc. along major regional highways, Jakarta-Tangerang, Jakarta-Bogor, Jakarta-Bekasi etc. and in the peripheral areas along the future Outer Ring Road.

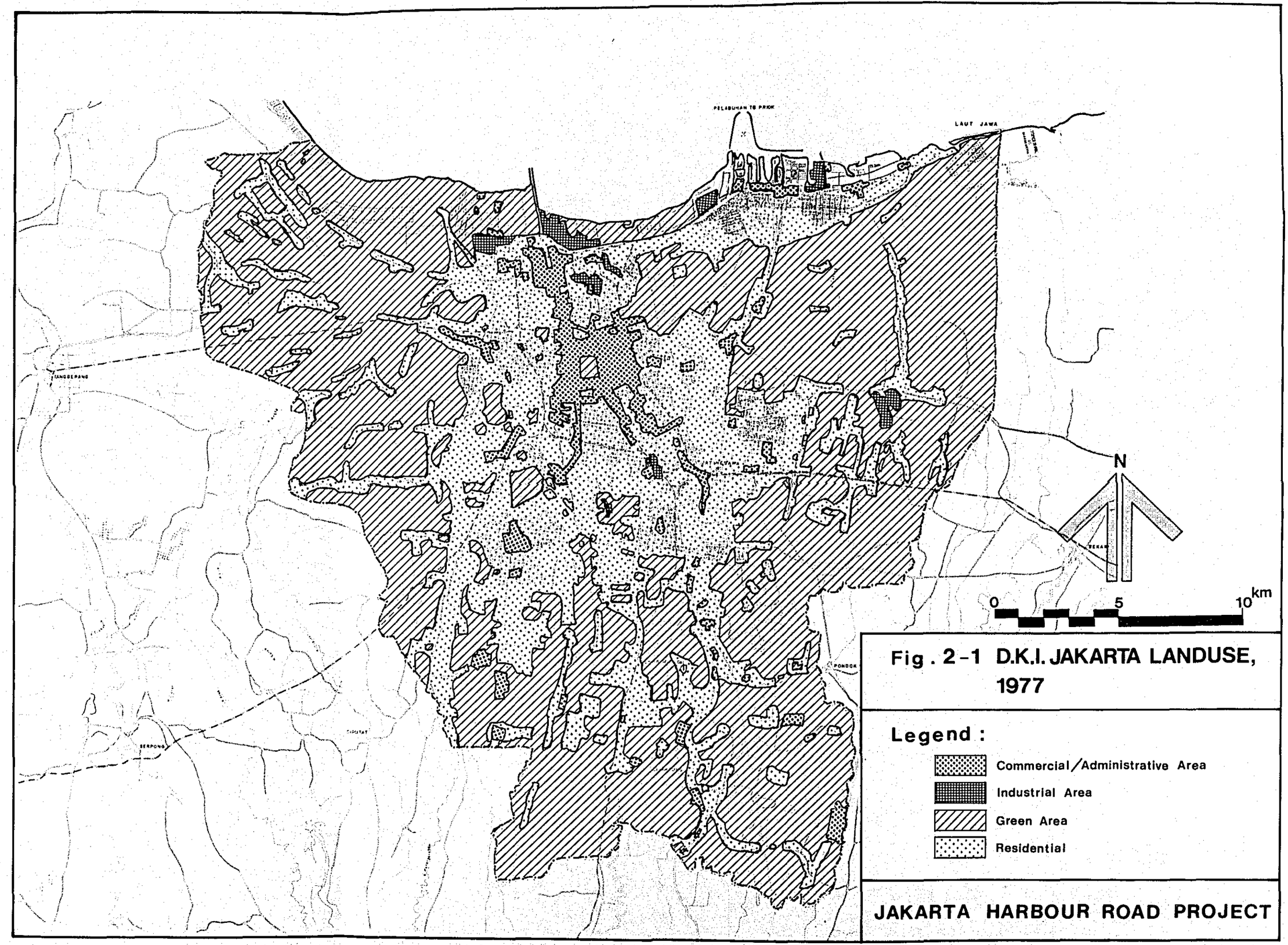


Fig. 2-1 D.K.I. JAKARTA LANDUSE, 1977

Legend :

- Commercial/Administrative Area
- Industrial Area
- Green Area
- Residential

JAKARTA HARBOUR ROAD PROJECT

Industrial areas, 2.4% in 1977, are concentrated mostly in Pulogadung, east of the city center. Areas for various light industries without obnoxious effects on the surrounding areas are planned around interchanges of the Outer Ring Road and radial highways such as Jakarta-Tangerang, Jakarta-Bogor and Jakarta Bekasi. Residential areas, 30.4% in 1977, penetrated mostly into the underdeveloped rural areas in the west and the south-west directions. They are also being developed massively in the east around the future industrial complexes. But still, for the moment, green or agricultural areas are predominant outside of a 10Km radius from the city center.

2.2 Existing Conditions in the Project Area

2.2.1 General Description in the Direct Influence Area

The Project Road is planned to extend from the eastern end of the Cengkareng Access to the junction with the future Jakarta Ring Road in Kecamatan Cilincing.

In an early period of the Study, the Team completed a reconnaissance in and around the Project Corridor in order to observe general features of the Project Area and to obtain general and specific information about the area for a later study.

The area covers seven (7) Kecamatans or fifteen (15) Kelurahans as listed below:

	Kecamatan	Kelurahan
(1)	Penjaringan	- Penjagalan - Penjaringan
(2)	Tambora	- Pekojan & Malaka
(3)	Taman Sari	- Pinangsia
(4)	Penjaringan	- Mangga Dua Utara - Pademangan Barat - Pademangan Timur
(5)	Tanjung Priok	- Sunter - Pepanggo & Sungai-Bambu - Kebon Bawang
(6)	Koja	- Rawa-Badak - Tugu
(7)	Cilincing	- Semper

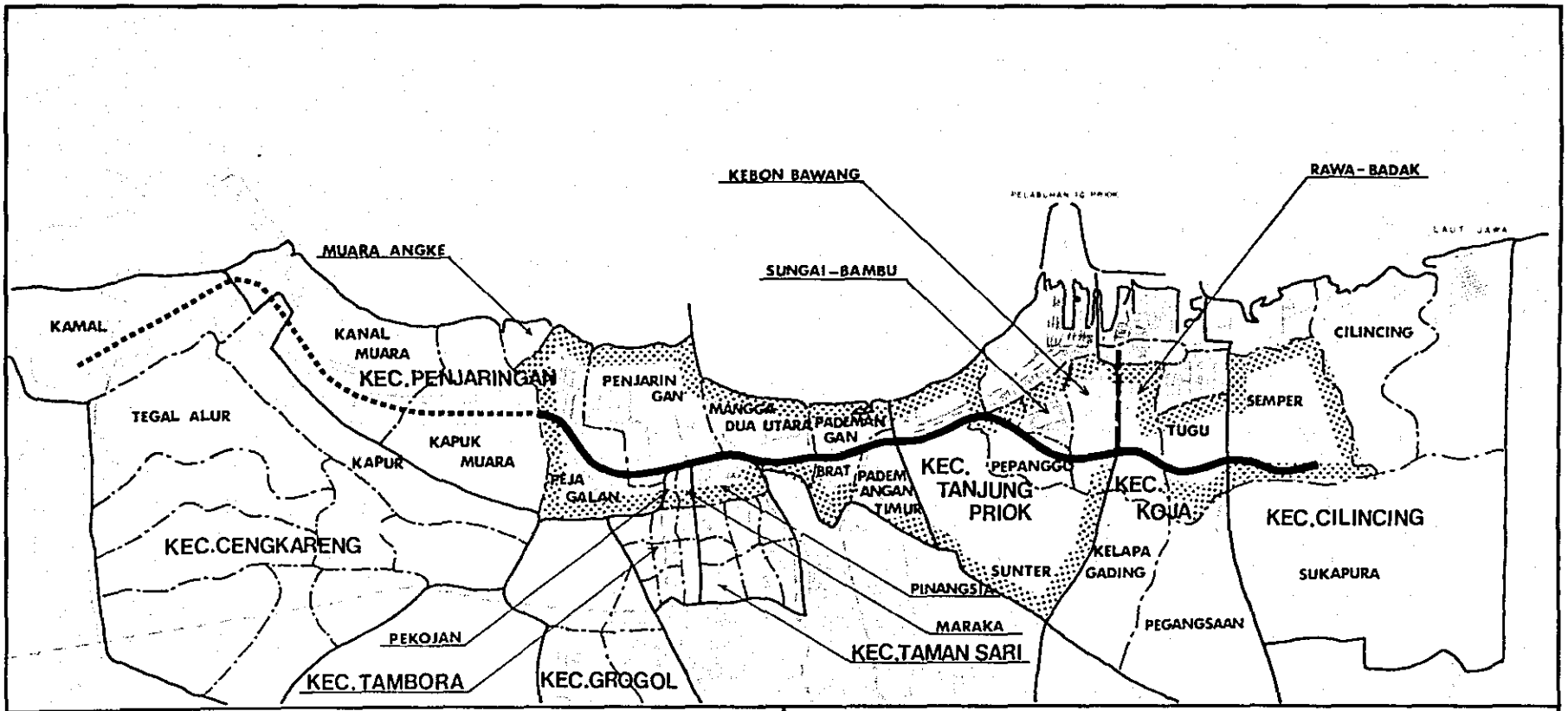


Fig.2.2 DIRECT INFLUENCE AREA AND KELURAHANS

JAKARTA HARBOUR ROAD PROJECT

Legend :

- Harbour Road
- Cengkareng Acces
- Tg.Priok Access
- Kecamatan Boundary
- Kelurahan Boundary
- Direct Influence Area

(1) Kecamatan Penjaringan

Kel. Penjagalan Teluk Gong existed as a fish pond in the past and was recently developed intensively as a residential area for low to middle income families. Along Jl. Teluk Gong, commercial and industrial complexes such as glass, plywood, tableware, sandals, plastic, steel processing and warehouses are located.

The Jembatan Tiga area was intentionally developed for warehouses and industries such as food processing (incl. coconut oil), printing, manufacturing (watches, clothes, steel, plastics), chemical, car assembly and oil refining.

Kel. Penjaringan This area is mainly divided into three sections, Pluit residential area in the west, Pulit reservoir in the north-east and a squatter area in the south.

The Pluit residential area was intensively developed for middle to high income families. The street network is well planned.

The squatter area located between Jl. Pluit and Jl. Bandungan Utara is expected to be re-developed. In the southern part of the area especially many warehouses are concentrated in a partly swampy area without appropriate access roads.

Along Jl. Bandungan Utara many complexes, such as steel processing, warehouses, plastic factories, elementary schools and a hospital are located.

In the area between Jl. Pluit Selatan and Jl. Pluit many warehouses and industries are located such as manufacturing (soap, radio and electronics, rubber, plastics), food (bread), automobile, repairs.

(2) Kecametan Tambora

Kel. Pekojan & Malaka The Pekojan area is characterised as the mixed area of residential, commercial and industrial areas. Many warehouses, industries and offices are located along Jl. Bandungan Utara/Selatan, Gedung Panjang and Raya Penjagalan as well as along narrow roads inside the area.

Kel. Malaka is also a mixed area. In the area between Jl. Nelayan and Jl. Kopi, significant warehouses are concentrated, although many offices in the area are also located along Jl. Tiang Bendera.

Big Banks and Offices are integrated along Jl. Besar Barat.

(3) Kecamatan Taman Sari

Kel. Pinangsia Kel. Pinangsia is a commercial area with PJKA Kota station in the center of the area. There are many buildings constructed before 1945. Many of these buildings are utilized for banks, offices and also a museum.

Jl. Pangeran Jayakarta is a four lane road with median strip. All railway crossings are at-grade in this area.

(4) Kecamatan Penjaringan

Kel. Mangga Dua Utara More than half of the residential area located at the north-eastern part has been developed for high class residents. The street network is well planned and constructed.

There are many large factories in the industrial area.

Sunda Kelapa is located at the north western end of the industrial area. This port is utilized for inter-island transportation by small ships. Cargo handled in the port is mostly lumber from Kalimantan.

Traffic congestion is severe at two intersections crossing Jl. Pakin, Jl. Tongkol, Jl. Lodan and Maritim Raya from Sunda Kelapa.

Kel. Pademangan Barat This area is divided into districts by the Ancol Canal, Ancol in the north and Kampung in the south.

There is an army complex in the west and a youth hostel in the north of the Kampung.

Traffic congestion is severe at the Ancol intersection of Jl. Gunung Sahari Ancol and Jl. Laks. R.E. Martadinata.

Kel. Pademangan Timur This area is classified as a residential area. Kemayoran airport is located in the south-east. Fish ponds still remain and many schools were recently constructed together to the north of the airport.

(5) Kecamatan Tanjung Prick

Kel. Sunter This area is divided into three parts, Ancol residential area and Jakarta Fair in the north, and fish pond in the south-east and residential area in the south-west.

Sunter area is expected to be a residential, commercial and industrial area and Jl. A (Kopelapip) is connected to Jl. Laks. R.E. Martadinata.

The residential area located east of the airport was affected by the floods and even after the construction of Kali Sunter, there are still some flood problems.

Kel. Pepanggo This area is located at the western end of the residential area influenced by Tg. Priok and consists mostly of fish ponds. The development speed for residential purposes is slow because of the unsuitable location.

Kel. Sungai Bambu The area is classified as the residential area for low to middle class families. The road system is formed on a grid pattern. These roads were constructed with a wall or ditch on both sides at 1 m height above the fish pond ground. The width of the roads is mostly less than 3 m.

Kel. Kebon Bawang The area is divided into two parts, residential area in the north and industiral area in the south. The industrial area is developing mainly for car industries as a part of sunter development plan. The intersection of Jl. Enam and Bambu Raya functions as a community center with a pasar and a cinema.

(6) Kecamatan Koja

Kel. Rawa Badak This area is divided into two parts by a transmission line located in the center, with a residential area in the north and Kampung in the south.

In the northen area a new residential area (Perumahan Nyiur-Melambai) is developed for middle class residents.

P.T. Pertamina and a transformer (Gardu Induk Plumpang) are located along Jakarta By-Pass.

Kel. Tugu This area is divided into two parts by Jl. Plumpang Semper running from west to east. Residential area and rice paddy fields are located in the north and kampung and rice paddy fields are located in the south.

In the northern part, a residential area for Tg. Priok workers has been constructed and a new housing complex is under construction.

(7) Kecamatan Cilincing

Kel. Semper The area is composed of two areas divided by Jakarta Ring Road running from north to south.

A residential area and rice paddy field are located in the west and a industrial area, grassland and rice paddy field in the east.

The industrial area in the east is composed of steel works (P.T. Budi Dharma Jakarta), car-repairing, paint, warehouses and factories.

The arterial streets in the area consist of three main lines running to four directions from the Tugak intersection. The width of these roads is 6-7 meters. There is Progadung Warehouse located in the south of Kel. Semper.

Further information above the Direct Influence Area including the area of the planned Cengkareng Access is introduced in the Progress Report on page 1-10.

2.2.2 Existing Road and Traffic Conditions along the Project Corridor

The Project Area includes a variety of landuse and historical background.

Kota district, in the West of Project Area, is an old city of Jakarta having been developed during the "Batavia" Era as a hinterland area for the ancient seaport "Senda Kelapa" and as a center of wholesale and retail trading. There exist resident, warehouses, trading companies, financial and business offices. The street network is very complicated and passes through a dense area. Lack of parking space causes a heavy traffic congestion in the district.

Cargo movements are the most vital problem for those people but a narrow and complicated street network hinder such movements as from seaport to warehouse, warehouse to market, etc.

Major traffic generating facilities along the Project Area are Tg. Priok Port, Ancol recreation area, Senda Kelapa Port and Kota district as well. Furthermore, development of new industrial complexes, residential complexes, seaport improvement plans, etc. are either in progress or being planned for this Project Area.

Only one trunk road exists in this east-west Corridor, namely Jl. Martadinata with a carriageway width of 5.5 m and a shoulder of 1.5 m wide for two-way traffic.

The composition of truck traffic on this road is more than 20% and that of motorcycle is more than 35%. The traffic volume in a 12-hour period from 6:00 in the morning to 6:00 in the evening exceeds 15,000 motor vehicles. Mixed traffic and a large number of trucks are producing significant delay in realization of potential socio-economic development in the Project Area.

Ancol Canal and the railway line from Kampung Bandan to Tg. Priok enclose the existing Jl. Martadinata on both sides and therefore, there is a little space for widening the road.

Inventory of existing roads in the Project Area are listed in Table 2.11 together with their locations in Fig. 2.3.

Hourly fluctuation of traffic volume in Jl. Martadinata and Jakarta Bypass is presented in Fig. 2.4. A peak-hour ratio for all vehicles in the 12-hour traffic (6:00 a.m. - 6:00 p.m.) falls in between 10% to 12% for Jl. Martadinata and more than 12% for the intersection with Jl. Suprapto. The shape of hourly fluctuation on the intersection with Jl. Suprapto reveals a conspicuous pattern that concentrates the traffic toward Tg. Priok in the morning and in the opposite direction in the evening.

Cross-sectional traffic volume and the vehicle composition ratios during a 12-hour survey 6:00 a.m. - 6:00 p.m. on major roads in the Project Area is presented in Fig. 2.5.

Fig. 2.3 Major Roads in the Project Area

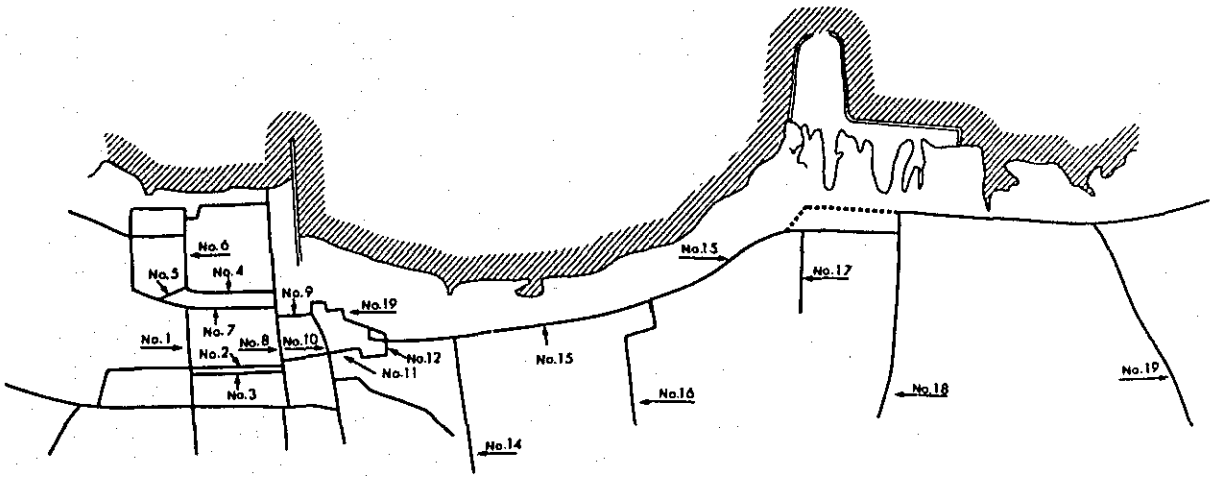


Table 2.11 Inventory of Existing Roads

NAME OF ROAD	CARRIAGEWAY (M)	MEDIAN (M)	SHOULDER (M)	SIDE WALK (M)	TYPE OF PAVEMENT
1. Jl. Jembatan Tiga	2 @ 7.0	Separated by Cannal	1.0	-	Asphalt pavement
2. Jl. Bandengan Utara	10.5	"	1.5	-	"
3. Jl. Bandengan Selatan	10.5	"	1.5	-	"
4. Jl. Raya Pluit Selatan (East)	2 @ 6.5	3.8	2.0	-	"
5. Jl. Raya Pluit Selatan (West)	2 @ 6.5	1.8	1.5 - 3.0	-	"
6. Jl. Raya Pluit Timur	2 @ (6.8-7.1)	3.4	-	1.7 (one side)	"
7. Jl. Pluit	9.0	-	-	0.9 - 1.2	"
8. Jl. Gedung Panjang	2@10.3	5.0	-	1.5 - 1.7	"
9. Jl. Pakin	9.0	-	-	1.5 - 2.1	"
10. Jl. Cengkeh	11.1	-	-	4.3 - 4.5	"
11. Jl. Kunir	14.95	-	-	2.4 or 4.2	"
12. Jl. Kampung Bandan	8.70	-	1.4 or 2.7	-	"
13. Jl. Lodan (West)	9.0	-	1.0 (one side)	1.35 (one side)	"
(")	9.1	-	2.0	-	"
14. Jl. Gunung Sahari Anchol	2@ 8.7 2@14.2	0.9 - 3.45	-	2.2 or 3.0	"
15. Jl. Laks. R.E. Martadinata	5.5	-	1.5	-	"
16. Jl. Baru Sunter	2 @ 6.9	3.2	-	-	"
17. Jl. Enem	4.1	-	0.5 - 1.25	-	"
18. Jl. Laks. Yos Sudarso (Jakarta Bypass)	2@(10.7-11.2)	0.9 - 5.85	3.2	1.5 - 2.3	"
19. Jl. Cilincing-Cakung	2 @ 3.75	-	1.5 or 3.0	-	"

Fig. 2.4 Hourly Fluctuation of Traffic Volume

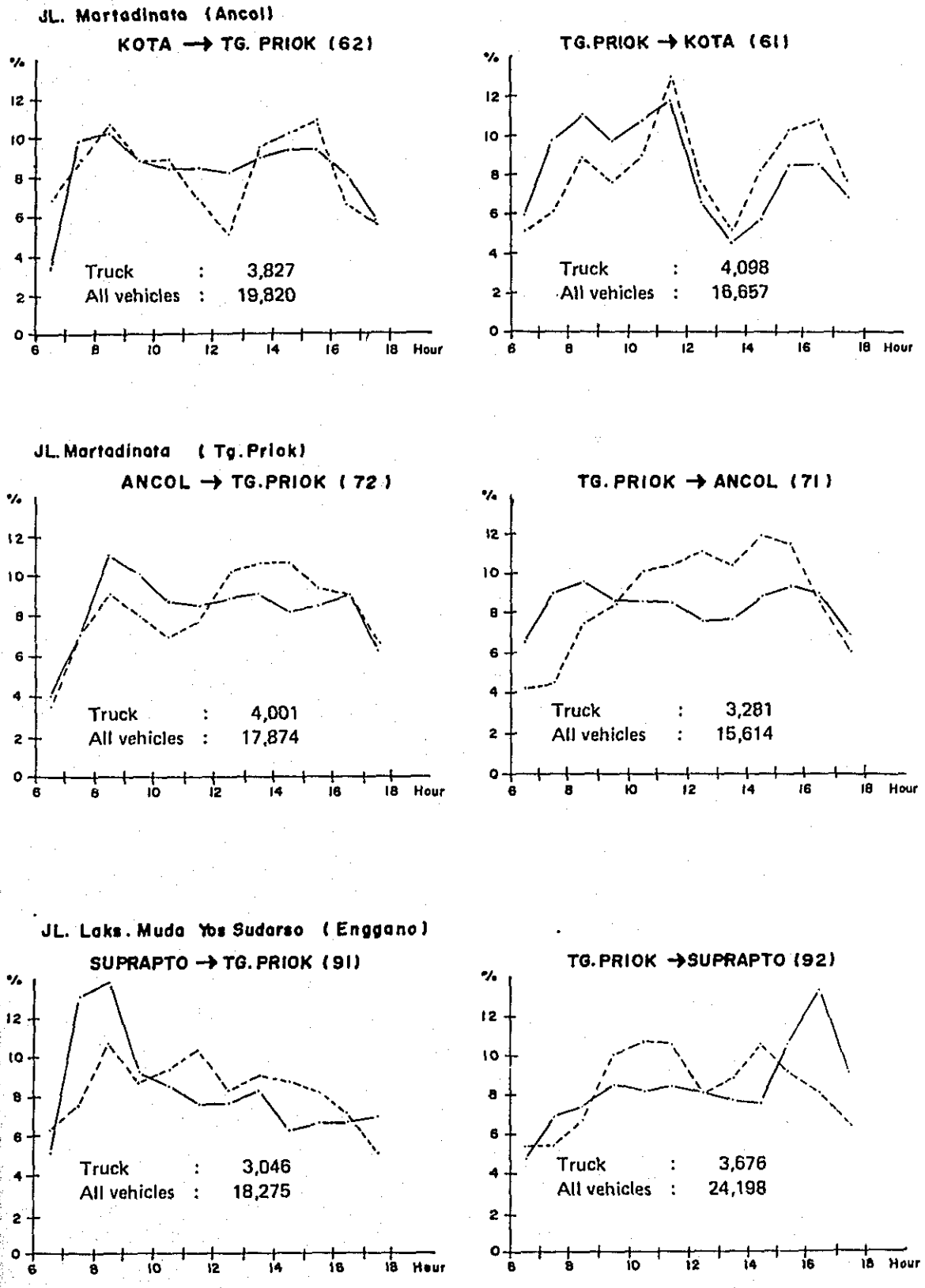
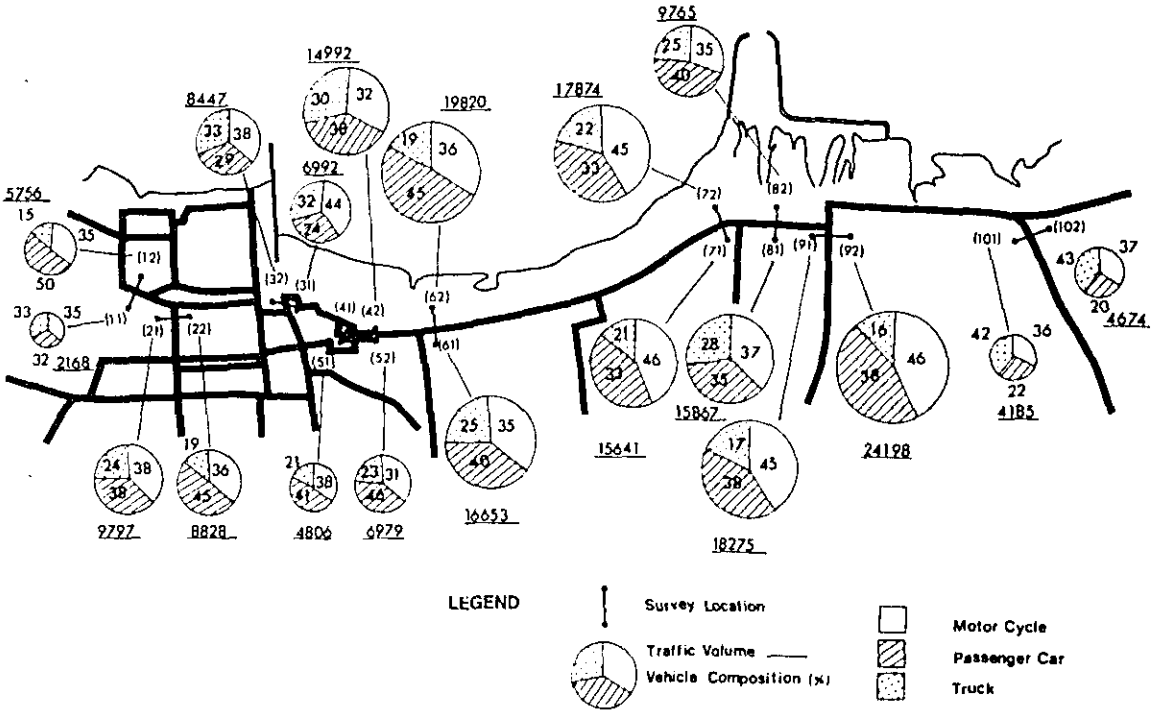


Fig. 2.5 Vehicle Composition along the Project Corridor



CHAPTER 3
EXISTING TRANSPORT FACILITIES AND TRAFFIC CONDITIONS

Chapter 3 EXISTING TRANSPORT FACILITIES AND TRAFFIC SURVEYS

3.1 Transport Networks and Facilities

3.1.1 Highway Network

The length of roads in DKI Jakarta in 1978 extended approximately three times longer than that in 1971, but it has remained at about 2,990 km between 1976 to 1978. The proportion of asphalt surface was 79.4%, that is 2,374 km, which is the highest ratio among the Provinces in Indonesia.

Table 3.1 Length of Road and Type of Surface

(Unit: Km)

Type of Surface	DKI	West Java	Java	Indonesia
Asphalt	2,374 (79.4%)	6,876 (57.7%)	26,770 (65.6%)	54,176 (42.6%)
Gravel	197 (6.6)	1,190 (10.0)	5,136 (12.6)	21,761 (17.1)
Earth	257 (8.6)	3,838 (32.2)	7,815 (19.1)	41,293 (32.5)
Unspecified	162 (5.4)	13 (0.1)	1,114 (2.7)	9,859 (7.8)
Total	2,990 (100.0%)	11,917 (100.0%)	40,835 (100.0%)	127.089 (100.0%)

Length of road per square kilometer in DKI Jakarta was approximately 5,000 m in 1978, which is extremely high when compared with other areas in Indonesia. If it is compared, however, with those of cities in other countries, it is considerably low. Highway networks with the number of lanes in DKI Jakarta and BOTABEK are shown in Fig. 3.1 and Fig. 3.2 respectively.

In DKI Jakarta, the number of motor vehicles registered in 1979, was about 700,000 including motorcycles, with the latter amounting to about 400,000. It has been calculated that the vehicle ownership rate per one thousand capita was 104 and the equivalent sedan ownership rate was 31.

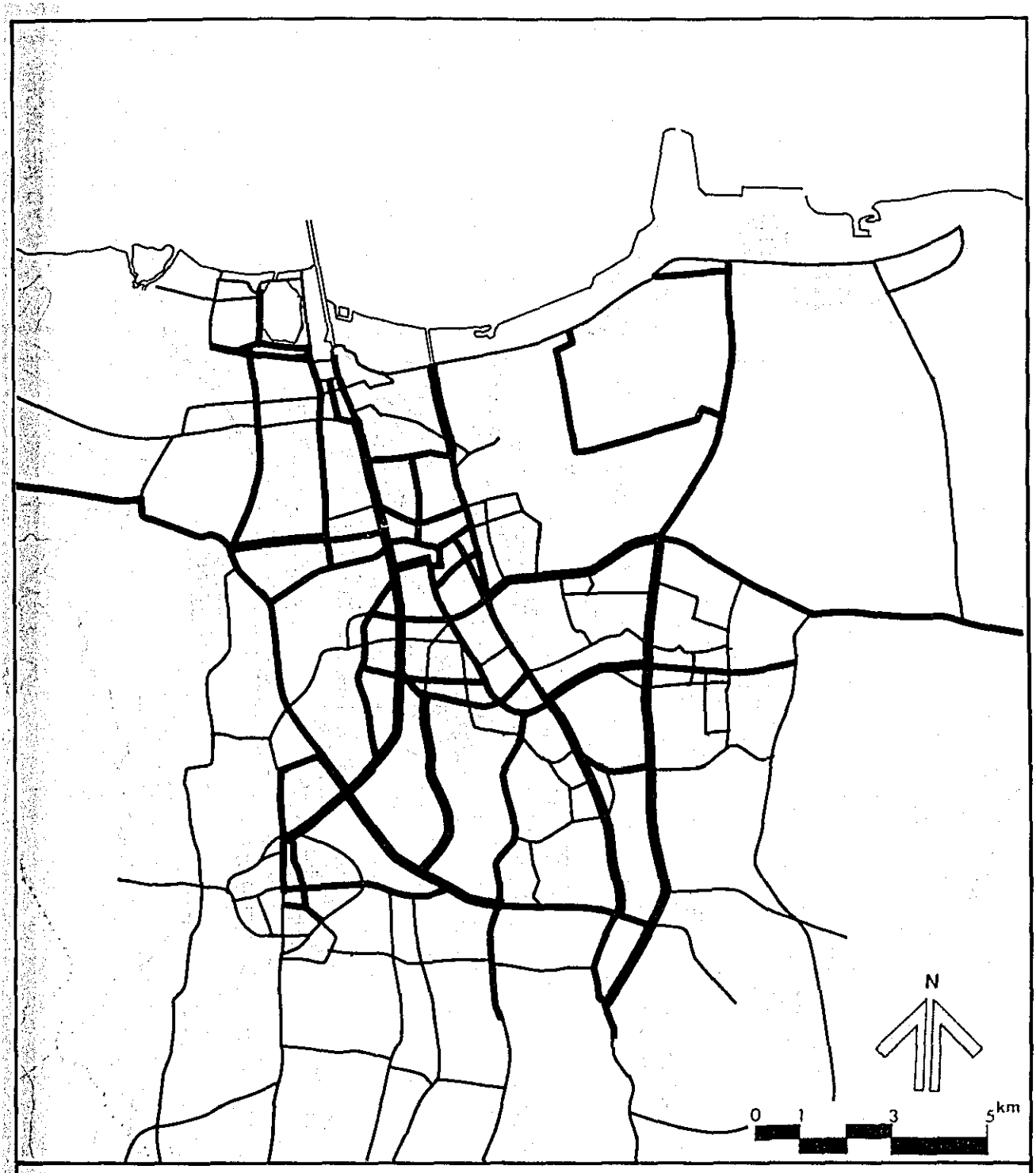


Fig. 3.1 EXISTING ROAD NETWORK IN JAKARTA

Legend :

- 2-Lane / 2-Lane + Space
- 4-Lane / 4-Lane + Space
- 6-Lane / 6-Lane + Space

JAKARTA HARBOUR ROAD PROJECT

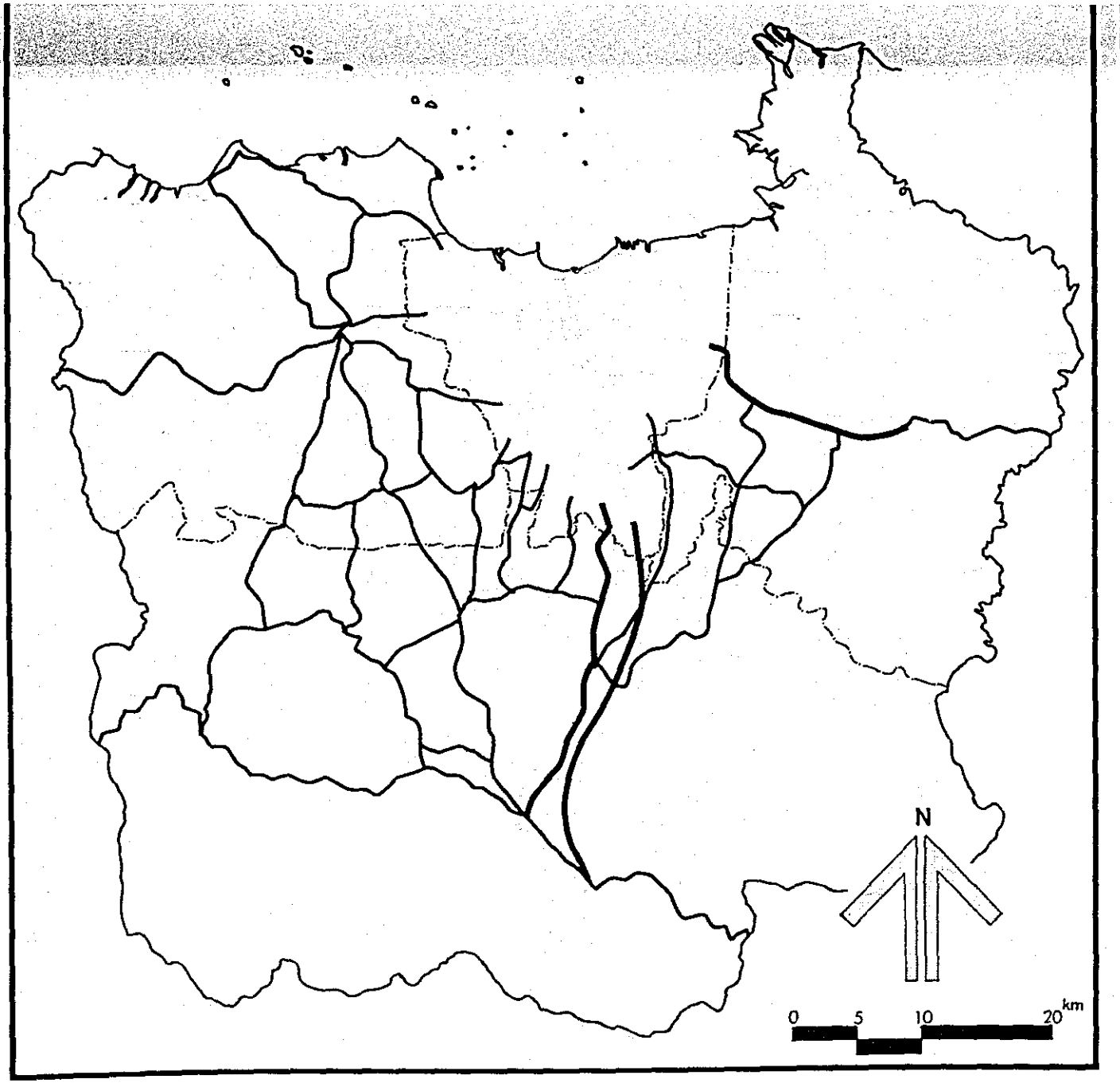


Fig. 3.2 EXISTING ROAD NETWORK IN JABOTABEK

Legend :

Boundary of Jakarta, Bogor, Bekasi & Tanggerang

2 - Lane

2 - Lane + Space

4 - Lane

4 - Lane + Space

JAKARTA HARBOUR ROAD PROJECT

Compared with figures in Japan, the vehicle ownership rate was one-third and the sedan ownership rate, one-sixth of the equivalent Japanese rates.

Traffic volumes on the road networks are shown in Fig. 3.8. This figure shows that the area within ten kilometers radius from the CBD, the roads carry rather large cross sectional traffic volumes.

The supply of road facilities in DKI Jakarta is not sufficient to meet the traffic demand. This applies both to the arterial road system and the feeder road system, so that it causes increased costs of trasnportation for goods and persons. A lower rate of road density in DKI Jakarta requires arterial roads to fulfill such services as those of arterial, collector and local roads at the same time. This is, therefore, likely to deter the effective traffic flows in the center of DKI Jakarta and such a condition will be most conspicuous in northern Jakarta. From this point of view, it is important for the Government to maintain the arterial function of the major routes.

If the above items are successful, then the following objectives for arterial highway planning will be achieved:

1) To prevent the migration into the special capital city of Jakarta, and encourage the development of satellite towns in the peripheral area.

2) To promote the more efficient synchronization of the JABOTABEK area as a Metropolitan area.

3) To develop and improve the port activities in Tg. Priok Port, which serves not only DKI Jakarta but also West Java and some parts of South Sumatera.

4) To reserve and maintain DKI Jakarta as the capital city and enable it to function as a center for the nation and the principal focal point for international relations.

3.1.2 Bus Network

In 1978, 1,385 city buses were operating everyday and 1.6 million passengers were transported everyday. City bus routes and locations of bus terminals are shown in Fig. 3.3.

There is a variety of public transport means such as city and inter-city buses, micro-buses running on fixed routes and oplet, bajaj, becak for local street services and taxi, etc.

Buses are the main public mass transport means in DKI Jakarta. The number of operating companies in 1980 is given below. The Government has given the guideline to reduce the number of companies in bus operation by inducing them to join the Government-owned bus company to maintain the service level of bus transport for the public.

Table 3.2 Number of Bus Companies

	1979	1980
City Bus		
- Government	1	1
- Private	12	4
Micro Bus		
- Private	2	2
Inter-City Bus		
- Government	1	1
- Private	60	60
Taxi		
- Private	8	9

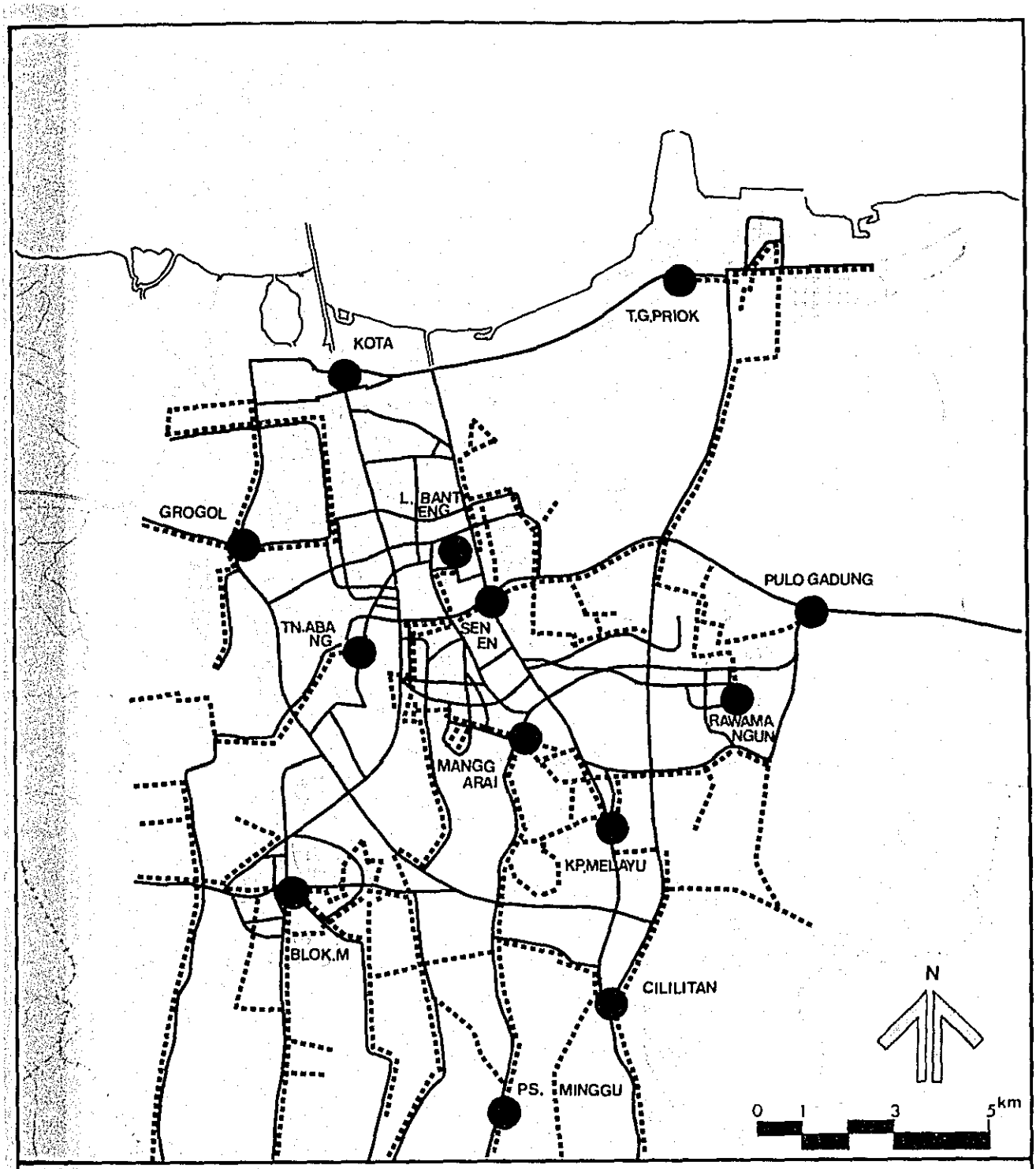


Fig. 3.3 BUS ROUTES IN DKI JAKARTA

Legend :

- BUS TERMINAL
- CITY BUS ROUTE
- MICRO BUS ROUTE

JAKARTA HARBOUR ROAD PROJECT

3.1.3 Railway Network

In the JABOTABEK area there is a railway network of 222 km long and DKI Jakarta accounts for 91 km or 40% of the JABOTABEK total length.

The railways in Jakarta can be grouped into a circular route encompassing the central business district of Jakarta, and four radial routes extending to the rural areas: Tangerang, Rangkasbitung, Bogor and Purwakarta.

Generally, the railway in Indonesia has the characteristics of an inter-regional transport system and does not contribute very much to the intra-urban transport.

The railway lines in DKI Jakarta consist of the major lines illustrated in Fig. 3.4 and outlined in Table 3.3. Eastern Line, Central Line, Western Line, Tangerang Line and Merak Line.

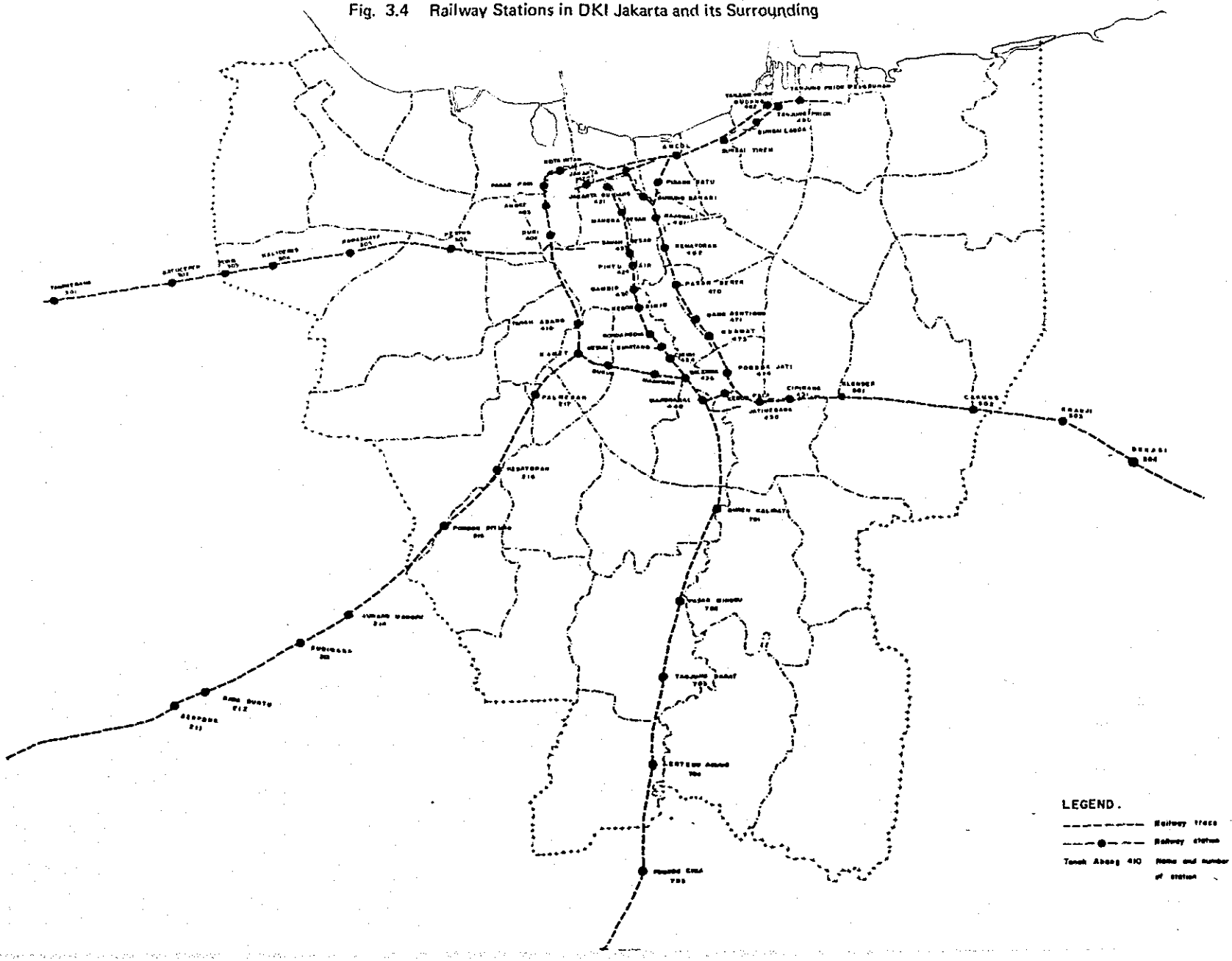
Table 3.3 Outline of Railway Lines

(Dec. 1980)

Line	Section	Distance (Kms)	Single or Double	Electrification	Railcars
Eastern Line	Jakarta ∿ Jatinegara	11.8	Double	Completed	EC, DC
	Jatinegara ∿ Bekasi	14.8	"	Not Yet	DC
	Jakarta ∿ Tg. Priok	8.1	"	Completed	EC, DC
	Tg. Priok ∿ Kemayoran	4.2	"	"	EC, DC
Central Line	Jakarta ∿ Manggarai	9.7	"	"	EC
	Manggarai ∿ Bogor	44.9	Single	"	EC
Western Line	Jakarta ∿ Kampung Bandan	2.7	"	Not Yet	DC
	Kampung Bandan ∿ Manggarai	14.3	Double	"	DC
	Manggarai ∿ Jatinegara	2.9	"	Completed	DC
Tangerang Line	Duri ∿ Tangerang	19.3	Single	Not Yet	DC
Merak Line	Tanah Abang ∿ Serpong	23.3	"	"	DC

EC = Electric Cars
DC = Diesel Cars

Fig. 3.4 Railway Stations in DKI Jakarta and its Surrounding



Transport capacity by rail in 1980 was 7,900 passengers per peak 2-hour period in the section between Manggarai station and Depok station as shown in Table 3.4 and the train operations at present are shown in Table 3.5.

Table 3.4 Existing Rail Transport Capacity

Line	Section	Year 1980		
		No. of Trains	cars/ train	Capacity (1000 pass./2hrs)
Central Line	Manggarai ∿ Depok	7	4	7.9
	Depok ∿ Bogor	5	4	5.7
Eastern Line	Jakarta ∿ Jatinegara	4	2	2.2
Western Line	Jakarta ∿ Duri	2	2 or 4	1.6

Source: "JABOTABEK AREA RAILWAY TRANSPORTATION STUDY" by JICA, March 1981.

Table 3.5 Train Operation (January 1981)

Railway Lines	Sections	No. of Trains (both directions) per Day				
		EC	DC	Long Distance Train	Freight Train	Total
Central Line	Jakarta ∿ Manggarai	42	4	24	-	70
	Manggarai ∿ Depok	42	4	2	2	50
	Depok ∿ Bogor	38	4	2	2	46
	Bogor	-	6	-	-	6
Eastern Line	Jakarta ∿ Jatinegara	3	20	16	8	47
	Tg.Priok ∿ Kemayaran	1	2	2	4	9
	Tg.Priok ∿ Jakarta	7	-	-	-	7
	Jatinegara ∿ Bekasi	-	16	46	8	70
Western Line	Jakarta ∿ Manggarai	-	16	2	7	25
Merak Line	Tanahabang ∿ Serpong	-	4	8	10	22
Tangerang Line	Duri ∿ Tangerang	-	10	-	-	10

Note: The above table includes non-scheduled train operation.
Source: "JABOTABEK AREA RAILWAY TRANSPORTATION STUDY" by JICA, March 1981.

(1) Passenger Traffic

Rail traffic in terms of passengers getting on and off at all stations in 1976 on the Central line up to Depok, the Eastern line up to Bekasi, the Western line up to Tangerang and the Marak line up to Serpong, amounted to about 8.8 million passengers per year or 24,000 passengers per day. In 1971, it was close to 12 million passengers and thereafter the number diminished but in 1974 it began to rise again.

Jakarta station handled the maximum volume of passengers, accounting for 40.3% of the total volume for Jakarta, followed by Gambir with 27.2% and Pasar-Senen with 16.7%. These three stations when added together account for 84.2%, indicating that the rail passengers are concentrated in the urban zone.

Since 1977, a prominent change developed in the traffic volume as the result of the "JABOTABEK" train being instituted with introduction of new EC and DC by PJKA under the "Intermediate Program".

The passenger volume transported by rail in 1980 was about 40,000 passengers per day and this accounts for about 0.8 percent of the total person trips in DKI Jakarta. The role of railway in urban transportation is still small (almost negligible). According to the railway development policy, however, the Indonesian Government intends to improve and develop the railway sector to enable it to function as the back bone of urban transportation.

(2) Passenger Fares

The fare of the rail passenger varies depending on the distance travelled as shown below, while the fare for bus passenger fixed at Rp.50/trip for any single route of the bus operation network, the length of which varies from a short distance to approximately 30 kilometers. In case of changing the bus or oplet, a fare must be paid again, while there is no need to pay double in the case of changing rail lines. The fare by bus is lower than the one by railway although the fare rate per kilometer for the railway decreases as the distance travelled increases.

Table 3.6 Comparison of Fares in and Around Jakarta

Mode of Transport	Km	Fare Type	Average Fare Rp./km.
Railway	0 - 10	50	10
	11 - 20	75	5
	21 - 30	100	4
	31 - 40	125	3.6
	41 - 50	150	3.3
	51 - 60	175	3.2
Bus	0 - 30	50	3

3.1.4 Air Transport

There are two airports in DKI Jakarta, namely, Kemayoran Airport used mainly for domestic flights and Halim Airport mainly for international flights. The number of air passengers has increased rapidly in the past 5 years at an annual average rate of 13.6% since 1974 to a total of 4.5 million passengers in 1979.

The number of passengers for both airports is shown in Tables 3.7 and 3.8.

Table 3.7 Number of Passengers in Kemayoran Airport

(Unit: 1,000 passengers)

YEAR	INTERNATIONAL		DOMESTIC		TRANSIT	TOTAL
	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL		
1974	50.7	51.3	713.1	721.2	-	1,536.3
1975	5.5	6.2	749.4	745.6	1.0	1,506.9
1976	1.7	1.3	900.1	892.2	-	1,795.3
1977	4.5	4.1	1,069.2	1,084.6	-	2,162.4
1978	2.2	2.5	1,275.9	1,272.2	-	2,552.8
1979	2.0	1.7	1,361.9	1,366.3	-	2,732.0

Table 3.8 Number of Passengers in Halim Airport

(Unit: 1,000 passengers)

YEAR	INTERNATIONAL		DOMESTIC		TRANSIT	TOTAL
	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL		
1974	343.0	328.6	42.7	46.4	89.3	849.9
1975	440.4	461.6	105.7	120.4	107.8	1,235.9
1976	474.2	487.4	132.8	141.9	126.9	1,363.2
1977	566.2	549.6	167.6	178.2	122.1	1,583.7
1978	661.9	661.6	185.2	193.0	113.2	1,814.8
1979	661.8	668.8	175.4	174.3	109.7	1,790.0

Source: PERUM ANGKASA PURA, JAKARTA, 1980

3.1.5 Sea Transport (Cargo)

The Major sea ports in DKI Jakarta are Tanjung Priok Port and Sunda Kelapa Port. The former is a port for overseas trade and the latter is one for inter-island trade.

The cargo handled at Tg. Priok Port in 1978 totalled 14.7 million tons, of which 67% or 9.9 million* tons were exported cargoes. The total volume handled at Tg. Priok Port accounts for 13% of the total in Indonesia.

The imported cargoes unloaded at Tg. Priok Port amounted to 4.8 million tons in 1978 or 37% of the total in Indonesia which makes it a primary port for international imports in Indonesia.

The cargo handling at the existing Tg. Priok Port has reached almost its full capacity. The Tg. Priok Port Master Plan, therefore, was prepared in 1975 and the further study is now in progress for the realization of the port improvement and extension to the east.

Sunda Kelapa Port mainly deals with inter-island trade. Cargo volumes loaded and unloaded at the Port in 1979 were 466,000 tons and 437,000 tons respectively. The Majority of the loaded cargo is wheat flour and fertilizer and that of unloaded cargo is logs which comprises about 70% of the total.

Note* Source: "Statistik Indonecia" 1978/1979, Biro Pusat Statistik, Jakarta.

3.2 Traffic Survey and Analyses

3.2.1 Zoning of the Study Area

The study area was divided into traffic zones considering the following:

i) The Kecamatan districts which are administrative units in JABOTABEK area are adopted as the basis for zone division to enable the data and information to be collected.

ii) Considering the influence area of Project Road, the zones for this study must be small along the tollway alignment and can be increased in size the further the area is situated from the Project Road. The zoning around the Project Road therefore is subdivided based on the Kelurahan which is the minimum administrative unit.

iii) The coordination of the zoning with other studies such as Ring Road Project, Intra Urban Project, etc. has also been considered, together with the configuration of the transportation network.

The zone code list and the zoning maps are shown in Table 3.9 and Figs. 3.5, 3.6 respectively.

DKI Jakarta	Central	8 zones	No. 1 - 8
	North	13 zones	No. 9 - 21
	West	10 zones	No. 22 - 31
	South	9 zones	No. 32 - 40
	East	10 zones	No. 41 - 50
	Total	50 zones	No. 1 - 50
BOTABEK	Tangerang	6 zones	No. 51 - 56
	Bogor	10 zones	No. 57 - 66
	Bekasi	7 zones	No. 67 - 73
	Total	23 zones	No. 51 - 73
Outside JABOTABEK		7 zones	No. 74 - 80
Total		80 zones	

As to the detailed zone division, please refer to Appendix 3.1.

Table 3.9 Zone Code List

No.	Zone Name	No.	Zone Name	No.	Zone Name
1	Gambir	31	Kebon Jeruk	61	Cileungisi
2	Sawah Besar	32	Tebet	62	Bogor
3	Kemayoran	33	Setia Budi	63	Ciawi
4	Senen	34	Mampang Prapatan	64	Rumpin
5	Cempaka Putih	35	Pejaten	65	Parung Panjang
6	Menteng	36	Serenseng Sawah	66	Leuwiliang
7	Kebon Melati	37	Kebayoran Baru	67	Pondok Gede
8	Gelora	38	Grogol Utara	68	Bekasi
9	Kamal Muara	39	Kebayoran Lama	69	Babelan
10	Kapuk Muara	40	Cilandak	70	Tambun
11	Pejagalan	41	Matraman	71	Cikarang
12	Mangga Dua Utara	42	Pulo Gadung	72	Setu
13	Pademangan	43	Cipinang Besar	73	Sukatani
14	Sunter	44	Klender	74	West Jawa-1
15	Pepanggo	45	Cililitan	75	West Jawa-2
16	Tanjung Priok	46	Halim Perdana K.	76	West Jawa-3
17	Koja	47	Gedong	77	Central Jawa
18	Tugu	48	Lubang Buaya	78	East Jawa
19	Pegangsaan Dua	49	Penggilingan	79	South Sumatra
20	Semper	50	Cakung	80	Out of Jawa Island
21	Sukapura	51	Tangerang		
22	Semanan	52	Teluknaga		
23	Pegadungan	53	Mauk		
24	Cengkareng	54	Cikupa		
25	Jelambar	55	Serpong		
26	Tomang	56	Ciputat		
27	Pal Merah	57	Sawangan		
28	Taman Sari	58	Depok		
29	Tambora	59	Cibinong		
30	Kembangan	60	Citeureup		

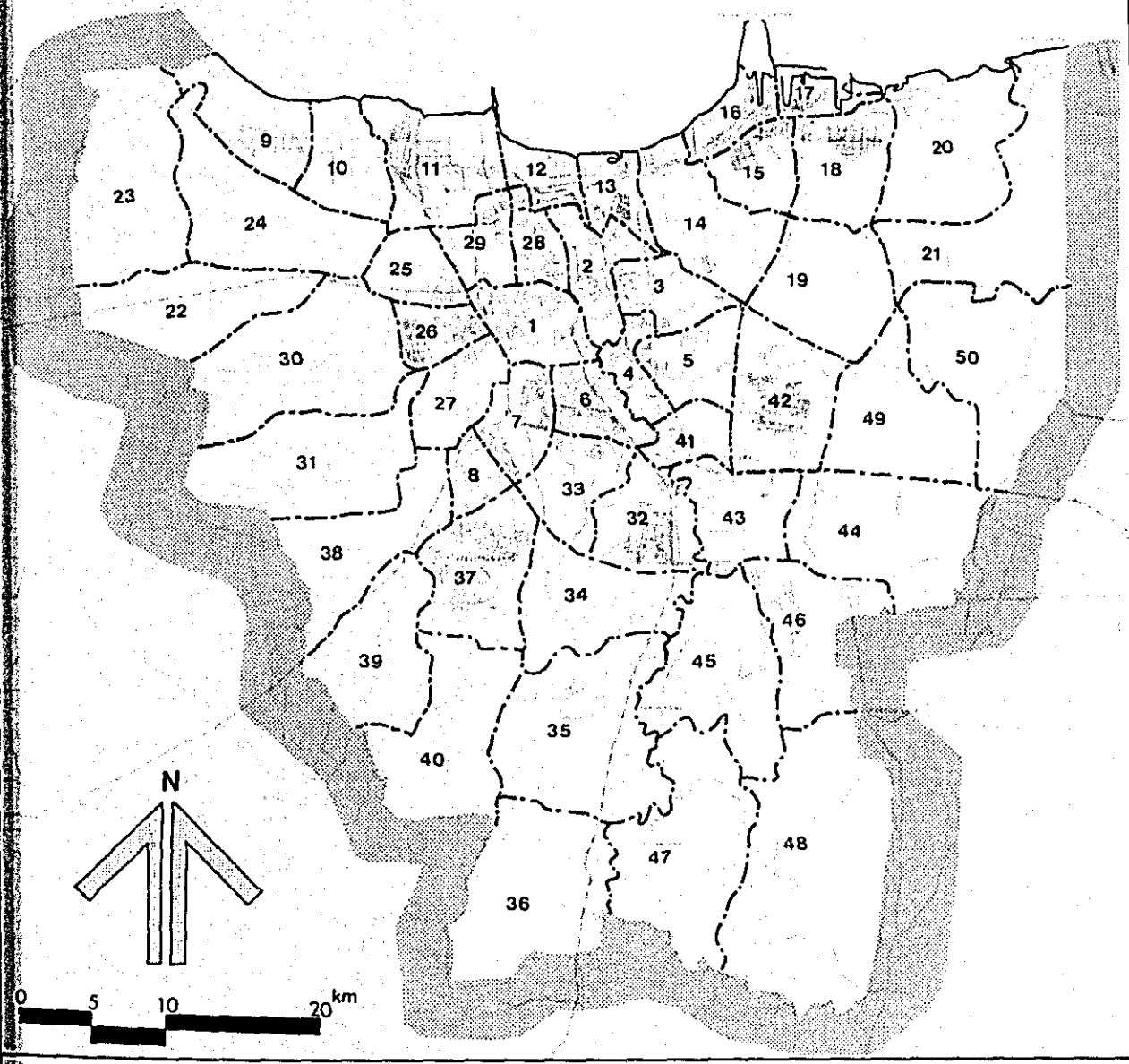


Fig. 3.5 ZONE DIVISION IN DKI JAKARTA

Legend : —·—·— : Zone Boundary
Zone No.1-No.50

JAKARTA HARBOUR ROAD PROJECT

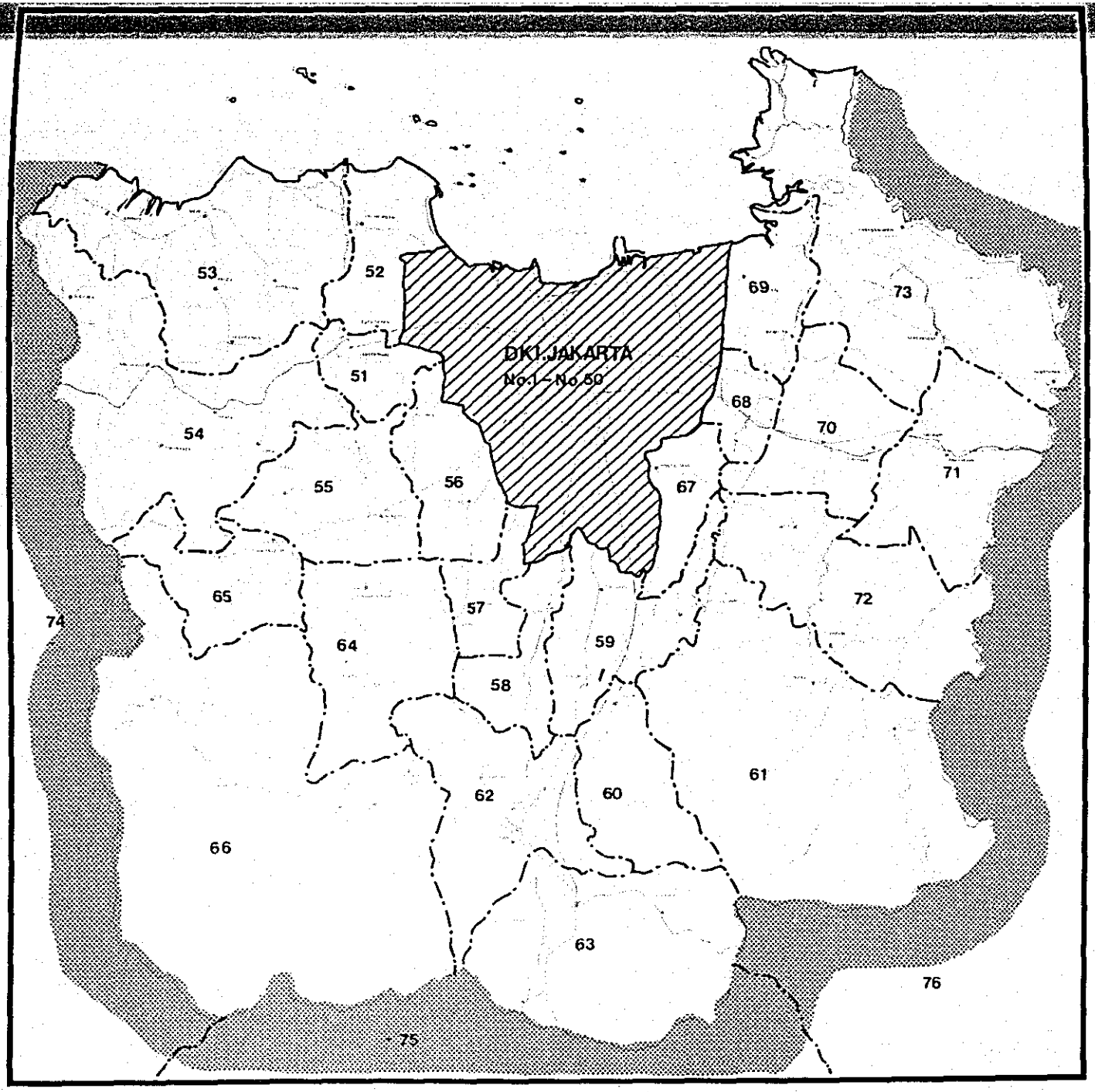


Fig. 3.6
ZONE DIVISION
IN BOTABEK AREA

Legend :

Zone Boundary
Zone No.51 - No.73

JAKARTA
HARBOUR ROAD
PROJECT

3.2.2 Traffic Count Survey

Traffic count survey was carried out in this study to define the existing traffic situation in DKI Jakarta. The survey was held for four days from September 29 to October 2, 1980. There were 27 survey locations as shown in Fig. 3.7. The survey was continued for 12 hours from six o'clock in the morning to six o'clock in the evening but at certain selected locations it was continued for 24 hours as shown in Table 3.10.

The results of the survey are summarized as shown in Fig. 3.8 with the aid of other related traffic count survey. Jl. Thamrin, Jl. Matraman Raya and a part of Jl. Gatot Subroto showed more than 100 thousand vehicles in 12 hours.

An hourly traffic fluctuation pattern was derived by collating the results of every survey location as shown in Fig. 3.9.

The result of the traffic count survey at each location is shown in Appendix 3.2.

Table 3.10 Locations of Traffic Count Survey

Station No.	Location	Survey Hours		Station No.	Location	Survey Hours	
		12	24			12	24
1001	Jl. Gunung Sahari	×		1015	Jl. Matraman Raya	×	
1002	"	×		1016	Jl. Jatinegara Barat	×	
1003	"	×		1017	"	×	
1004	"	×		1018	Jl. Bekasi Barat R.	×	
1005	"	×		1019	Jl. Oto Iskandardinata	×	
1006	"	×		1020	"	×	
1007	"	×		1021	"	×	
1008	"		×	1022	Jl.Prof. Dr.Latu.	×	
1009	Jl. Kramat Raya	×		1023	"	×	
1010	"	×		1024	"	×	
1011	Jl. Salemba Raya	×		1025	"	×	
1012	"	×		1026	"	×	
1013	Jl. Matraman Raya	×		1027	Jl. Cakung	×	
1014	"	×					

Note: 12 hours : 6:00 - 18:00
24 hours : 6:00 - 6:00

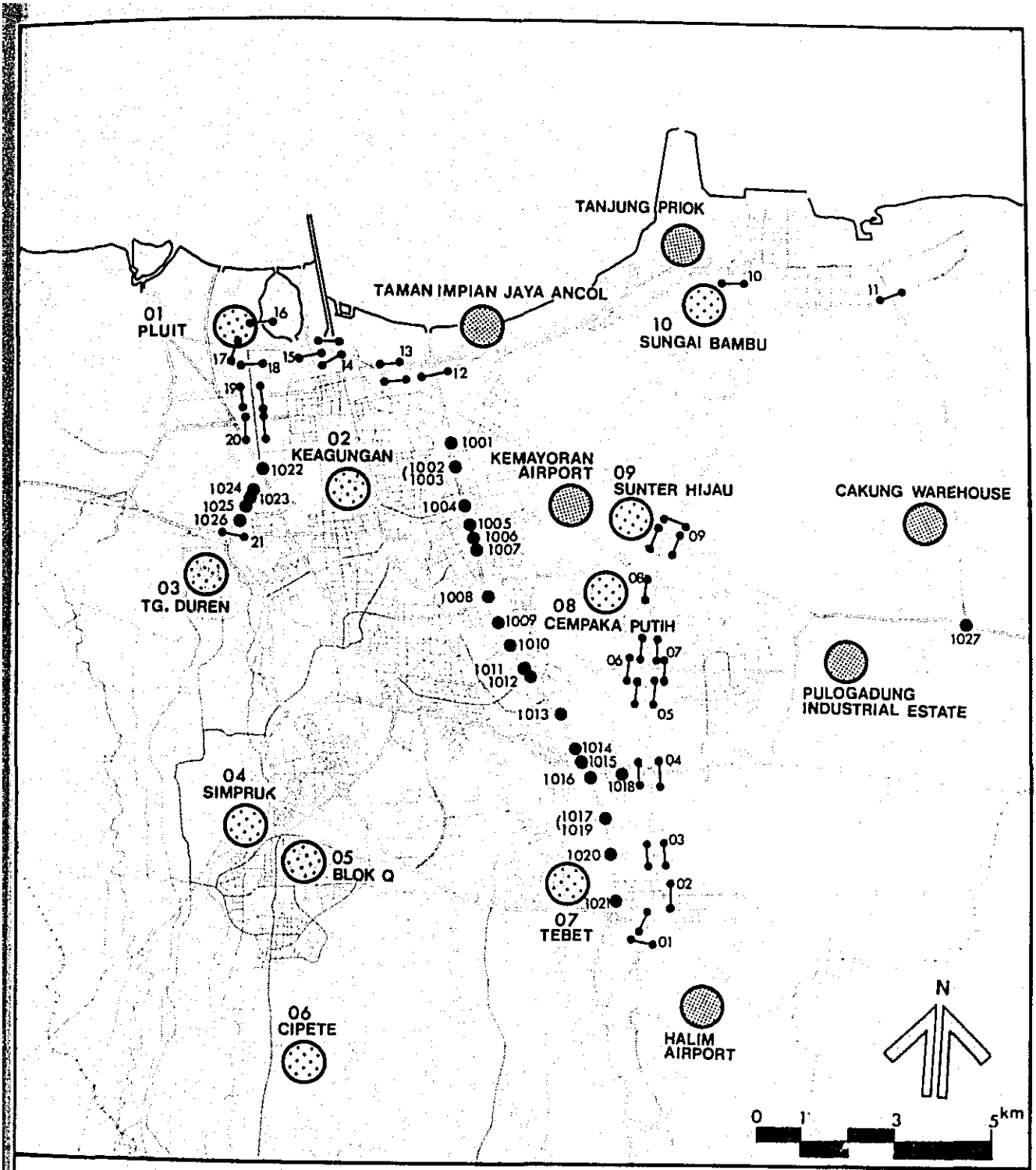


Fig. 3.7 TRAFFIC SURVEY LOCATIONS

Legend :

- Traffic Count Survey
- Facility O-D & T-C Survey
- Road Side O-D & T-C Survey
- Home Interview Survey

JAKARTA HARBOUR ROAD PROJECT

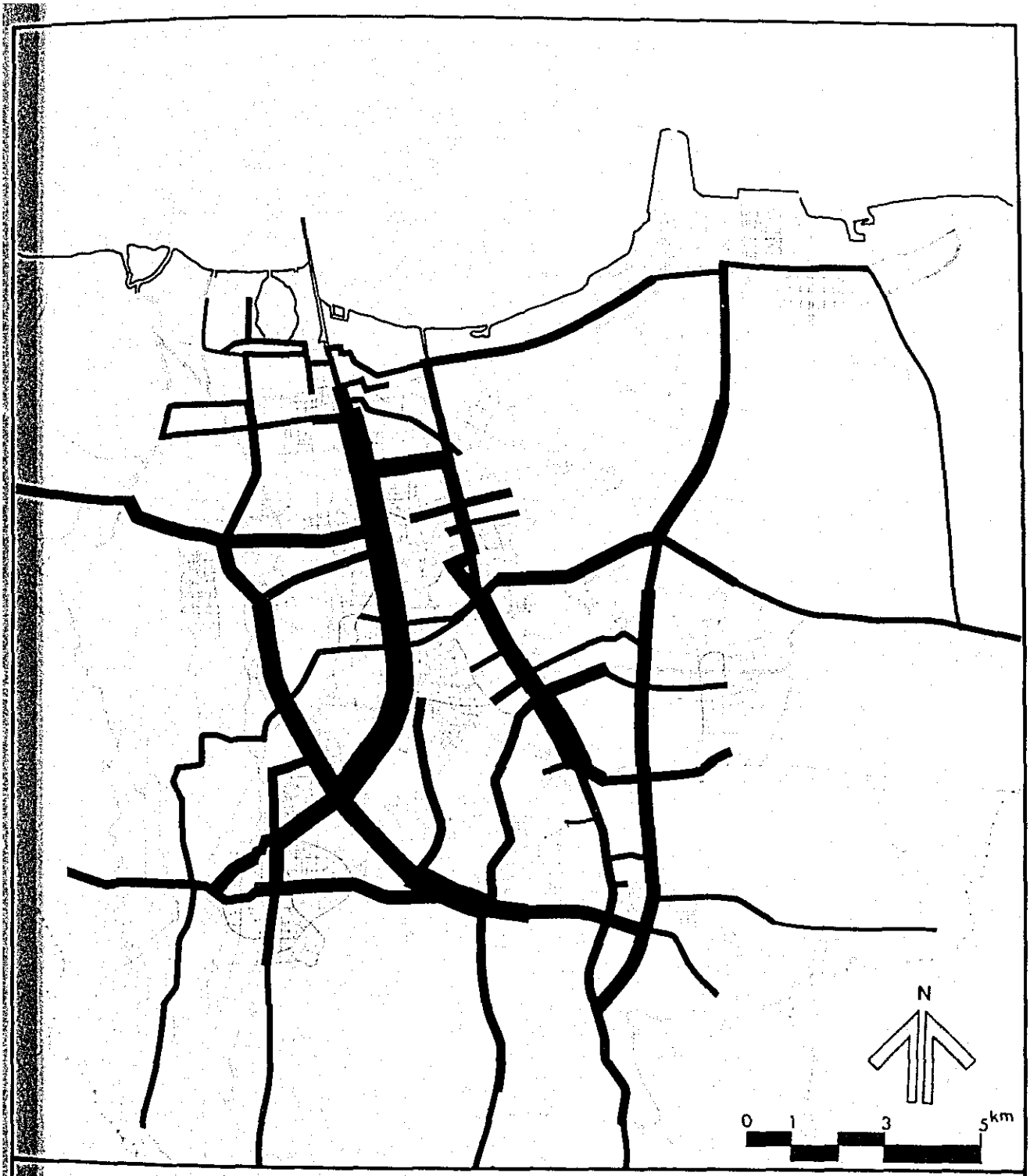


Fig.3.8 TRAFFIC FLOWS ON ARTERIES IN DKI JAKARTA, 1980

Legend :

(Including Motorcycle)

Unit : Vehicle/12Hours (6:00-18:00)

0-10,000	50,000-70,000
10,000-30,000	70,000-100,000
30,000-50,000	100,000------

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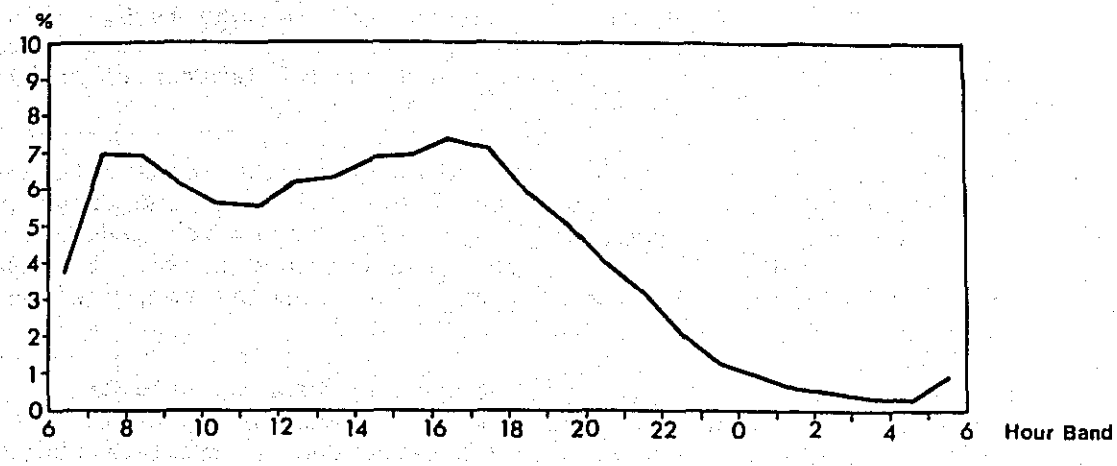
Fig. 3.9 Hourly Traffic Fluctuation Pattern in DKI Jakarta



Daytime Ratio	1.328
Morning Peak Ratio (7:00–9:00/24 hours)	13.8 %

3.2.3 Roadside OD Survey

(1) Execution of the Survey

An origin and destination survey was made on the existing road between the Halim and Grogol intersections in June 1980. This time, an origin and destination survey was carried out in order to obtain OD data in the north and the east part of DKI Jakarta to supplement the previous survey.

Twenty one survey locations were selected on the roads between Halim and Tg. Priok, Tg. Priok and Pluit and Pluit and Grogol, as shown in Fig. 3.7 and Table 3.11. The survey was made for six days from October 6 to October 14, 1980 and it was continued for sixteen hours from six o'clock in the morning to ten o'clock at night.

The necessary information was obtained by handing vehicle occupants a postcard containing a questionnaire together with instructions. Occupants were requested to complete the card in their own time and return it within ten days.

In Appendix 3.3, the format of the questionaire is shown together with the format for other OD surveys.

A classified vehicle count was undertaken simultaneously with the distribution of the postcards in order to relate the cards returned to the total volume of traffic.

(2) Result of the Survey

The number of postcards distributed to vehicles amounted to 281 thousand and the number of postcards returned amounted to 15,652. The rate of return was therefore 5.6%. There were some differences in the rate of return among the various types of vehicles; motorcycle 6.2%, sedan 6.0%, light truck 4.8% and heavy truck 2.6%, as shown in Table 3.12.

The postcards returned were then utilized to establish a vehicle OD table as follows:

1) Check sample data and calculate expansion factors for each survey station.

2) Establish original OD tables and complete OD tables.

3) Confirm its reliability by screen check.

The complete OD tables, the reliability of which amounted to 87%, are presented in a summarized form in Table 6.1.

These vehicle OD tables were then converted to person OD tables by obtaining average occupancy per type of vehicle. By the person trip OD tables, the inflow and outflow situation to and from each zone was calculated. These results are shown in Fig. 3.10 as the zones of excess inflow.

Table 3.11 Locations of Roadside OD & Traffic Count Surveys

Location No.	Location	No. of Stn.	Traffic Count Hours		Location No.	Location	No. of Stn.	Traffic Count Hours	
			16	24				16	24
01	Halim	2	×		12	Ancol	1	×	
02	J1.Halim Raya	1	×		13	Kampung Bandan	2	×	
03	Otista	2	×		14	Pasar Ikan	2	×	
04	Jatinegara	2		×	15	Gedung Panjang	1	×	
05	Utan Kayu	2	×		16	Pluit Timur	1	×	
06	Pemuda	2		×	17	Pluit Barat	1	×	
07	Rawasari	2	×		18	Jembatan Tiga	1	×	
08	Cempaka Putih	1	×		19	Bandengan	2	×	
09	Suprapto	3		×	20	Angke	2	×	
10	Enggano	1	×		21	Latumeten	1	×	
11	Cacing	1	×			TOTAL	33		

Note: Postcard Distribution 16 hours: 6:00-22:00
Traffic Count 16 hours: 6:00-22:00
24 hours: 6:00- 6:00

Table 3.12 Postcards Distributed and Returned

	Traffic Volume	Distributed Card	Rate of Distribution	Returned Card	Rate of Return
Motorcycle	175,326	102,331	58.4%	6,295	6.2%
Sedan	167,898	117,663	70.1	7,032	6.0
Light Truck	41,986	32,261	76.8	1,556	4.8
Heavy Truck	37,699	29,043	77.0	769	2.6
TOTAL	422,909	281,298	66.5	15,652	5.6

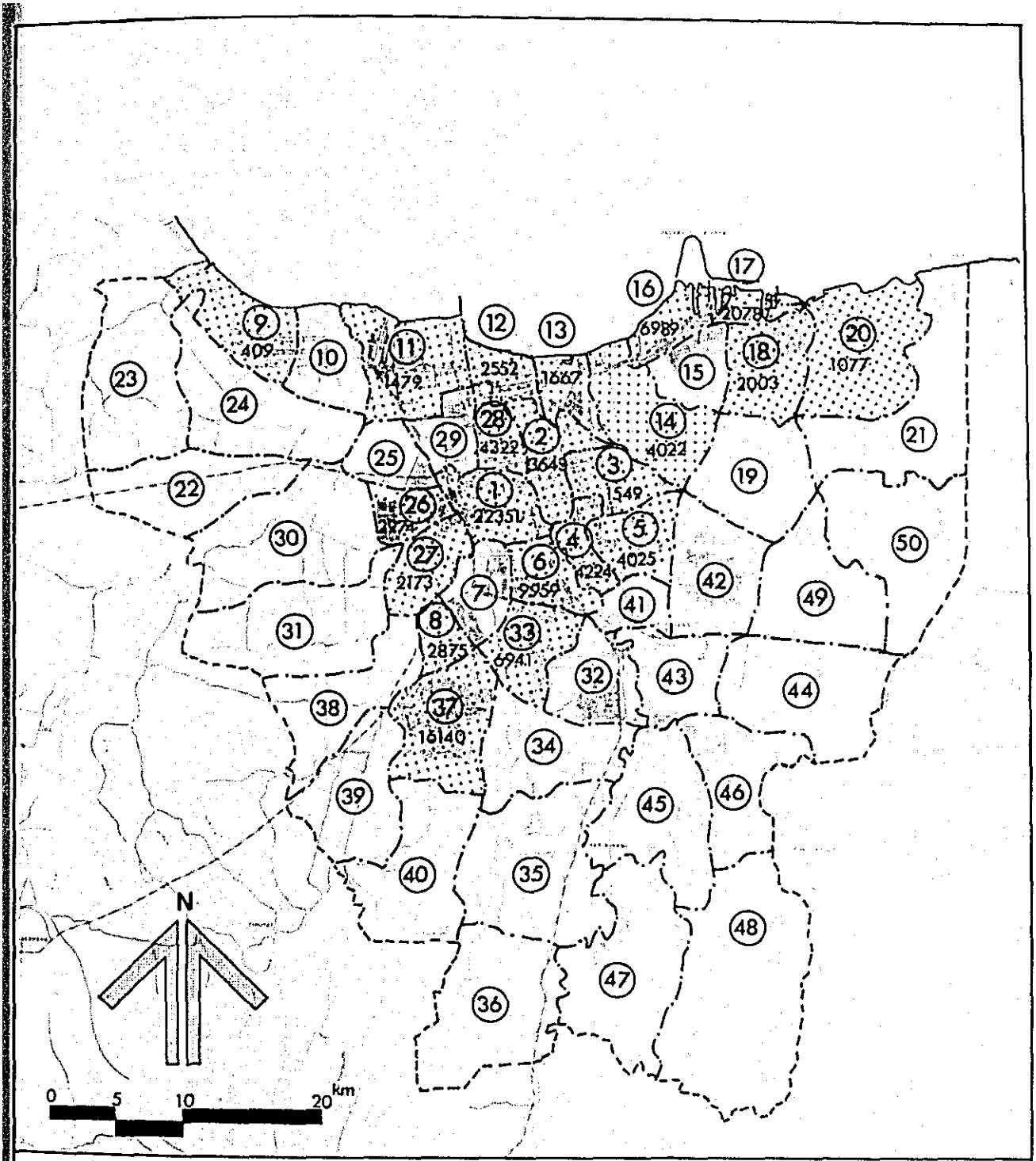


Fig. 3.10 ZONES OF EXCESS INFLOW

Legend :

- (x x) Zone Number
- Zone of Excess Inflow
- x x Excess Inflow of Person Trip
- ------ DKI Jakarta Boundary
- -·-·-·- Zone Boundary

JAKARTA HARBOUR ROAD PROJECT

3.2.4 Home Interview Survey

In order to clarify the characteristics of person trips in DKI Jakarta, a Home Interview Survey was conducted.

(1) Methods of Survey

1) Survey Period

Questionaires were distributed and collected during the period November 16, 1980 - November 23, 1980. A trip date was designated for a normal working day, that is from Monday to Thursday.

2) Survey District

The survey areas where sample households were selected consisted of the following 10 districts (shown in Fig. 3.7).

1. Pluit
2. Keagungan
3. Tanjung Duren
4. Simpruk
5. Kebayoran Baru (Blok Q.)
6. Cipete
7. Tebet
8. Cempaka Putih
9. Sunter Hijau
10. Sungai Bambu

3) Data Coding

Contents of the questionaire were classified in three categories as shown below:

i) Identification of Survey District

ii) Household Information

- Number of Persons who live in the same house
- Number of Persons older than 6 years
- Number of Persons who have jobs
- Number of Persons receiving education

  Junior High School, Senior High School, University, and special Training Course.
- Number of vehicles in the households possession.

  Motorcycle, Sedan, Colt, Others.
- Repair and Maintenance Budget for Transport.

iii) Information on Individuals

- Status in Household

  Husband, Wife, Children, etc.
- Sex

- Age
- Occupation
- Type of Working Place
- Address of Working Place
- Trip Information:

  Address of Destination,

  Time of Departure,

  Means of Transportation,

  As a driver or as a passenger and

  Trip Purpose

The questionaire is shown in Appendix 3.3.

(2) Results obtained by Home Interview Survey

Home Interview Survey was performed to supplement the Road-side OD Survey and the number of samples obtained was limited for this reason. This means that the number of samples obtained was insufficient to allow an estimate of the total number of person trips in DKI Jakarta to be made.

The number of households interviewed was 2,893, and 88.6 per cent of these produced effective results. If compared with the number of households in the Kelurahan containing the Survey District, the ratio of collected samples was an average of about 5.2 per cent. If compared with total households in DKI, it was less than 0.3 per cent.

Facesheet of households answered are shown in Table 3.13. As shown in this table, the average trips per person for all the districts amount to 2.05, but there are large differences among the ten districts ranging from 1.52 to 2.59 trips per person. The trip frequency per person is distributed as shown in Table 3.14 and it indicates that more than 65% of the answered samples make 2 trips per person. However, it was found in this table that 527 samples made only one trip per person and they did not return home anyhow. It was, therefore, assumed that these samples forgot to fill out return trips in the format.

Accordingly, the average trips per person are estimated to be 2.09 based on the results of Home Interview Survey.

Table 3.14 Distribution of Trip Frequency per Person

Trips	No. of samples	Ratio (%)
0	1633	13.2
1	527	4.2
2	8120	65.5
3	480	3.9
4	1212	9.8
5	279	2.3
6	95	0.8
7	17	0.1
8	13	0.1
9 over	17	0.1
Total	12393	100.0

The intra zonal trip ratio, was calculated to be an average of 69.1% by the Home Interview Survey. For this study purpose, however, it was necessary to make this ratio available for all of DKI Jakarta. Considering the configuration of land use and the size of areas in these selected districts, it was reviewed and estimated to be 63.5%.

3.2.5 OD Survey at Major Traffic Generating Facilities

Six facilities were selected as major traffic generating facilities in DKI Jakarta, as shown in Fig. 3.7 and Table 3.15. Halim Airport, Kemayoran Airport and Taman Impian Jaya Ancol are major facilities for person trip generation and attraction, and Pulo Gadung, Cakung and Tg. Priok are those for cargo trip generation and attraction. At the former three facilities, an OD survey was carried out by distributing postcards to the occupants of passenger cars and at the latter three facilities, it was executed by interviewing truck drivers.

Table 3.13 Summary of Answers of Home Interview Survey

		Pluit Zone 11	Kedoungdoh Zone 28	Tg.Duren Zone 26	Simpruk Zone 38	Blok. Q Zone 37	Cipete Zone 40	Tebet Zone 32	Cempaka P Zone 05	Sunter Hijau Zone 14	Sungai Bambu Zone 15	Unknown	Total
Number of Households Answered		123	295	396	114	281	418	365	176	146	250	11	2575
Number of Residents		671	1090	2495	592	1810	2567	2515	1287	531	1622	602	15782
Number of Answered Samples		586	877	1819	572	1693	2084	2168	943	445	1156	50	12393
Sex	Male	271	429	826	237	790	993	1058	455	187	593	19	5858
	Female	313	443	942	333	902	1078	1098	479	241	552	30	6411
	Unknown	2	5	51	1	1	13	12	9	17	11	1	124
Status in Family	Husband	115	259	331	109	242	354	333	154	120	221	4	2242
Family	Wife	112	273	334	110	259	344	340	140	129	192	7	2240
	Child	163	183	733	116	772	891	1042	416	106	647	25	5194
	Guest	22	7	54	1	28	45	49	33	5	40	1	285
	Servant	114	30	226	236	219	265	211	145	50	38	10	1544
	Others	59	22	90	0	173	148	94	39	31	11	3	670
	Unknown	1	3	51	0	0	37	99	16	4	7	0	218
Age	6—9	28	22	160	0	67	132	175	70	21	76	7	758
	10—19	125	177	593	122	476	730	725	326	88	438	20	3820
	20—29	197	237	386	215	513	424	523	218	136	223	10	3082
	30—39	116	179	298	83	186	268	274	124	111	127	6	1772
	40—49	75	125	211	99	153	269	253	120	35	152	2	1494
	50—59	25	76	80	42	171	138	135	57	14	95	3	836
	60—69	12	35	34	11	80	66	52	21	5	14	1	331
	70—	4	19	12	0	27	34	22	6	0	4	1	129
	Unknown	4	7	45	0	20	23	9	1	35	27	0	171
Number of Vehicles	Motorcycle	67	57	104	26	93	84	108	53	55	91	180	918
	Sedan	122	14	207	247	157	205	190	217	37	43	57	1496
	Colt	6	0	27	1	19	40	31	21	13	2	192	352
	Others	1	3	98	0	11	37	26	16	7	3	159	2118
	Total	196	74	436	274	280	366	355	207	112	139	579	3118
Average Cost for Vehicles per Month Per Household (1.000 Rp)		18,5	2,2	24,9	2,3	19,0	21,8	35,3	42,3	10,4	2,7	47,2	18,3
Total Trips		1518	1647	3460	871	3482	5124	4407	2132	761	1912	98	25412
Average Trips per Household		12.341	5.583	8.737	7.640	12.391	12.258	12.074	12.114	5.212	7.648	8.909	9.869
Average Trips per Person		2.590	1.878	1.902	1.523	2.057	2.459	2.033	2.261	1.710	1.654	1.960	2.051
Average Car ownership per House Hold		1.593	0.251	1.101	2.404	0.996	0.876	0.973	1.176	0.767	0.556	–	1.211

The survey was made for five days from October 15 to October 21, 1980, and the survey period for each facility depended on its operating hours as shown in Table 3.15.

Number of samples collected at Halim Airport, Kemayoran Airport and Taman Jaya Ancol were 3,728, 5,284 and 10,192 vehicles respectively and the distribution of origin or destination was as shown in Table 3.16.

Table 3.15 Selected Major Traffic Generating Facilities

Location	Number of Station	Station	SURVEY OD	SURVEY TC	Hours
Halim Airport	1	Exit	×	×	15 (7:00-22:00)
Kemayoran Airport	2	Exit (Angkasa)	×	×	14 (6:00-20:00)
		Exit (Garuda)	×	×	"
Taman Impian Jaya Ancol	3	Entrance (West)	×	×	12 (6:00-18:00)
		" (East)	×	×	"
		Exit (Center)	-	×	"
Pulo Gadung Industrial Estate	3	North	×	×	16 (6:00-22:00)
		Center	×	×	"
		South	×	×	"
Cakung Warehouse	1	Exit	×	-	7 (9:00-16:00)
Tanjung Priok	7	Gate No. 1	×	×	16 (6:00-22:00)
		" 2	×	×	12 (6:00-18:00)
		" 3	×	×	"
		" 4	-	×	"
		6	×	×	"
		7	×	×	"
		9	-	×	16 (6:00-22:00)

Note: 1) OD Survey by Post Card at:
Halim Airport, Kemayoran Airport,
Taman Impian Jaya Ancol.

2) OD Survey by Interview at:
Pulo Gadung Industrial Estate,
Cakung Warehouse,
Tanjung Priok.

Table 3.16 OD Distribution of Major Facilities – Passenger Car

		(From) Halim Airport			(From) Kemayoran Airport			(To) Taman Impian Jaya Ancol		
		No. of Passenger Cars	No. of Passengers	Average Pass./ Veh.	No. of Passenger Cars	No. of Passengers	Average Pass./ Veh.	No. of Passenger Cars	No. of Passengers	Average Pass./ Veh.
DKI Jakarta	Central	960	2,878	3.0	2,309	6,527	2.8	2,111	9,859	4.7
	North	222	896	4.0	107	291	2.7	793	4,627	5.3
	West	380	1,330	3.5	417	1,059	2.5	2,292	11,469	5.0
	South	634	1,529	2.4	1,014	3,130	3.1	2,032	9,604	4.7
	East	527	2,189	4.2	607	1,908	3.1	1,517	8,052	5.3
	Total	2,723	8,822	3.2	4,454	12,915	2.9	8,745	43,611	5.0
Botabek	Tangerang	-	-	-	-	-	-	34	101	3.0
	Bogor	31	62	2	220	721	3.3	140	320	1,579
	Bekasi	-	-	-	-	-	-	320	1,579	4.9
	Total	31	62	2	220	721	3.3	494	2,339	4.7
Outside Jabotabek		974	3,912	4.0	610	1,787	2.9	953	3,379	3.5
Total		3,728	12,796	3.4	5,284	15,423	2.9	10,192	49,329	4.8

At Pulo Gadung, Cakung and Tg. Priok, the number of samples collected amounted to 1,918, 2,053 and 2,343 vehicles as shown in Table 3.17. Truck flow between each of the three facilities and the main zones is presented in Figs. 3.11 through 3.13.

Table 3.17 Samples Obtained at Major Facilities – Truck

LOCATION	STATION	Vehicle	Passen-ger	P/V	Total Tonnage	T/V	Total Capacity	C/V
Tg. Priok Port (one day)	Gate 1	50	101	2.1	211	4.2	205	4.1
	2	904	1,868	2.1	3,001	3.3	4,119	4.6
	3	181	402	2.2	384	2.1	775	4.3
	6	454	980	2.2	1,907	4.2	1,860	4.1
	7	754	1,555	2.1	2,949	3.9	3,267	4.3
	Total	2,343	4,906	2.1	8,452	3.6	10,226	4.4
Pulo Gadung Industrial Estate (one day)	A	800	1,741	2.2	1,748	2.2	2,749	3.4
	B	609	1,403	2.3	1,060	1.7	1,655	2.7
	C	509	1,281	2.5	884	1.7	1,648	3.2
	Total	1,918	4,425	2.3	3,692	1.9	6,052	3.2
Cakung Warehouse (5 days)		2,053	4,181	2.0	15,518	7.6*	9,368	4.6

Note: All samples are included in this table
P/V.....Passenger/Vehicle
T/V.....Tonnage/Vehicle
C/V.....Capacity/Vehicle (ton/veh.)
* Includes vehicle weight

3.2.6 OD Survey at Weigh Bridges

As shown in Fig. 3.14, there are seven weigh bridges, where OD survey was carried out on October 15, 1980.

The survey was executed by interviewing the drivers of truck sixteen hours from six o'clock in the morning to ten o'clock at night.

Number of samples collected at these weigh bridges amounted to 6,321 vehicles as shown in Table 3.18. Since the weight of a vehicle is included in the tonnage, tonnage per vehicle is greater than capacity per vehicle in this case.

Table 3.18 OD Survey at Weigh Bridges

Survey Station	Vehicle	Passenger	P/V	Total Tonnage*	T/V *	Total Capacity	C/V
Batu Ceper	1543	3939	2.6	6656	4.3	4921	3.2
Bulak Kapal	1165	3259	2.8	5351	4.6	3732	3.2
Cibitung	1162	2789	2.4	6979	6.0	4640	4.0
Kramat Jati.	804	1992	2.5	2451	3.0	2272	2.8
Parung	382	949	2.5	1756	4.6	1122	2.9
Pasar Rebo	598	1315	2.2	2112	3.5	1628	2.7
Tajur	667	1705	2.6	2625	3.9	2019	3.0
Total	6321	15949	2.5	27930	4.4	20333	3.2

Note* : Includes vehicle weight

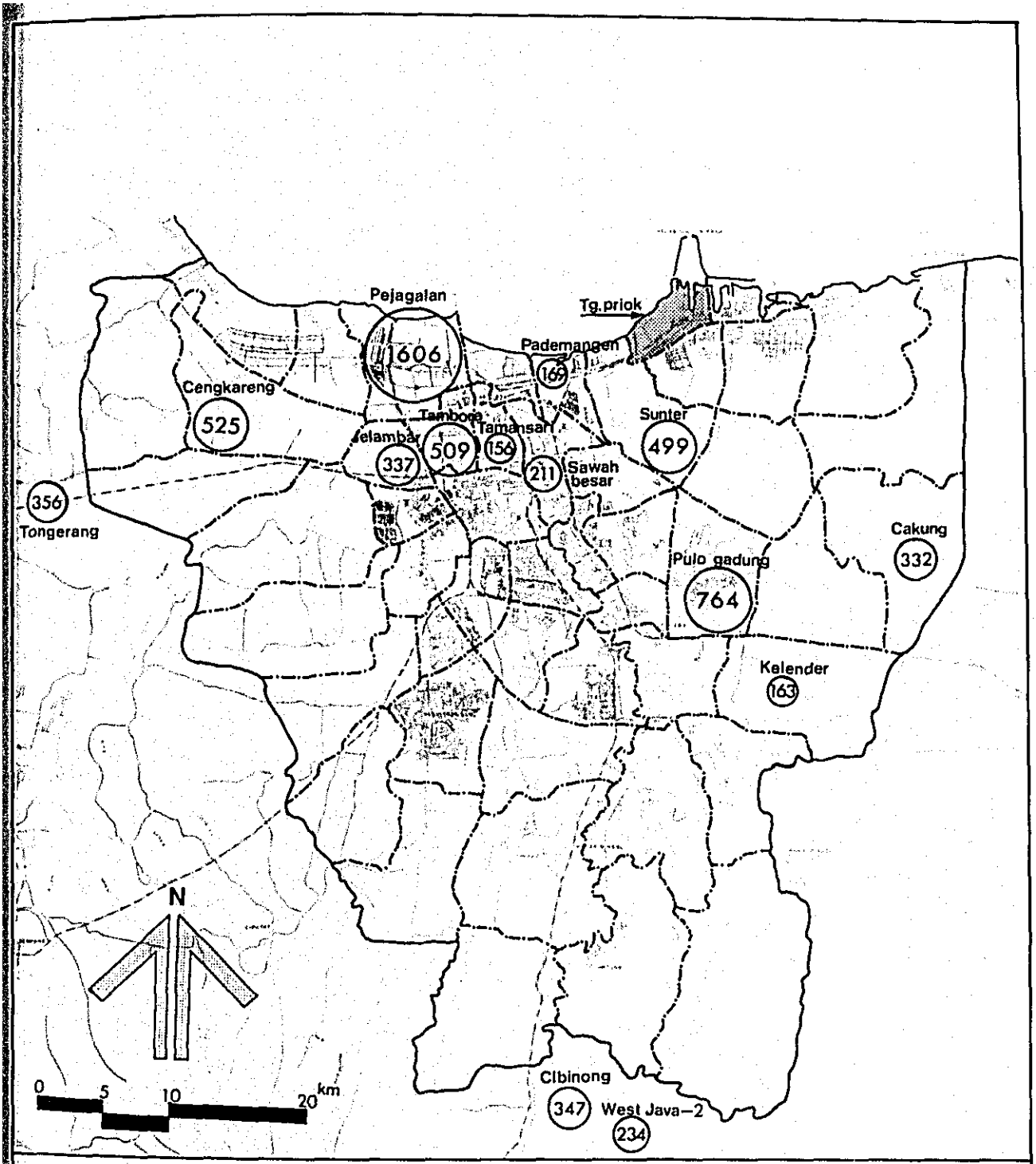


Fig. 3.11 TRUCK FLOW BETWEEN TG.PRIOK PORT & MAIN ZONES

Note:
1) Unit: Vehicle/6:00 - 22:00
2) Truck flow which originated from & was destined for Tg. Priok Port totalled 8094 vehicles.
3) Truck flow between Tg. Priok Port and main zones includes 76.7% of all the flow.

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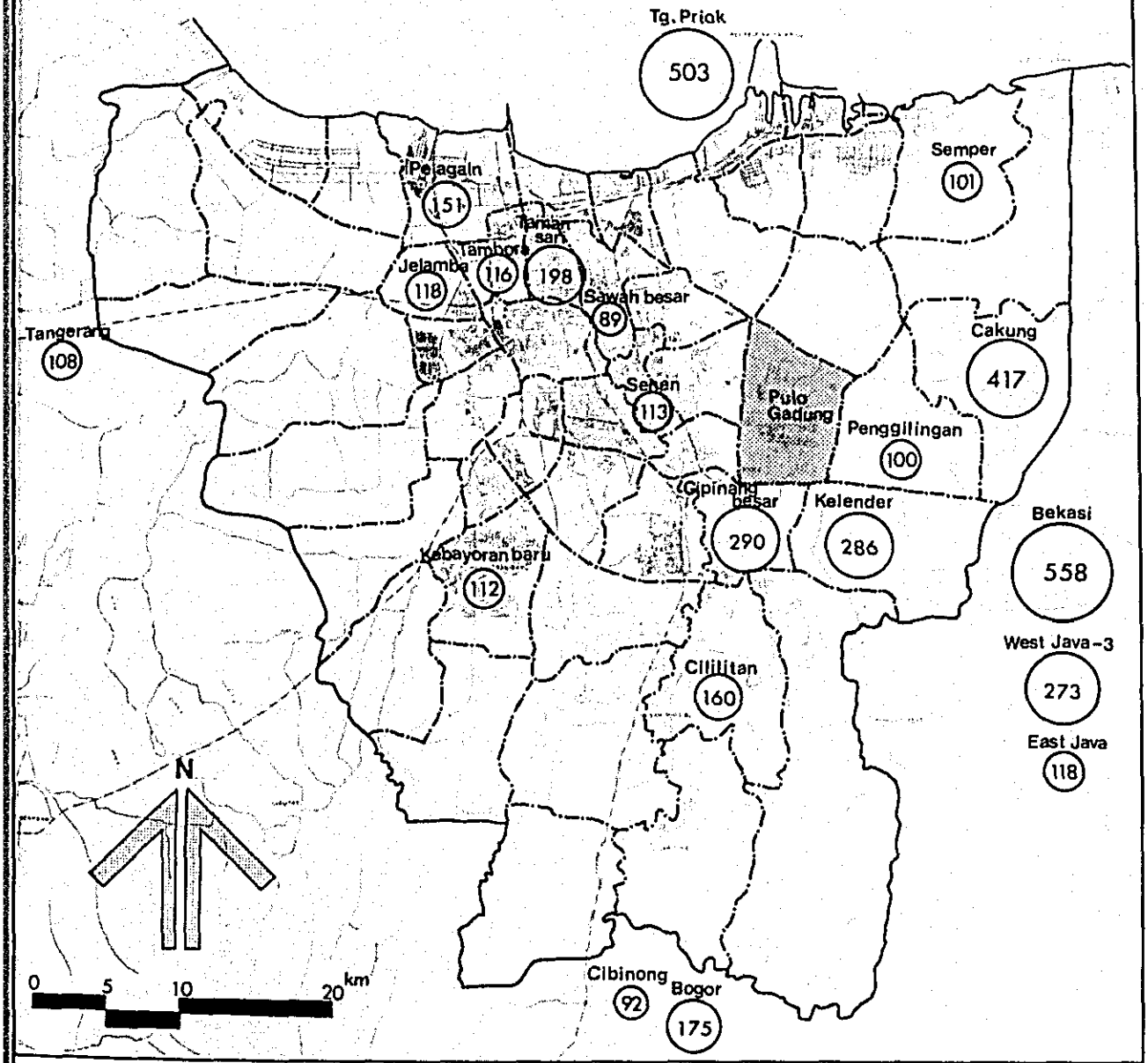

Fig .3.12 TRUCK FLOW BETWEEN PULO GADUNG INDUSTRIAL ESTAT AND MAIN ZONES

Note:

1) Unit: Vehicle/6:00 - 22:00
2) Truck flow which originated from & was destined for Pulo Gadung Industrial Estate totalled 5356 vehicles.
3) Truck flows between Pulo Gadung Industrial Estate and main zones include 76.2% of all the flow.

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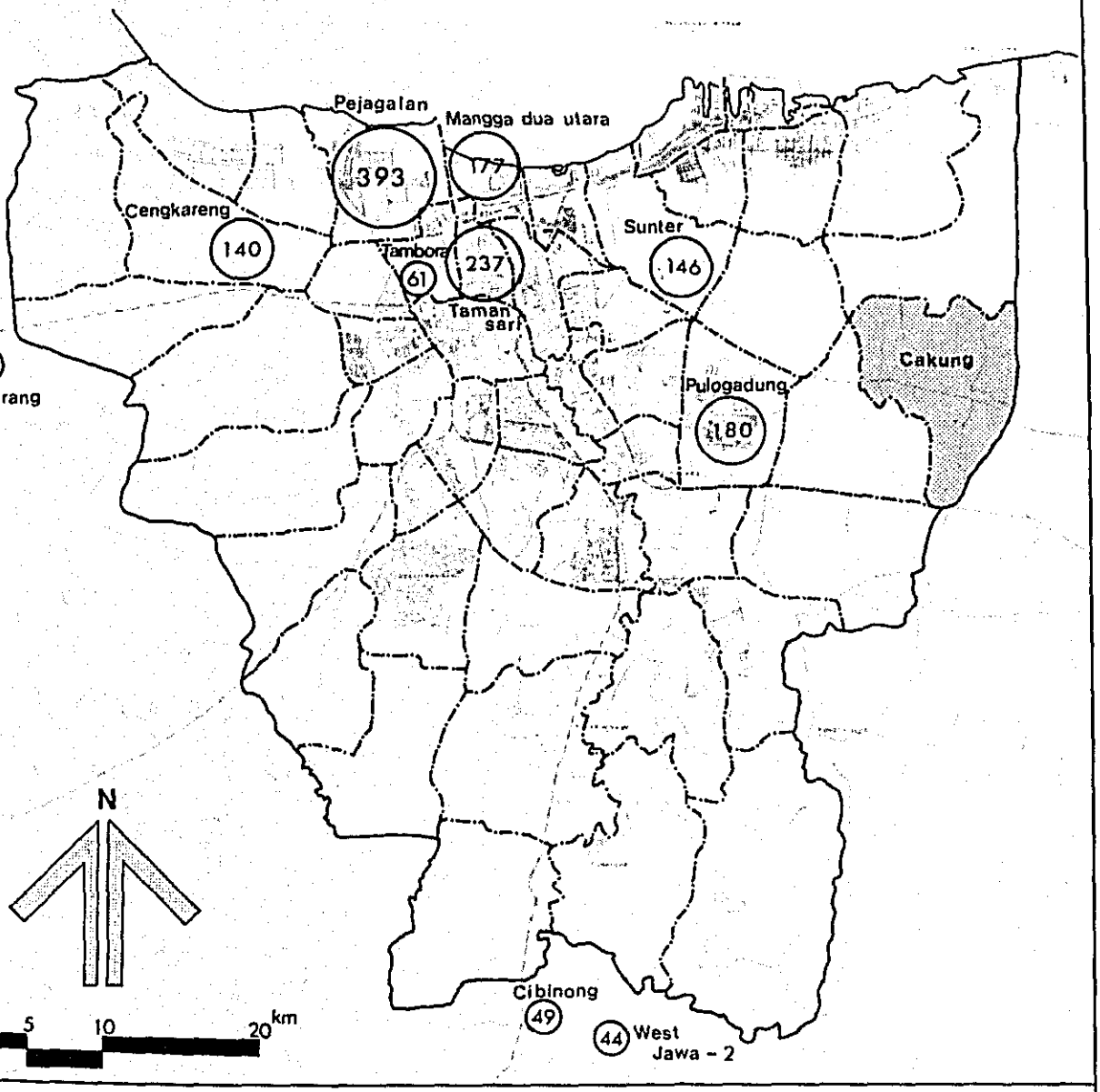

Fig.3.13 TRUCK FLOW BETWEEN CAKUNG WAREHOUSE & MAIN ZONES

Note:

1) Unit: Vehicle/9:00 - 16:00 for one week except Sunday and Friday
2) Truck flow originated from Cakung Warehouse totalled 1961 vehicles.
3) Truck flow between Cakung Warehouse and main zones includes 76.4% of all the flow.

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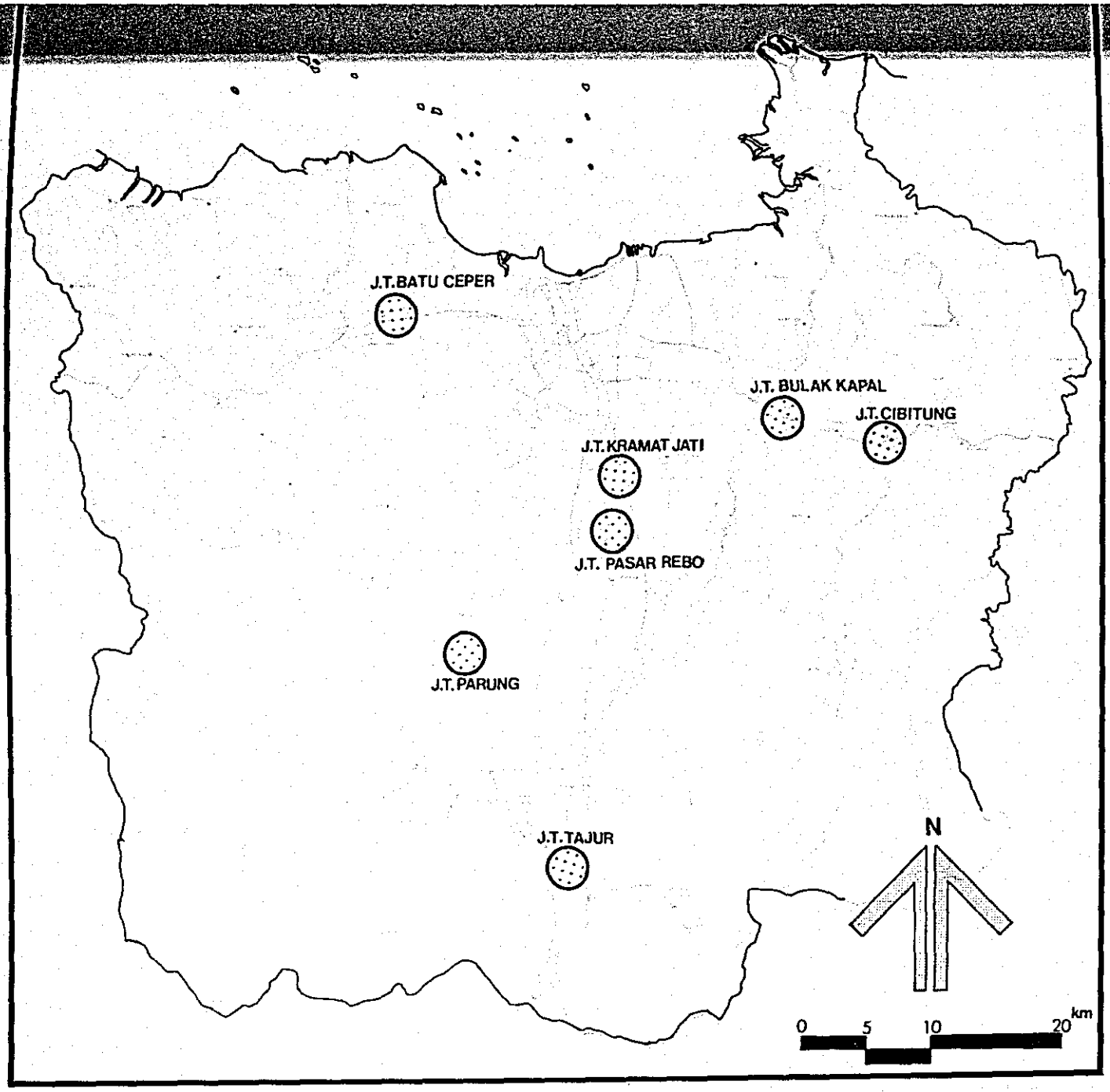


Fig. 3.14

O-D & T-C SURVEYS AT WEIGH BRIDGES

Legend :

Location of Weigh Bridge

JAKARTA HARBOUR ROAD PROJECT

3.2.7 Running Speed Survey

(1) Purpose and Method

The Running Speed and Delay Survey was undertaken to obtain precise information on the travel speeds and impediments to traffic stream flow within major sections of the road network in Jakarta. This survey was needed to evaluate the existing levels of service of the road network and to clearly define the causes of impediments to traffic stream flow.

The Running Speed and Delay Survey was carried out in two hour periods, 7:00 - 9:00 and 12:00 - 14:00.

A survey team was composed of one driver and two surveyors, whose jobs were as follows:

- At each check point, measure the distance and the arrival time from the starting point.
- When the test vehicle is forced to stop, measure the duration of the stop and note the reason for it.
- The drivers were instructed to travel at the same average speed as all other traffic at that point and time.

(2) Survey Results

The survey results are summarized in Tables 3.19.
In the morning peak, average running speed is 31.6 km/hour and overall travel speed is 27.0 km/hour. The stopping time/travel time ratio is 14.6 per cent. For the causes of delay, "traffic signals" are far above any other cause, but if compared with results from the 12:00 - 14:00 period, "public transport stopping", "right turning vehicle" and "general traffic congestion" indicate longer durations and higher frequency.

In the 12:00 - 14:00 period, the average running speed is 35.0 km/hour and overall travel speed is 30.8 km/hour, both of which are higher than those of the morning peak. The stopping time/travel time ratio is 12.2%, which is less than that of morning peak. For the causes of delay, "traffic signal" is the most important factor and accounts for 75.3%. If compared with the morning peak, "traffic signal" and "vehicles loading/unloading" contribute more to the delay.

For the detailed results of the running speed survey, please refer to Appendix 3.4.

Table 3.19 Summary of Result of Running Speed and Delay Survey

Survey items	(7:00 - 9:00)	(12:00 - 14:00)
Total distance	272.4 Km	274.2 Km
Total travel time	10 Hrs 5 Min 22 Sec	8 Hrs 54 Min 53 Sec
Total stopped time	1 Hrs 28 Min 27 Sec	1 Hrs 5 Min 1 Sec
Total running time	8 Hrs 36 Min 55 Sec	7 Hrs 49 Min 52 Sec
Overall travel speed	27.0 Km/Hour	30.8 Km/Hour
Average running speed	31.6 Km/Hour	35.0 Km/Hour

Causes of delay	(7:00 - 9:00)			(12:00 - 14:00)		
	Duration (Second)	% of Total Duration	Frequency	Duration (Second)	% of Total Duration	Frequency
Traffic signal	3112	58.6	94	2937	75.3	100
Railway crossing	40	0.8	1	17	0.4	2
Right turning vehicles	436	8.2	22	105	2.7	9
Public transport stopping	593	11.2	28	201	5.1	17
Vehicles loading/unloading	0	0	0	186	4.8	3
Other obstructions	403	7.6	4	0	0	0
General traffic congestion	723	13.6	27	455	11.7	18
Total	5307	100.0	127	3901	100.0	149

CHAPTER 4

DEVELOPMENT PLANS

Chapter 4 DEVELOPMENT PLANS

4.1 Area Growth Analyses

4.1.1 Methodology

There are two main objectives for the area growth study, and they are:

- To obtain the future potential of statistical and physical conditions in DKI Jakarta and its surroundings;
- To prepare a statistical base for the Transportation Study.

The area growth study was executed through four steps as follows:

- Inventory;
- Projection of Basic Statistics;
- Land use planning; and
- Estimation of Planning Parameters by zone.

The past development of basic statistics such as the residential population and employment rate were analysed and projected referring to studies which had been issued in the past.

Projection was made by means of a fairly demographic procedure with a very limited amount of planning measures formulated in the process of the area growth study.

In this chapter, projection of basic statistics which are significant as a control total for the zonal analyses was studied. The detailed zonal study on planning parameters is reported in Chapter 5.

4.1.2 Residential Population

(1) General

The statistical framework for the future residential population was made for DKI Jakarta (Daerah Khusus Ibukota Jakarta), and BOTABEK (Kabupaten *) of Bogor, Tangerang and Bekasi, and Kotamadya *) Bogor) for transportation studies.

Notes: *) The Province of West Java is divided into 20 Kabupatens (Countries) and Kotamadya (Cities).

The DKI Jakarta border has been expanded continuously almost

every year adding a considerable amount of sparsely inhabited fringe areas which used to be part of BOTABEK. The area of each Kecamatan indicated in the statistical year books, (the administrative units division for DKI Jakarta) seems to be changing rather frequently.

The map of administrative units division by DKI Jakarta, ADMINISTRATIVE DIVISION of DKI Jakarta, scale 1:50,000 was utilized for zone division in this study.

(2) Residential Population

1) Preparatory Work

The population added to DKI Jakarta resulting from the changes in its boundary is calculated to be 121 thousand in 1975 based on the data provided by the DKI Office. The population density of this added portion of DKI Jakarta is applied to the rural area added in each year of boundary expansion in computing the added population in each year.

Table 4.1 Population Development Adjusted by Border Changes

(Unit: 1,000 persons)

YEAR	AREA *)-1 (Km^2)	AREA ADDED (Km^2)	POPULATION ADDED						POPULATION CENSUS *)-2	ADJUSTED POPULATION	GROWTH RATE - (%/yr)
			1	2	3	4	5	TOTAL			
1973	576.41	7.92	11	20	114	5	19	169	4,973	5,142	-
1974	578.41	2.00	11	21	116	5	-	153	5,183	5,336	3.8
1975	578.41	-	11	21	118	-	-	150	5,404	5,554	4.1
1976	682.23	49.82	11	22	121	-	-	154	5,702	5,856	5.4
1977	637.10	8.87	12	22	-	-	-	34	5,925	5,959	1.8
1978	642.06	4.96	12	-	-	-	-	12	6,082	6,094	2.3

Source: *)-1 STATISTICAL YEARBOOK OF DKI JAKARTA, 1979

*)-2 STATISTICAL YEARBOOK OF DKI JAKARTA, 1979

The study team obtained "JABOTABEK METROPOLITAN DEVELOPMENT PLANNING, June 1980", which is a complete revision of "1973 JABOTABEK" and "1976 JABOTABEK". This report, therefore, is reflected in this study from the standpoint of reginal development. The study referred as "JMDP" in this study indicates the latest one, unless otherwise mentioned as "JABOTABEK" for both the 1973 and 1976 Reports.

The future DKI Jakarta population is projected through two steps. First, a relatively approximate curve of the migrating population into DKI Jakarta is assumed by means of a rather strictly demographic procedure. This framework is named the "Potential Population Framework".

Secondly, the maximum capacity of population absorption by DKI Jakarta is fixed by setting an optimum gross population density, and then, part of the migration population into DKI Jakarta estimated in the "Potential Population Framework" is assumed to overspill, or actually shift to outside DKI Jakarta as a result of the future development of the BOTABEK region. This projection is called the "Adjusted Population Framework".

These two steps are taken to identify a portion of the BOTABEK population which can be considered to spill over from DKI Jakarta.

2) Potential Population Framework

The average growth rate for DKI Jakarta population during 1973 to 1978 was 3.5% yr., and according to "JABOTABEK", 1973, the natural increase in growth rate was around 2.0%/yr., and the rest was due to migration. During the same period BOTABEK and JABOTABEK (the whole metropolitan area including Jakarta and BOTABEK) recorded population growth rates of 2.2%/yr. and 3.2%/yr respectively.

Assuming that the growth rate of the natural increase in 1971 in BOTABEK was equal to that for all of Java - Madura region (2.2%/yr.) where there was no migration increase into BOTABEK.

The natural growth rates in DKI Jakarta, BOTABEK and JABOTABEK are assumed to decrease continuously to around 1.5%/yr by the year 2000.*).

Notes: *) "STATISTICAL YEARBOOK OF INDONESIA, 1978" forecast that the natural growth rate will decline down to around 1.5%/yr. due to the effect of family planning campaign.

The future population of JABOTABEK is projected by referring to other studies. For intermediate stages, the population growth by migration is forecasted for each 5 year period assuming the largest migration volume would be recorded during the period from 1985 to 1990. Attention should be paid to the fact that an increase by migration during a five year period will start producing natural growth during the next 5 year period.

The population increase in JABOTABEK resulting from migration for each five year period is divided into DKI Jakarta and

Table 4.2 Potential Population Framework (Provisional Framework)

Year	Jakarta		BoTaBek		JaBoTaBek	
	(1) Total		(1) Total		(1) Total	
	(2) Average Annual Growth Rates (%) For next 5 years	(3) Increase in next 5 years ('000 persons)	(2) Annual Growth Rates or next 5 years (%)	(3) Increase in next 5years ('000 persons)	(2) Annual Growth Rates For next 5 years (%)	(3) Increase in next 5 years ('000 persons)
	(4) Natural Growth Rates (%)	(5) Natural: Migration: ('000persons)	(4) Natural Growth Rates (%)	(5) Natural: Migration: ('000 persons)	(4) Natural Growth Rates (%)	(5) Natural: Migration: ('000 persons)
1975	(1) 5,570		(1) 4,150		(1) 9,720	
	(2) 3.8	(3) 1,130	(2) 3.0	(3) 660	(2) 3.4	(3) 1,740
	(4) 1.9	(5) 570 560	(4) 2.1	(5) 450 210	(4) 2.0	(5) 1.020 770
1980	6,700		4,810		11,510	
	3.2	1,140	3.3	850	3.2	1,990
	1.8	630 510	1.9	470 380	1.8	1,100 890
1985	7,840		5,660		13,500	
	2.5	1,030	3.6	1,090	3.0	2,120
	1.7	690 0,340	1.8	530 560	1.7	1,220 900
1990	8,870		6,750		15,620	
	2.0	920	3.1	1,110	2.5	2,030
	1.6	730 190	1.6	560 550	1.6	1.290 740
1995	9,970		7,860		17,650	
	1.8	890	2.4	990	2.0	1,880
	1.5	760 130	1.5	610 380	1.5	1,370 510
2000	10,680		8,850		19,530	
	1.6	870	1.7	780	1.6	1,650
	1.4	770 130	1.4	640 380	1.4	1,410 510
2005	11,550		9,630		21,180	
	1.6	950	1.7	850	1.6	1,800
	1.4	830 120	1.4	690 210	1.4	1,520 280
2010	12,500		10,480		22,980	

BOTABEK assuming the pattern of migration into both regions in the future.

Based on the above considerations, the results of estimated "Potential Population" are as shown in Table 4.2. According to this estimation, the potential population for DKI Jakarta in the year of 2000 will be approximately 10.7 million.

3) Adjusted Population Framework

According to the "Potential Population Framework" the gross DKI Jakarata population density in 2000 will be 163 persons/Ha which is almost twice as high as that in 1976, when it was 89 persons/Ha, and this figure seems to be quite unacceptable. The "Potential Population Framework" should therefore be revised setting the maximum population of DKI Jakarta in 2000. Assuming 150 person/Ha to be the optimum gross population density in DKI Jakarta the maximum capacity of population absorption by DKI Jakarta would be about 9.8 million at that time. *)

Note: *) Adjustment of a demographic population forecast from an urban planning point of view has to be done with a reasonable range. Reference was made to past studies including "Jakarta Masterplan 1965 - 1985", "JMATS", "JABOTABEK" and "JMDP" as shown in Table 4.3.

Table 4.3 Gross Population Density of DKI Jakarta in future by Issued Report

"JAKARTA MASTER PLAN 1965 - 1985"	"JMDP"	JMATS	"JABOTABEK"
(1985)	(2003)	(2000)	(2000)
107 persons/Ha	186 persons/Ha	160 persons/Ha	91 persons/Ha

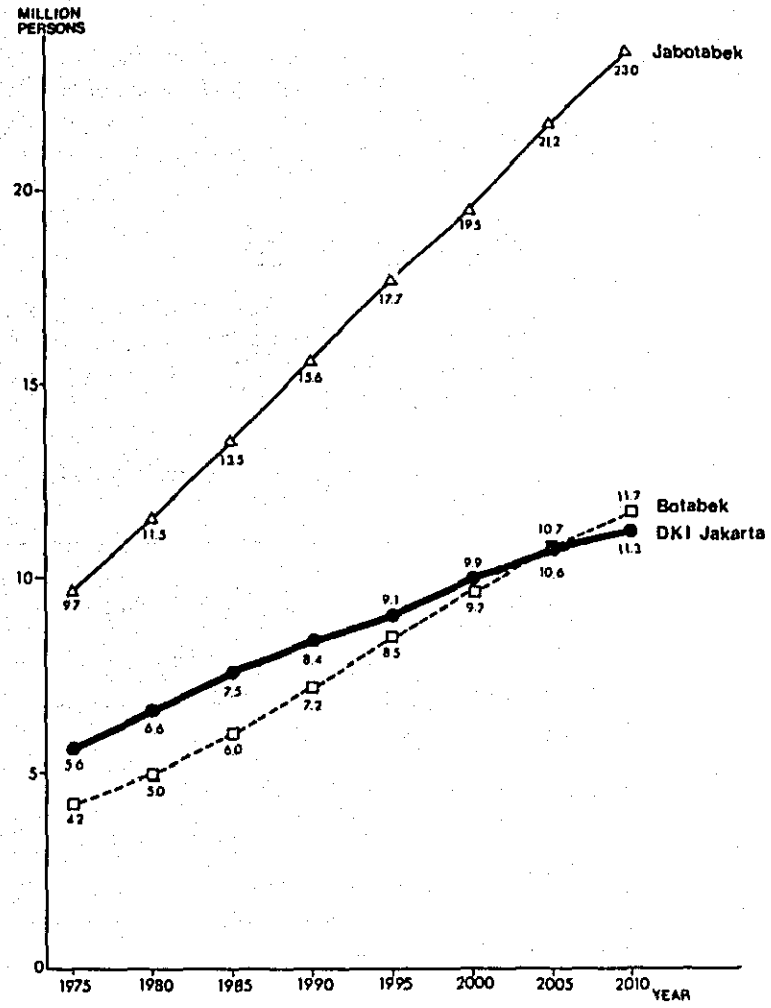
Under the conditions mentioned above, a portion of the future DKI Jakarta population in the "Potential Population Framework" is moved out of DKI Jakarta into the surrounding regions in BOTABEK. There is no change for the population framework for JABOTABEK as a whole.

As a result the residential population in JABOTABEK in the years 1990, 2000 and 2010 is estimated to be 15,620 thousand persons, 19,530 thousand persons and 22,980 thousand persons, respectively. The results are shown in Table 4.4 and Fig. 4.1.

Table 4.4 Population Framework

Year	Jakarta		Botabek		Jabotabek
	(1)Total		(1)Total		Total
	(2)Average Annual Growth Rates (%) for next 5 years	(3)Increase in next 5 years ('000 persons)	(2)Average Annual	(3)Increase in next 5 years ('000 persons)	
	(4)Natural Growth Rate (%)	(5) Natual: (6) Migration: ('000 persons)	(4) Natural Growth Rate (%)	(5) Natural: (6) Migration: ('000 persons)	
1975	(1) 5.57		(1) 4.15		(1) 9.72
	(2)3.3%	(3)0.99	(2)3.6	(3)0.80	
	(4)1.9	(5)0.57 (6)0.42	(4)2.1	(5)0.45 (6)0.35	—
1980	6.56		4.95		11.51
	2.8	0.97	3.8	1.02	
	1.8	0.62 0.35	1.9	0.49 0.53	—
1985	7.53		5.97		13.50
	2.2	0.86	3.9	1.26	
	1.7	0.66 0.20	1.8	0.56 0.70	—
1990	8.39		7.23		15.62
	1.7	0.75	3.3	1.28	
	1.6	0.69 0.06	1.6	0.60 0.68	—
1995	9.14		8.51		17.65
	1.5	0.72	2.6	1.16	
	1.5	0.72	1.5	0.66 0.50	—
2000	9.86		9.67		19.53
	1.4	0.69	1.9	0.96	
	1.4	0.69 —	1.4	0.70 0.26	—
2005	10.55		10.66		21.18
	1.4	0.76	1.9	1.04	
	1.4	0.76 —	1.4	0.77 0.27	—
2010	11.31		11.67		22.98

Fig. 4.1 Future Population Forecast



4.1.3 Employed Population

(1) Rate of Employment

The estimates of future employment rates in DKI Jakarta and BOTABEK in 1980, 1990 and 2000 are based on the "JMDP" study. However, the employment rate applied for the year 2003 in the "JMDP", 41.1%, was assumed to be attained by the year 2010 in this study.

(2) Sectoral Composition of Employment

For the determination of future sectoral composition of employed population, the employment rate applied for each industrial sector was used from "JMDP" for the whole JABOTABEK area as shown in Table 4.5.

Table 4.5 Rate of Employment and Sectoral Composition in 2000 by Reports Issued

(Unit: %)

Names of Reports		"JMDP" (2003)			"JMATS"		"JABO-TABEK"	"OUTER RING ROAD"		
Regions		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Rate of Employment		41.1	41.1	41.1	31	31	-	31.0	28.0	29.6
Sectoral Composition	I	1.0	43.0	20.1	2	35	5	0.5	19.0	8.4
	II	99.0	57.0	79.9	28	25	35	32.5	32.0	32.3
	III				70	40	60	67.0	49.0	59.3

Note: (1) DKI Jakarta

(2) Botabek

(3) Jabotabek

(3) Future Employed Population

The estimated future employed population in JABOTABEK area based on the assumptions of the JMDP report is 5,544 thousand persons, 7,574 thousand persons and 9,438 thousand persons for the years 1990, 2000 and 2010, respectively. These are further detailed in Table 4.6.

Table 4.6 Future Employment Structure in DKI Jakarta & Botabek

(Unit: 1,000 persons)

			1980	1990	2000	2010
DKI JAKARTA	Residential Population		6,560.0	8,390.0	9,860.0	11,310.0
	Rate of Employment (%)		32.1	35.4	38.8	41.1
	Employed Population		2,105.1	2.972.0	3.823.7	4,645.0
	Sectoral Composition (%)	I	2.7	1.2	0.4	0.2
		II+III	97.3	98.8	99.6	99.8
	Employed Population by Sector	I	57.1	36.0	15.0	7.0
		II+III	2,048.0	2,936.0	3,808.7	4.638.0
BOTABEK	Residential Population		4,950.0	7,230.0	9,670.0	11,670.0
	Rate of Employment (%)		32.4	35.6	38.8	41,1
	Employed Population		1,601.1	2,571.5	3,750.0	4,792.9
	Sectoral Composition (%)	I	59.6	50.0	42.0	39.5
		II+III	40.4	50.0	58.0	60.5
	Employed Population by Sector	I	953.7	1,287.0	1.576.7	1.891.1
		II+III	647.4	1,284.5	2.173.3	1.898.1
JABOTABEK	Residential Population		11,510.0	15,620.0	19,530.0	22,980.0
	Rate of Employment (%)		32.2	35,5	38.8	41.1
	Employed Population		3,706.2	5,543.5	7,573.7	9,437.9
	Sectoral Composition (%)	I	27.3	23.9	21.0	20.1
		II+III	72.7	76.1	79.0	79.9
	Employed Population by Sector	I	1,010.8	1,323.0	1.581.7	1.898.1
		II+III	2,695.4	4,220.5	5,982.0	7,539.8

4.1.4 Estimation of Future Jobs (At work Place)

(1) Preparatory Work

1) Balance of Jobs and Employed Population

The employed population (at residence) implies generated work trips on one hand and the number of jobs at work place indicates attracted work trips on the other hand.

The number of jobs in a region was computed by estimating its outflow and inflow in work trips derived from the roadside OD survey carried out for the study. A future framework of jobs was computed by estimating a balance of the inflow and outflow of work trips to and from the region.

According to this survey, excess flow in work trips was estimated to be 59,700 person trips per day as shown in Table 4.7.

From the above, OD matric trips attracted to Jakarta exceeds those generated from Jakarta. It is, therefore, considered that the number of jobs in Jakarta is larger than the employed population and the balance is supplemented by other regions. The break-down of excess inflow work trips to Jakarta is shown in Table 4.8.

Table 4.7 All Day Work Trip Generation and Attraction in 1980

O \ D	JAKARTA	BOTABEK	OTHER	TOTAL	EXCESS IN-FLOW WORK TRIPS
JAKARTA	873.3	80.9	5.1	959.3	59.7
BOTABEK	140.3	7.6	0.5	148.5	Δ59.5
OTHER	5.4	0.5	0.0	5.9	Δ 0.2
Total	1,019.0	89.0	5.7	1,113.7	0

Note: Δ means "Excess Out-flow"

Table 4.8 Distribution of Excess In-Flow Work Trips by Origin of Trips

(Unit: 1,000 person trips)

	TANGE-RANG	BOGOR	BEKASI	BOTABEK	OTHER	TOTAL
Excess In-Flow Work Trips to Jakarta	24.0	22.2	13.2	59.4	0.3	59.7
	(40.2)	(37.2)	(22.1)	(99.5)	(0.5)	(100%)
	(40.4)	(37.4)	(22.2)	(100.0%)	(0.5)	(100.5%)

2) Work Places and Rate of Effective Working Days

According to the Home Interview Survey, those who have their work places outside their zone (traffic analysis zone) and those who have their work places inside their zone account for 47.65% and 52.35% respectively of the total number of workers sampled. Taking this into consideration, the total number of potential work trips (including intra-zonal trips) generated in Jakarta is estimated based on the total employed population in the region as shown below.

Estimated Potential Work Trips in Jakarta, 1980

(Unit: 1000 persons)

Employed Population	Potential Intra-zonal Work Trips	Potential Inter-zonal Work Trips	
		(Generated)	(Attracted)
2,105.1	1,102.0	1,003.1	1,065.5

The rate of effective working days per annum, therefore, is calculated as follows;

$$\left(\begin{array}{l}\text{Inter-zonal} \\ \text{Work Trip Generation}\end{array}\right) \Big/ \left(\begin{array}{l}\text{Potential Inter-zonal} \\ \text{Works Trips}\end{array}\right)$$

$$= 959.3 \;/\; 1{,}003.1 \quad = \quad 0.956$$

This figure, derived from the Home Interview survey and the estimated OD matrix, is quite reasonable compared with the following rate of estimation.

Sunday	52 days/year
National Holiday	15 days/year
Total Holidays	67 days/year
Potential workdays	365 - 67 = 298 days/year
Paid leave	15 days/year
Leave ratio	15/298 = 0.05
Effective workday ratio	1 - 0.05 = 0.95

3) Estimation of Jobs in Jakarta, 1980

Taking the effective rate of working days, 95%, the total number of jobs in Jakarta is estimated as follows:

Attracted Work Trips to Jakarta	1,019.0 thousand persons
Rate of effective working days	95%
Potential No. of Workers Attracted to Jakarta	1,065.5 thousand persons
Potential Intra-Zonal Work Trips	1,102.0 thousand persons
Estimated No. of Jobs in Jakarta	2,167.5 Jobs

4) Estimation of Jobs in BOTABEK, 1980

Based on the excess flow in work trips to Jakarta and the employed population in BOTABEK, the number of jobs in BOTABEK is estimated as follows:

Potential In-Flow Work Trips to Jakarta, 1980

(Unit: 1000 persons)

	Tangerang	Bogor	Bekasi	BOTABEK	OTHER	TOTAL
Actual	24.0	22.2	13.2	59.4	0.3	59.7
Potential	25.1	23.2	13.8	62.1	0.3	62.4

Table 4.9 Estimated Number of Jobs in Jabotabek, 1980

(Unit: 1000 persons)

	Employed Population	Excess in-flow to JKT (Potential)	JOBS
J a k a r t a	2,105.1	+62.4	2,167.5
BOTABEK	1,601.1	-62.1	1,539.0
Tangerang	445.8	-25.1	420.7
Bogor	813.8	-23.2	790.6
Bekasi	341.5	-13.8	327.7
JABOTABEK Total	3,706.2	+0,3	3,706.5
OTHER	A	-0,3	A-0,3
T O T A L	3,706.2+A	0	3,706.2+A

(2) Estimation of Future Jobs in Jakarta and BOTABEK

The potential excess in-flow of work trips to Jakarta was estimated at 62,400 thousand persons per day. This accounts for 9.64% of the total BOTABEK population employed in secondary and tertiary sectors.

Future excess in-flow of work trips were estimated assuming 10% of the total BOTABEK population employed in secondary and tertiary sectors. Eventually, the future growth of excess in-flow in 2000 was calculated to be 217,300 thousand persons or 3.48 times larger than that in 1980.

The "JMDP" also estimated the employment balance between Jakarta and BOTABEK. According to this report, the excess work trips flowing to Jakarta was estimated at 43,700 thousand persons per day in 1978 and is expected to grow to 138,300 thousand persons per day in 2003, or 3.16 times larger than that in 1978.

As can be seen from the above the growth ratios of the excess of work trips (or balance of employment) to Jakarta during the coming 20 years will be 3.16 times and 3.48 times larger than the respective study years in "JMDP" and this study respectively, and these figures are very close to each other.

Taking the above into consideration,the future excess of work trips flowing to Jakarta are estimated as shown in Table 4.10.

Table 4.10 Future Excess In-Flow of Work Trips

	1980	1990	2000	2010
Excess In-Flow of Work Trips to JKT (persons/day)	62,400	128,500	217,300	290,200
From BOTABEK	62,100	127,900	216,200	288,700
From OTHER REG.*	300	600	1,100	1,500

Note: * Among the excess in-flow of work trips to Jakarta, 0.5% of the total excess derives from outside JABOTABEK in 1980.
This portion was assumed to remain in the future.

The future number of agricultural jobs in Jakarta, was based on the "DKI Jakarta Landuse, 2000".

The previous estimation of future excess in-flow of work trips to Jakarta is to be reflected in the balance of employment level in Jakarta, Tangerang, Bogor and Bekasi. Taking this into consideration the preliminary estimate of jobs is adjusted as shown in Table 4.11.

Table 4.11 Future Jobs in Jabotabke Area (1)

(Unit: 1000 Persons)

Region \ Year / Ind.Sector	1980				1990			
	I	II	III	Total	I	II	III	Total
Jakarta	57.1	228.0	1,887.4	2,167.5	36.0	310.7	2,753.8	3,100.5
BOTABEK	953.7	147.1	438.2	1,539.0	1,287.0	304.1	942.5	2,443.6
TANGERANG	231.1	59.8	129.8	420.7	299.5	119.3	227.9	646.7
BOGOR	510.0	57.3	223.3	780.6	696.1	114.7	453.1	1,263.9
BEKASI	212.6	30.0	85.1	327.7	291.4	70.1	171.5	533.0
JABOTABEK	1,010.8	375.1	2,320.6	3,706.5	1,323.0	614.8	3,606.3	5,544.1

Future Jobs in Jabotabek Area (2)

(Unit: 1000 Persons)

Region \ Year / Ind.Sector	2000				2010			
	I	II	III	Total	I	II	III	Total
Jakarta	15.0	369.6	3,656.4	4,041,0	7.0	426.2	4,502.0	4,935.2
BOTABEK	1,576.7	545.5	1,411.6	3,533.8	1,831.4	763.2	1,909.6	4,504.2
TANGERANG	358.4	210.4	411.6	1,010.4	412.3	309.6	679.5	1,401.4
BOGOR	857.4	190.0	665.4	1,712.8	998.2	238.0	796.3	2,032.5
BEKASI	360.9	145.1	304.6	810.6	420.9	215.6	433.8	1,070.3
JABOTABEK	1,591.7	915.1	5,068.0	7,574.8	1,838.4	1,189.4	6,411.6	9,439.4

4.1.5 Economic Development of DKI Jakarta

Economic indices for DKI Jakarta show a steady growth in the economy in the past several years. The future GRDP and Per Capita Income were estimated to grow at an annual average rate of 6.5% by the year 2000, based on that the annual growth rate estimated in "JMDP" was 6.54% from the year 1978 up to 2003, and the annual growth rate by the year 2010 was assumed to be 6.0%, taking into account the fact that the economic development would attain full growth after the year 2000.

The results of this estimation are as shown in Table 4.12.

Table 4.12 GRDP and Income

(at 1975 Constant Prices)

	1980	1990	2000	2010
GRDP ($x10^9$ R_p)	1,634	3,065	5,776	10,344
Per Capita Income ($x10^3$ R_p)	218.2	388.8	774.6	1387.3

Car ownership has also been estimated by correlating a relationship to GRDP and Per Capita Income. Estimated car ownership and mobilization level are shown in Table 4.13.

Table 4.13 Car Ownership Forecast

	1979	1980	1990	2000	2010
Total Motor Vehicle	692,817 (100.0)	749,060 (100.0) [1.0]	1,178,590 (100.0) [1.6]	1,657,750 (100.0) [2.2]	2,076,240 (100.0) [2.8]
Sedans	202,781 (29.3)	221,580 (29.6) [1.0]	351,580 (29.8) [1.6]	506,710 (30.6) [2.3]	646,820 (31.2) [2.9]
Trucks	64,713 (9.3)	68,520 (9.1) [1.0]	104,110 (8.8) [1.5]	139,790 (8.4) [2.0]	172,600 (8.3) [2.5]
Motor Cycles	403,668 (58.3)	436,120 (58.2) [1.0]	687,850 (58.4) [1.6]	962,020 (58.0) [2.2]	1,194,560 (57.5) [2.7]
Busses	21,655 (3.1)	22,840 (3.0) [1.0]	35,050 (3.0) [1.5]	49,230 (3.0) [2.2]	62,260 (3.0) [2.7]
Motorizations(1)*1 (Per 1000 people)	111.0	114.2	140.5	168.1	183.6
Motorization (2)*2 (Per 1000 people)	32.5	33.8	41.9	51.4	57.2

Notes: *1 : including motorcycles
*2 : sedan ownership rate

Figures in parentheses show the share of vehicles.
Figures in [ ] show the index compared with 1980.

4.2 Landuse in DKI Jakarta

4.2.1 General

So far, several landuse concepts have been proposed by past studies and some of them have become somewhat outdated by the rapidty of actual development.

According to the landuse prospect in the target year for this study, 2010, the gross density in DKI Jakarta is estimated to be 150 persons/Ha and this requires conversion of existing green areas to residential areas in almost every part within DKI Jakarta city limits, except for some special low building coverage areas for green preservation, river banks, recreational areas, aquiferous recharge areas, etc.

DKI Jakarta Government has been revising the "Jakarta Masterplan 1965 - 1985" continuously. Jakarta Metropolitan Area Transportation Study (JMATS), Jabotabek Masterplan Study and other transportation sector studies, such as Jakarta Ring Road Study, Jakarta-West Java Tollway Study, Jakarta Intra Urban Tollway Study, Jakarta Urban/Suburban Railway Study and Jabotabek Bus Study have provided impact to the need for an updated masterplan.

Generally, the commuting area will expand still more widely exceeding the boundary of 15 km radius area, because an organized highway network can pick up commuters from every part of the city through regional collector roads without difficulty. Potential residential area can be permitted to expand all over the city if there are improvements in the road network.

In the recent "Jabotabek Metropolitan Development Planning" report, the area along the DKI Jakarta border was considered to be a transitional zone from rural to semi-urban. Within this zone developments would start along major directions towards growth poles in regional centers in the JABOTABEK-region, such as Tangerang, Bogor, Cikarang, Bekasi, Serpong, Depok, etc.

Furthermore, the proposed Outer Ring Road will encourage this development by stimulating development along the road corridor. Especially, at interchanges of Outer Ring Road and radial arterials, development of the surrounding area will occur.

At the same time, development of the transitional zone, will occur in opposite direction from rural growth poles towards DKI Jakarta. This is due to the expansion of the rural growth poles by absorbing the migrating population from rural areas within BOTABEK.

To accelerate this dual directional development, it will be effective to locate sub-growth poles with some urban character not far from the Outer Ring Road.

In dispersing these sub-growth poles, some of the urban activities should also be distributed in the form of activity centers, as will be mentioned later.

Within DKI Jakarta city border, commercial and administrative areas will be intensively developed along major arterials such as Jalan Gator Subroto, Jakarta By-Pass and Jakarta-Bekasi Highway. Needless to say, expansion of the existing CBD will continue constantly.

Masterplan of DKI Jakarta is shown on Fig. 4.2 drawn based on a consideration of the future highway network, based on "Jakarta Masterplan 1965 - 1985".

4.2.2 Future Urban Structure

(1) Sub-growth Pole

In the "JABOTABEK" report the area along the Jakarta border is considered to be a transitional area which will be developed under the influence of DKI Jakarta City. The area within DKI Jakarta border will be a residential area before the year of 2000, and excess population from Jakarta will increase the population in this area.

Along with the residential development within DKI Jakarta and major BOTABEK growth poles, the development of transitional areas should be initiated to meet the future demand. This would start in area along major radial highways, corridors, in a dual directional from DKI Jakarta towards BOTABEK. By locating regional urfan centers or sub-growth poles with a magnitude of more than a rural center in each corridor near the interchange of Outer Ring Road and radial highways, the dual directional development can be connected.

The character of each sub-growth pole depends on landuse conditions around it.

Five major corridors were selected for alternative locations of sub-growth poles.

1) Jakarta - Tangerang Corridor

In a narrow zone between the Jakarta-Tangerang Highway and Tangerang Railway Line, ribbon industrial developments are planned. When Outer Ring Road is extended to Harbour Road, this area will have a strong connection to Tg. Priok. When Jakarta Airport Cengkareng is constructed, more traffic will use Outer Ring Road and a considerable amount of this traffic will flow into Jakarta-Tangerang Highway through the interchange. Therefore, for both passenger and cargo traffic, the interchange in this corridor will become one of the most important nodes on Outer Ring Road.

There are several housing projects within DKI Jakarta, and they will require a regional center. Therefore, a regional city center with commercial and administrative facilities and a cargo terminal will be suitable in this corridor.

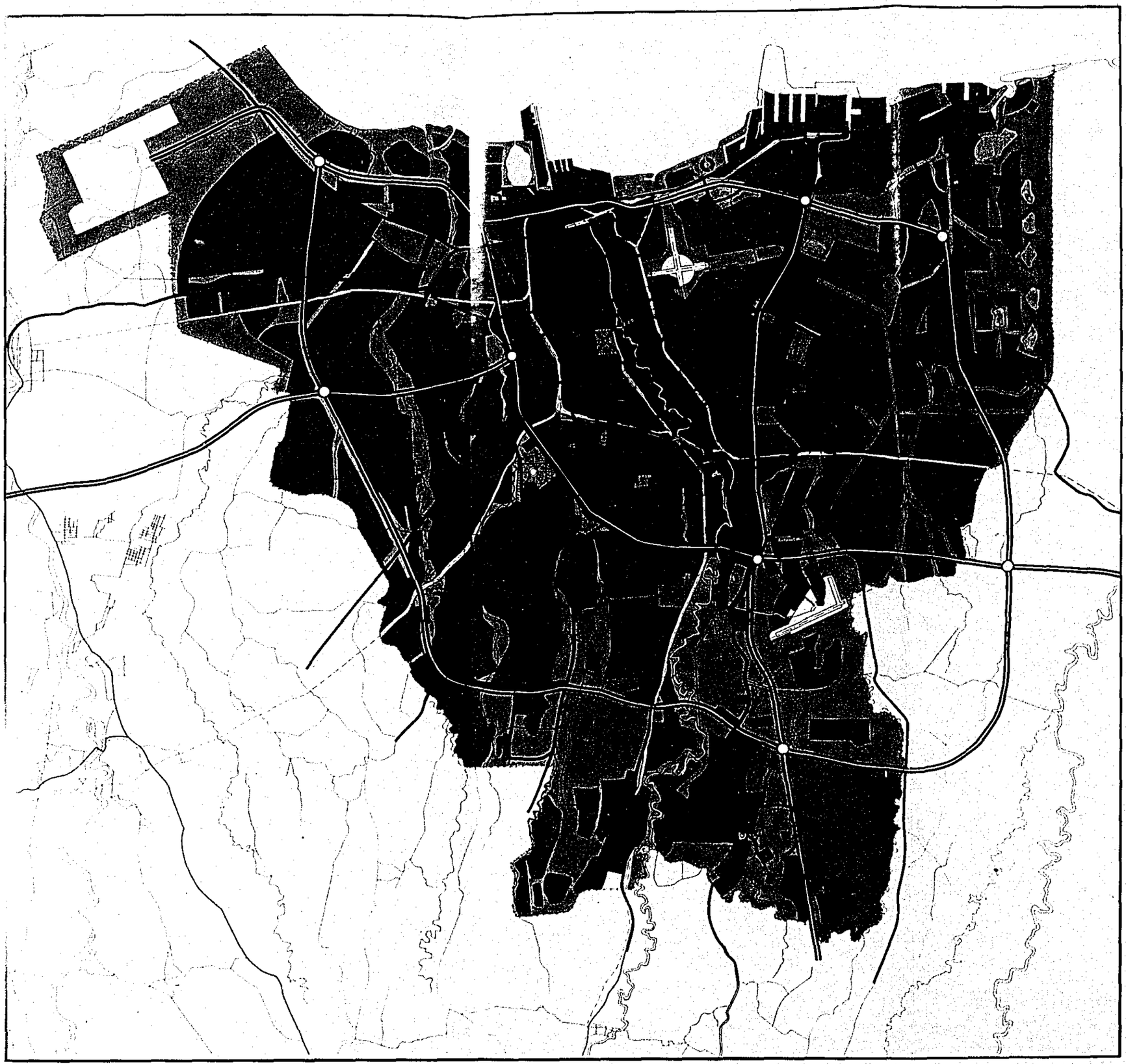


Fig. 4·2

MASTER PLAN

OF DKI JAKARTA

LEGEND

- COMMERCIAL, PUBLIC FACILITIES
- MIXED BUILDINGS
- HOUSING
- INDUSTRY
- GREEN, PARK & CATTLE BREEDING
- LAKE
- TOLLWAY
- ARTERIAL ROAD
- FEEDER ROAD
- RAILWAY

N

0 1 2 3 4 5km

JAKARTA

HARBOUR ROAD

PROJECT

2) Jakarta - Serpong Corridor

This corridor is on the extension of good residential areas within DKI Jakarta city and the potential for residential developments is very high. Jakarta-Serpong Highway and the improvement of Parung Panjang Railway Line, or Jakarta-Serpong Line will add more favourable conditions. If the railway is electrified and used for commuting, continuous residential developments along the railway will become possible. Also, the Jakarta-Serpong Highway will not be a tollway and will be freely accessible to the populated areas along it. A city center with commercial and administrative facilities around the interchange of Outer Ring Road and Jakarta-Serpong Highway will serve these residential communities.

3) Jakarta - Depok Corridor

There are already several institutions such as a military complex, recreational facilities, university etc. It would be reasonable to encourage institutional or recreational developments in this direction while preserving sufficient green space.

4) Jakarta - Bogor Corridor

This connection between DKI Jakarta and Kotamadya Bogor has always been very strong. Bogor is the second largest city in the Jakarta metropolitan region and along Bogor Highway there is a chain of commercial and residential developments.

When the Jagorawi Highway is extended to Bogor and the Intra Urban Tollway is open, Tanjung Priok and the DKI Jakarta city center will become more accessible from this area.

At present there exists a large wholesale market for agricultural products along the Bogor Highway. A development with terminal facilities or an industrial complex for processing agricultural products would be suitable around the interchange of the Outer Ring Road and the Jagorawi Highway.

5) Jakarta - Bekasi Corridor

East of Jakarta, Pulo Gadung, there will be an extensive industrial development. The cargo flow in this direction is the most massive of all directions and it will increase steadily. When the Outer Ring Road and Jakarta-Cikampek Highway are open, they will add impetus to the amount of cargo flowing into the industrial area. Therefore, the area around the interchange of Outer Ring Road and Jakarta-Bekasi Highway will be a suitable location for a large scale cargo terminal.

The area around these future terminals will be suitable locations for activity centers, thus assisting in the decentralization of urban facilities.

(2) Activity Centers

The definition of an activity center is an area where higher activities than the surroundings are generated, by pasar, transportation terminal and/or public facilities of residential, religious, recreational functions etc.

Among these activities, pasar and transportation terminals are the most important.

1) Pasar

According to "KUMPULAN PERATURAN PERPASARAN, D.K.I. JAKARTA", 1975, during a period from 1971 to 1975 the total number of pasars has remained almost the same, however, their distribution and size have changed to a certain extent. In Central Jakarta, the total number of pasars has decreased, especially the number of small scale pasars which deal with goods on a daily basis.

The growth rate of residential population in the same area has been lower than the other wilayah.

In other areas, a small increase in the number of pasars has been recorded, especially in South Jakarta. This is due to the residential development in the same area. Around large scale pasars there are many smaller pasars located and these also generate higher regional activities. Most of the large scale pasars are located around major transportation terminals.

2) Transportation Terminals

There are at present about 10 bus terminals in DKI Jakarta and each of them forms the core of an activity center.

DKI Office has a plan to drive out inter-regional long distance buses from the CBD by moving the long distance bus terminals outside the CBD. In the distant future, the constructing of bus terminals at junctions of Outer Ring Road and inter-regional highways is planned to serve not only long distance buses but also city buses within the residential areas inside the Outer Ring Road.

(3) Existing Development Plans

1) Residential Developments

There are three kinds of residential development as follows:

i) Kampung Improvement Project

The Kampung Improvement Project started in 1969 and its first stage was completed in 1978. By the end of the first stage 7,838 Ha of Kampung was planned to be improved. In the second stage after 1979, improvement of those areas in the suburbs and further up-grading of the already improved Kampung will become the main objectives.

ii) Housing Development by the Government

The Local and Central Governments have residential development plans for their employees. They also have residential development plans for low income people such as Site and Service Housing Projects or Low Cost Housing Projects in Tegal Alur, Prondok Kelapa, etc. and these will be carried out by Perumnas (National Housing Board).

iii) Housing Projects by Private Developer

There are many housing projects by private developers, for example those in Pluit, Ancol, Sunter, etc.

Residential development in green reservation area is permitted only within a building coverage of from 5% to 15%, and also the minimum lot size must be more than 2,500 m^2. For example, Desa Setu is assigned to have less than 5% building coverage and Desa Kemang is designed for 15% of building coverage.

2) Industrial Developments

Following the policy of "Masterplan of DKI Jakarta 1965 - 1985" industrial areas will be concentrated in Pulogadung, Gandaria and Rawa Buaya.

Other industrial areas include the timber estate in Marunda, handicraft industries in Tanah Kusir and assembling industries along the Jakarta By-pass. Small scale home industries are encouraged within the residential areas. DKI Government has been relocating warehouses in Kota or Jelambar to East Sunter or Pulogadung.

3) Other Major Development

The planned military complex (Hankam) in Cilangkap has already progressed up to the land levelling stage. Although its further development is pending it will resume soon or later. This military complex is expected to accommodate approximately 30,000 employees. Other military facilities are planned in fringe areas such as air force facilities around the Halim Airport in the future.

The University of Indonesia will move to the central district in Depok area in the future.

4.2.3 Future Land Use Composition

DKI Office has been revising the "Jakarta Masterplan 1965 - 1985" continuously, and a future land use map, conventionally called the "DRAFT MASTERPLAN", as one of the products of this revision is provided. The "DRAFT MASTERPLAN" in this report is used as a base for the future land use planning, and the land use in it is classified into:

- Industrial Areas;
- Commercial/Administrative Areas;
- Residential Areas;
- Green Areas.

For the purpose of this study the above classification is re-classified into:

- Commercial/Administrative Areas;
- Industrial Areas;
- Residential Areas outside Kampungs;
- Kampungs;
- Agricultural Areas; and
- Green Areas.

As shown in Table 4.14, Commercial/Administrative Area, Manufacturing Industrial Area and Residential Area tend to increase and Agriculture Areas tend to decrease.

Table 4.14 DKI Jakarta Land Use

Land Use	1977		2000		Rate of Increase (%)
	Area (ha)	%	Area (ha)	%	
Commercial/Administrative Area	3,494	5.3	5,495	8.4	157.3
Manufacturing Industry	1,543	2.4	8,522	13.0	452.3
Residential Area	19,900	30.4	33,605	51.4	168.9
Outside Kampung	12,062	18.4	25,767	39.4	113.6
Kampung	7,838	12.0	7,838	12.0	0
Agriculture	28,102	43.0	4,600	7.0	Δ83.6
Green, etc.	12,367	18.9	13,184	20.0	6.6
Total Area	65,406	100.0	65.406	100.0	0

Note: Δ means rate of decrease.

4.3 Transport Development Plans

4.3.1 General

In this paragraph, the contents of existing main transport development plans were summarized with regard to the following facilities:

- Tollway Network Plan,
- Railway Improvement Plan,
- Jakarta Airport Cengkareng,
- Ports Development Plan.

All of the developments listed above have a strong relation with the Harbour Road, and the function of Harbour Road will be characterized by the establishment of these projects.

4.3.2 Tollway Network

Jakarta-West Java Tollway System is scheduled to be constructed to promote unification of JABOTABEK area as a metropolis and to improve traffic congestion in the area.

The tollway network consists of the following tollways, which are illustrated on Fig. 4.3.

- Jakarta - Tangerang Freeway;
- Jagorawi Freeway;

- Jakarta - Cikampek Freeway;

- Jakarta Outer Ring Road;

- Cengkareng Access;

- Jakarta Harbour Road;

- Jakarta Intra Urban Tollway;

The Jakarta-West Java Tollway System is the backbone of the highway network in the Jakarta Metropolitan area. In general, the objectives of the Jakarta-West Java Tollway system are as follows:

i) To prevent migration into the special capital city of Jakarta, and encourage the development of satelite towns in the peripheral area.

ii) To promote more efficient coordination of JABOTABEK area as a Metropolitan region.

iii) To assist and improve the port activities of Tg. Priok, which serves not only for DKI Jakarta but also for West Java and some parts of South Sumatra.

iv) To serve and maintain DKI Jakarta as the capital city and enable it to continue to function as such.

By giving consideration to these objectives and clarifying the land use zoning, it is also expected that manufacturing factories will be encouraged locate outside DKI Jakarta. Local government's guidance in relocation of manufacturing outside DKI Jakarta and provision of good access to the Tollway System will enable those manufactures to achieve faster access to the trading port by trunk highways. This will result in reduced transportation costs and thus encourage other manufacturers to locate far outside of the city. The resulting increase in job opportunities in the peripheral area will help to stop the inflow of population.

Following this concept, the policy of regional freeways was established. These freeways run in three directions from Jakarta, to south, west and east. The Jagorawi Freeway, extending to south, is now under operation; the construction of Jakarta-Merak Highway (i.e. Jakarta-Tangerang Freeway, Ci Ujung Bypass and Serang Bypass) is now in progress assisted by an OECF loan and is scheduled to be completed by the middle of 1984; and the Jakarta-Cikampek Freeway stretching to east has started land acquisition, after completion of the negotiations with the World Bank and the Kuwait Fund. As a result, from 1983 to 1985, by those regional freeways and other radial arteries, a vast amount of traffic will be generated toward Jakarta.

In order to allow Tanjung Priok Port, which has DKI Jakarta and West Java as hinterlands, to function effectively and to make direct links with the peripheral area, Jakarta Harbour Road and Jakarta Outer Ring Road are being planned. These roads will not only serve as bypasses but will also provide development impacts on the peripheral area.

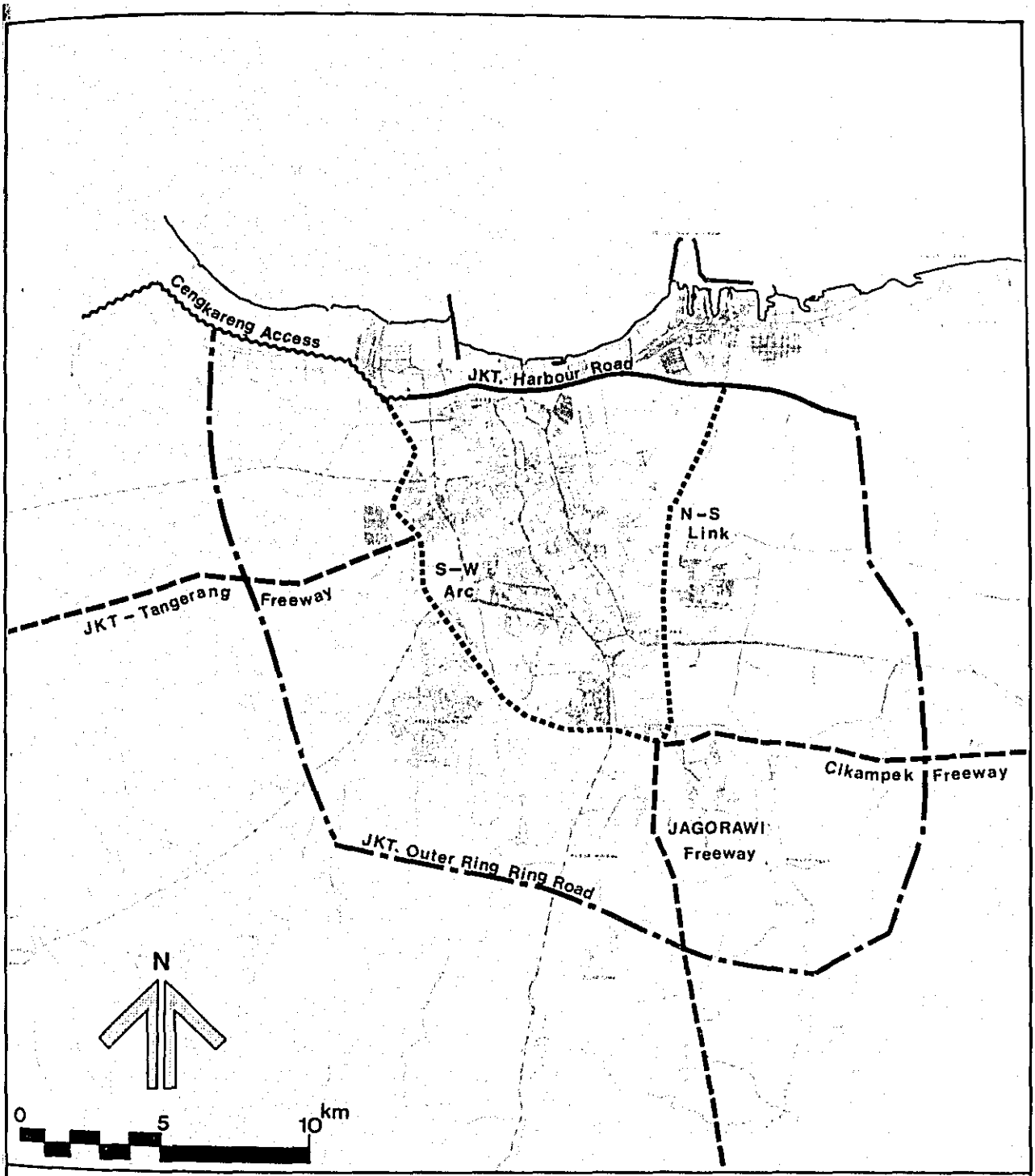


Fig. 4.3 JAKARTA-WEST JAVA TOLLWAY SYSTEM

Legend :

- Harbour Road
- Jakarta Ring Road
- Intra Urban Tollway
  South-West Arc, North-South Link
- Inter-Regional Freeway
  Jakarta-Cikampek Freeway
  Jagorawi Freeway
  Jakarta-Tangerang Freeway
- Cengkareng Access

JAKARTA HARBOUR ROAD PROJECT

4.3.3 Railway Improvement Plan

The Indonesian Government is pushing an overall development program covering the "JABOTABEK" area. Pertaining to the railway improvement, the Intermediate Program has been planned and is already underway aimed at the urgent and intermediate improvement, while the Urban/Suburban Railway Transportation Study has just completed the preparation of the masterplan in the "JABOTABEK" area with the target year 2000 A.D.

(1) Intermediate Program

The Intermediate Program which was started in 1976 consists of four phases as mentioned below:

Phase I:

i) Procurement of planned material for the Phase I was executed by the Japanese EXIM bank Export Credit: 20 electric railcars (Eastern Line), 16 diesel railcars and 4 sub-station units.

ii) To prepare for the operation of the above railcars, track maintenance, installation of fence and clearing illegal dwellers off the land are being executed on the Eastern and Central Lines.

iii) The reinforcement of workshop and depot facilities is also being execution.

Phase II:

i) The crossing facilities, signal and telecommunication system and the sub-stations on the Eastern and Central Lines and track maintenance on the Western Line will be reinforced to provide a safe, efficient and speedy operation.

ii) Additional diesel railcars will be introduced on the Western Line to reinforce and establish frequent transportation service in this area.

iii) Eelectrification of Western Lines as the next step as well as problems in Phase III and Phase IV the consulting engineering services are being carried out to provide detailed implementation program.

The execution of the above consulting engineering service, however, shifted in Phase III and was to have been finalized by early 1981.

Phase III:

i) Based upon the implementation program derived from the results of engineering services, the purchase of the

necessary materials and equipment for electrification of the Western Line is to be executed.

ii) Electric railcars for the Eastern and Central Lines as well as diesel railcars for Western and Collector Lines will be introduced to provide frequent service.

iii) Installation of fence and elevating platforms will be carried out continuously.

Phase IV:

i) Construction work for the electrification on the Western Line will be executed.

ii) The operation of electric railcars will be started on the Western Line replacing diesel railcars with electric railcars.

iii) Installation of fence, lighting for platforms and improvement of workshop and depot facilities will be continued.

iv) Engineering services will be carried out to study the feasibility of extension of the electrification of the suburban area, improvement of frequent train operation, necessity of flyover, etc.

(2) Urban/Suburban Railway Transportation in "JABOTABEK" Area

The captioned study was begun in May, 1980 and was finalized in March, 1981. The objective of the study is to formulate a railway masterplan with the target year 2000 A.D. The study also includes the feasibility study of high priority within the framework of the above long-term masterplan.

The noteworthy programs for the masterplan are:

i) Construction of new railway lines, that is a Cengkareng Jakarta Airport line and Cibinong-Cakung-Tanjung Priok freight line;

ii) Elevation of Central Line and Eastern Line.

4.3.4 Jakarta Airport Cengkareng

The assessment report of "Jakarta Airport Cengkareng" was prepared in 1977 in order to update previous traffic forecasts. According to this report the future airport traffic is forecast to be approximately 31 million passengers per year including international traffic and domestic traffic in the year of 2000.

Jakarta Airport Cengkareng, which will have two runways of more than 3,000 meters, will function not only as a major international airport but also as a major domestic airport meeting the future increasing demand for air-transportation.

Some forecasts for the airport plan described in the assessment report are shown as follows. Further, the detailed data for the relevant traffic is indicated in Appendix 4-1.

(1) Passenger Forecast

Forecasts of overall passenger traffic are as shown in Table 4.15.

In the year 2000 the number of passengers for international traffic is estimated to be about 7.8 million per year which means approximately 21 thousand passengers per day, and as for domestic traffic, 64 thousand passengers per day, which is three times larger than that estimated for international traffic.

Table 4.15 Forecasts of Overall Passenger Traffic

(in thousands of passengers, arrival + departure)

	1976	1980	1985	1990	2000
International traffic	964.5	1,548	2,488	3,742	7,780
Average annual growth rate	12.6%	10.0%	8.5%	7.6%	
Domestic traffic	2,067.0	3,690	6,480		
Average annual growth rate	15.6%	11.9%	9.9%	8.5%	
T o t a l	3,031.5	5,238	8,968	14,142	31,380
Average annual growth rate	14.7%	11.4%	9.5%	8.3%	

(2) Ground Traffic

Based on the analyses of future transport choice by air passengers and average vehicle occupancy, vehicle flow (p.c.u.) for a peak hour and also daily average flow are estimated to be 3,426 p.c.u. and 33,338 p.c.u. respectively.

Total ground traffic volume including other traffic such as the freight and mail traffic, the ground personal traffic and the miscellaneous traffic is estimated to be approximately 51,000 p.c.u. per day in the year of 2000 as shown in Table 4.16.

It is presumed that most of them will have a relation with the Cengkareng Access Road and Harbour Road, so that the figure is very significant not only for the traffic demand forecast of Harbour Road, but also for the consideration of function to be provided by Harbour Road.

Table 4.16 Average Daily Flow of Road Traffic per Direction

(Year 2,000)

Air passengers		33,338
- Domestic	26,898	
- International	6,440	
Freight and mail		7,172
Ground personnel		7,178
Flight personnel		1,221
Miscellaneous (visitors, general avaiation, concessionaires) etc. .. estimate		2,091
T O T A L :		51,000 p.c.u.

(3) Construction Schedule

Construction schedule of the Airport is to be as follows:

Year 1983 Open to international air traffic

Year 1987 Open to domestic air traffic

4.3.5 Ports Development Plan

(1) Tanjung Priok Port Improvement Plan

Tanjung Priok Port Masterplan, Swan Wooster Engineering 1975, is now being reviewed by the same consulting firm. Until completion of the above study the Tanjung Priok Port Authority intends to follow the short term improvement scheme proposed by the masterplan.

The access road network plan has a very strong effect upon this port study.

For reference material to evaluate the present function of Tanjung Priok Port, the actual record of cargo handling at the port is shown below.

Table 4.17 Cargo Handling at Tanjung Priok

(Tons/yr)

Year	International Trade				Inter Island Trade				Total of Cargo Handling	%
	Import	%	Export	%	Unloading	%	Loading	%		
1970	2,371,815	79	291,113	7	202,156	7	197,365	7	2,990,450	100
1971	2,542,541	80	196,657	6	224,513	7	205,317	7	3,169,030	100
1972	3,058,927	79	236,140	6	229,502	8	277,627	7	3,872,196	100
1973	4,464,393	83	166,584	3	330,444	6	434,165	8	5,395,586	100
1974	4,477,250	81	155,313	3	419,430	8	440,887	8	5,492,880	100
1975	4,282,126	80	124,337	2	507,621	10	403,180	8	5,317,264	100
1976	4,283,939	79	202,668	4	558,704	10	436,427	8	5,481,738	100
1977	4,248,152	76	227,491	4	558,157	11	529,843	9	5,593,643	100
1978	5,016,037	73	356,440	5	782,323	11	703,989	11	6,858,789	100
1979	4,846,349	65	933,897	12	660,104	9	983,895	14	7,424,245	100
1980*)	3,837,369	68	542,781	10	527,781	9	717,279	13	5,624,538	100

*) January - August
Source: STATISTICAL YEAR BOOK OF JAKARTA

(2) Other Ports Development Plan

1) Kali Baru

Kali Baru is located east of Tanjung Priok and has the role of a fishery port. According to the port master plan, it is planned to become part of the Tanjung Priok Complex.

2) Marunda

Marunda is further east of Kali Baru, and will serve the timber industry in the hinterland.

3) Sunda Kelapa

Sunda Kelapa which is one of the oldest sea ports in the Republic serves for domestic sea transport of timber, fertilizer and cement.

Table 4.18 Cargo Transport at Sunda Kelapa (Excluding Logs)

(Unit: ton)

	1975	1976	1977	1978	1979
Arrival	465,152	425,939	285,436	425,436	437,371
Departure	232,559	254,459	227,527	365,705	465,751
T o t a l	697,711	680,398	512,963	791,498	903,122

Log Transport

(Unit: M^3)

Arrival	345,248	320,789	208,816	310,702	302,103

4) Pasar Ikan

Pasar Ikan is next to Sunda Kelapa and redevelopment project is in process.

- Wholesale Market;
- Rest House;
- Dormitory;
- Refrigeration Facilities; and
- Parking Area.

are planned.

4.4 Development Plans along Project Corridor

Along Cengkareng Access and Harbour Road, there are several development plans as mentioned below and as illustrated on Fig. 4.4, which are expected to influence the future generation of traffic along the Harbour Road Corridor.

- Tg. Priok Port Improvement Plan;
- Other Ports Development Plan (Kali Baru, Marunda, Sunda Kelapa)
- Pasar Ikan Fishery Port;
- Jakarta Airport Cengkareng;
- Ancol Project;
- Sunter Development Project;
- Redevelopment Plan in Kota Area;
- Railway Improvement Plan
- Construction of Related Tollways.

Most of the development plans listed above have already been explained in the former division 4.3, Transport Development Plans. The Ancol Project can be summarized as follows:

P.T. Jaya Ancol has its own future development plan. Reclamation is planned to start after 1984 and the total area will be increased from 550 Ha to 720 Ha. According to the latest information the coastal zone between the canal and the coastal line is divided into five parcels of land, and various kinds of land use, such as:

- Jakarta Fair, which at present is located around the Monas Tower for accommodating the exhibition fair and is planned to be opened in the Ancol area;
- Ancol Timur Housing;
- Ancol Barat Housing; and
- Industrial Estate.

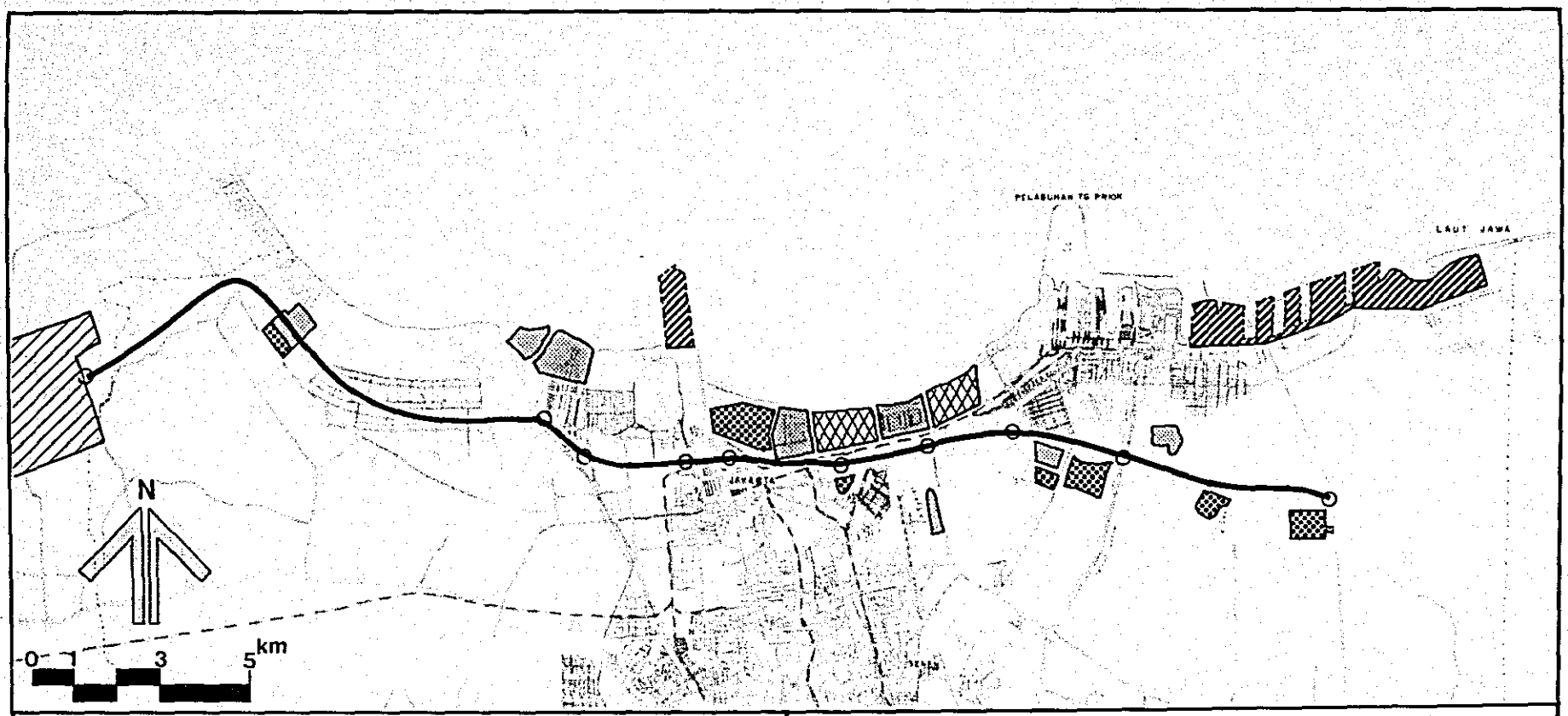


Fig. 4.4 DEVELOPMENT PLANS ALONG PROJECT CORRIDOR

JAKARTA HARBOUR ROAD PROJECT

CHAPTER 5

ZONAL PLANNING PARAMETERS

Chapter 5 ZONAL PLANNING PARAMETERS

5.1 General

An analysis of zonal parameters such as population, employed population and jobs provides the dominant factors, among others of transportation characteristics in the region. Therefore, such parameters are often used in forecasting future traffic demand and the pattern for peak-hour traffic.

In order to estimate these zonal parameters, the following method was used.

(1) Analysis of work trip situation was made based on the road-side OD survey and the home interview survey with reference to the latest landuse map in Jakarta, 1977.

(2) On the basis of the above analyses, a regional framework on population, employed population and jobs were established taking into consideration regional development plans and relevant study reports and data.

(3) The average employment ratio derived from the regional frame work was adjusted for respective zones based on the average intra-zonal trip ratio (intra-zonal vs. inter-zonal work trip generation) and zonal work trip generation was derived from the 1980 Work Trips OD matrics.

(4) From the above estimation of zonal employed population, intra-zonal work trips were estimated and were added to the inter-zonal work trip attraction to calculate the number of jobs by zone taking into account the rate of effective working days.

Based on the above method and the framework set up in Chapter 4 the following zonal parameters are estimated in this chapter.

- Land use;
- Residential Population;
- Employed Population in Sector I;
- Employed Population in Sectors II + III, and
- Number of Jobs in Sectors II + III.

Zone divisions in DKI Jakarta and BOTABEK/outside JABOTABEK are shown in Figs. 3.6 and 3.7 respectively in Chapter 3.

5.2 Landuse by Zone

The existing and future landuse composition by category and by zone were obtained by measuring the existing land use map and the master-plan map for the year of 2000.

The results of these measurements are shown on Tables 5.1 and 5.2.

Fig. 5.1 Methodological Flow Chart for Estimations of Zonal Employed Population and Jobs in Jakarta, 1980

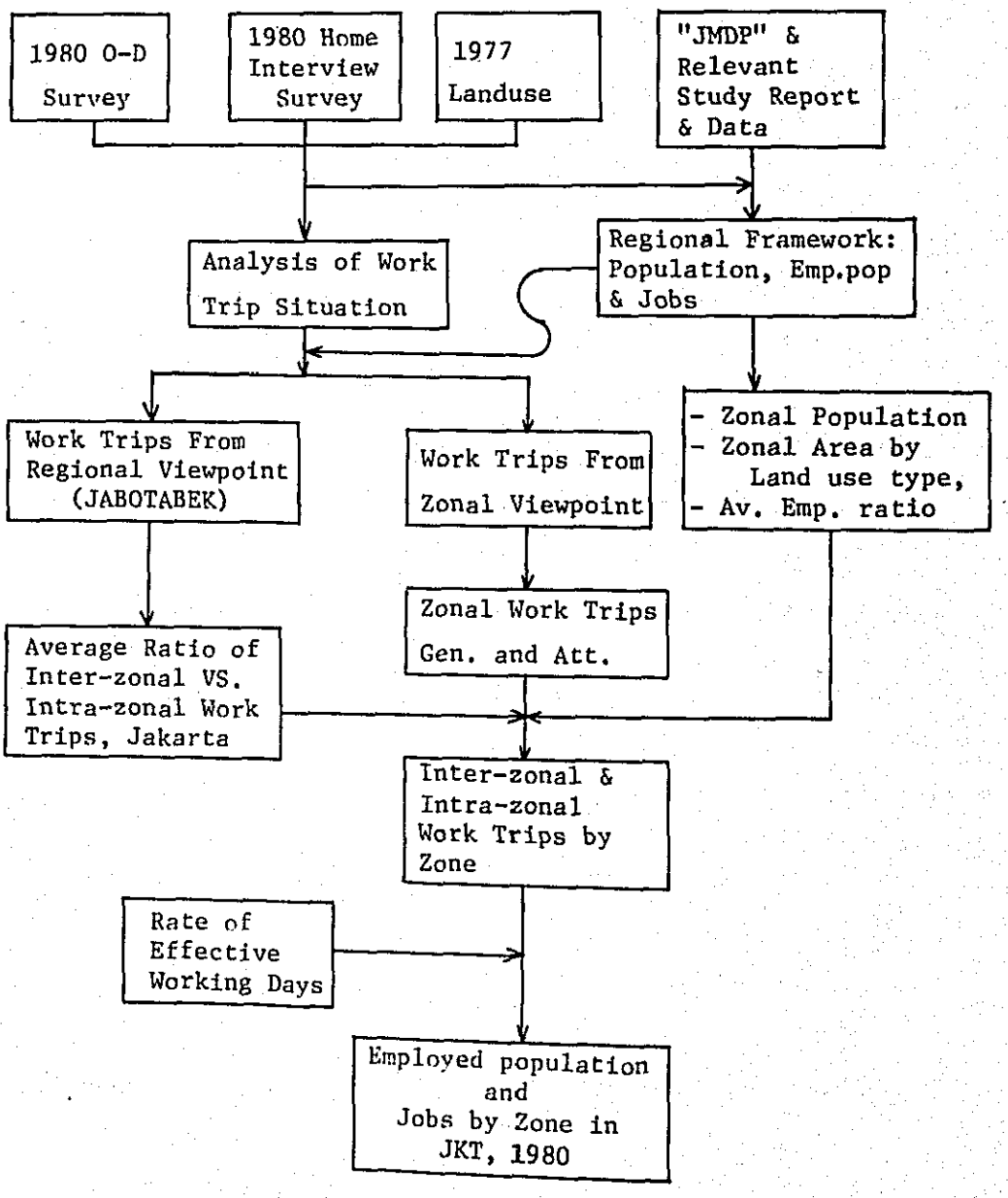


Table 5.1 DKI Jakarta Landuse, 1977

(Unit : Ha)

NO.	NAME OF ZONE	COMMERCIAL/ ADMINISTRA-TIVE AREA	INDUSTRIAL AREA	RESIDENTIAL AREA			AGRICULTU-RAL AREA	GREEN AREA	TOTAL
				KAMPUNGS	OUTSIDE KAMPUNGS	TOTAL			
	GAMBIR	256	9	147	268	415	-	89	769
	SAWAH BESAR	162	93	186	59	245	-	145	645
	KEMAYORAN	54	15	327	137	466	-	191	724
	SENEN	160	8	244	12	256	-	4	428
	CEMPAKA PUTIH	50	27	351	229	580	-	63	720
	MENTENG	149	2	121	334	455	-	34	640
	KEBON MELATI	118	9	365	110	475	-	57	659
	GELORA	66	-	28	32	60	-	189	315
	JAKARTA PUSAT	1.015	163	1.769	1.181	2.950	-	772	4.900
	KANAL MUARA	-	-	-	-	-	625	141	766
	KAPUK MUARA	-	-	-	-	-	958	216	1.174
	PEJAGALAN	95	99	180	333	513	-	640	1.347
	MANGGA DUA UTARA	43	165	8	56	64	-	85	357
	PADEMANGAN	25	5	163	47	210	-	363	603
	SUNTER	9	9	-	136	136	635	264	1.053
	PEPANGGO	3	11	345	441	786	188	-	988
	TANJUNG PRIOK	67	214	-	30	30	-	164	475
	KOJA	75	87	25	-	25	-	-	187
	TUGU	5	16	354	122	476	300	929	1.726
	PEGANGSAAN II	20	10	-	23	23	1.502	-	1.555
	SEMPER	103	9	73	141	214	300	741	1.367
	SUKAPURA	-	-	-	49	49	2.138	-	2.187
	JAKARTA UTARA	445	625	1.148	1.378	2.526	6.646	3.543	13.785
	SEMANAN	-	81	-	303	303	628	240	1.252
	PEGADUNGAN	7	-	-	712	712	1.472	562	2.753
	CENGKARENG	23	-	140	264	404	938	359	1.724
	JELAMBAR	23	13	147	217	364	190	31	621
	TOMANG	37	-	187	127	314	63	21	441
	PAL MERAH	65	6	328	249	577	35	15	698
	TAMAN SARI	114	30	187	123	310	-	4	458
	TAMBORA	103	3	327	92	419	-	1	526
	KEMBANGAN	20	10	14	448	462	1.533	506	2.531
	KEBON JERUK	43	7	188	250	438	900	329	1.717
	JAKARTA BARAT	435	150	1.518	2.785	4.303	5.759	2.074	12.721
	TEBET	80	45	611	103	714	63	33	935
	SETIA BUDI	81	5	235	502	737	63	14	900
	MAMPANG PRAPATAN	180	61	312	588	900	433	136	1.720
	PEJATEN	152	3	62	628	690	1.329	546	1.720
	SERENGSENG SAWAH	57	2	15	267	282	1.329	500	2.170
	KEBAYORAN BARU	142	9	204	706	910	127	72	1.260
	GROGOL UTARA	54	27	208	446	654	697	239	1.671
	KEBAYORAN LAMA	40	9	147	279	427	758	245	1.479
	CILANDAK	116	3	61	633	694	697	301	1.811
	JAKARTA SELATAN	902	164	1.855	4.153	6.008	5.506	2.086	14.666
	MATRAMAN	66	4	418	-	418	-	34	522
	PULO GADUNG	129	90	361	502	863	253	133	1.468
	CIPINANG BESAR	70	14	550	38	588	253	130	1.055
	KELENDER	8	-	125	192	317	1.266	460	2.051
	CILILITAN	130	25	70	340	410	1.076	426	2.067
	HALIM PERDANA KUSUMAH	49	-	-	130	130	949	354	1.482
	GEDONG	164	149	24	445	469	1.203	411	2.396
	LUBANG BUAYA	62	3	-	458	458	2.532	1.012	4.067
	JATINEGARA	-	-	-	274	274	1.119	-	1.393
	CAKUNG	21	156	-	185	185	1.539	932	2.833
	JAKARTA TIMUR	699	441	1.548	2.564	4.112	10.190	3.892	19.334
	JAKARTA TOTAL	3.496	1.543	7.838	12.061	19.899	28.101	12.367	65.406

Table 5.2 DKI Jakarta Landuse, 2000

(Unit : Ha)

ZONE NO. NEW	NAME OF ZONE	COMMERCIAL/ ADMINISTRATIVE AREA	INDUSTRIAL AREA	RESIDENTIAL AREA			AGRICULTURAL AREA	GREEN AREA	TOTAL
				KAMPUNGS	OUT SIDE KAMPUNGS	TOTAL			
1.	GAMBIR	300	-	147	233	380	-	89	769
2.	SAWAH BESAR	186	28	186	172	358	-	73	645
3.	KEMAYORAN	49	-	327	168	495	-	180	724
4.	SENEN	184	-	244	-	244	-	-	428
5.	CEMPAKA PUTIH	73	-	351	294	645	-	2	720
6.	MENTENG	176	-	121	235	456	-	8	640
7.	KEBON MELATI	150	-	365	122	487	-	22	659
8.	GELORA	61	-	28	38	66	-	188	315
	JAKARTA PUSAT	1.179	28	1.769	1.362	3.131	-	562	4.900
9.	KANAL MUARA	7	-	-	299	299	20	440	766
10.	KAPUK MUARA	2	-	-	260	260	238	674	1.176
11.	PEJAGALAN	97	110	180	898	1.078	-	62	1.347
12.	MANGGA DUA UTARA	44	50	8	-	8	-	255	357
13.	PADEMANGAN	18	239	163	-	163	-	183	603
14.	SUNTER	49	120	-	641	641	83	160	1.053
15.	PEPANGGO	47	128	345	125	470	24	319	988
16.	TANJUNG PRIOK	4	471	-	-	-	-	-	475
17.	KOJA	7	155	25	-	25	-	-	187
18.	TUGU	27	585	354	334	688	122	304	1.726
19.	PEGANGSAAN II	122	527	-	234	234	192	480	1.555
20.	SEMPER	54	463	73	589	662	54	134	1.367
21.	SUKAPURA	30	742	-	757	757	188	470	2.187
	JAKARTA PUSAT	508	3.590	1.148	4.137	5.285	921	3.481	13.785
22.	SEMANAN	14	600	-	580	580	-	58	1.252
23.	PEGADUNGAN	135	257	-	1.356	1.356	243	762	2.753
24.	CENGKARENG	110	-	140	965	1.105	204	305	1.724
25.	JELAMBAR	49	124	147	226	373	31	44	621
26.	TOMANG	62	-	187	100	287	10	82	441
27.	PAL MERAH	87	-	328	204	532	10	69	698
28.	TAMAN SARI	134	5	187	132	319	-	-	458
29.	TAMBORA	118	7	327	74	401	-	-	526
30.	KEMBANGAN	56	47	14	2.006	2.020	249	159	2.531
31.	KEBON JERUK	95	-	188	1.183	1.371	146	105	1.717
	JAKARTA BARAT	860	1.040	1.518	6.826	8.344	893	1.584	12.725
32.	TEBET	101	30	611	118	729	10	65	935
33.	SETIA BUDI	130	-	235	493	728	10	32	900
34.	MAMPANG PRAPATAN	192	41	312	561	873	83	531	1.720
35.	PEJATEN	222	-	62	1.727	1.789	240	469	2.720
36.	SERENGSENG SAWAH	108	-	15	1.498	1.513	230	319	2.170
37.	KEBAYORAN BARU	240	9	204	687	891	20	100	1.260
38.	GROGOL UTARA	281	54	208	963	1.171	114	51	1.671
39.	KEBAYORAN LAMA	121	5	147	1.016	1.163	124	66	1.479
40.	CILANDAK	161	-	61	1.091	1.152	131	367	1.811
	JAKARTA SELATAN	1.556	139	1.855	8.154	10.009	962	2.000	14.666
41.	MATRAMAN	104	-	418	-	418	-	-	522
42.	PULO GADUNG	174	127	361	637	998	42	127	1.448
43.	CIPINANG BESAR	91	-	550	143	693	42	229	1.055
44.	KELENDER	44	193	125	1.381	1.506	207	101	2.031
45.	CILILITAN	174	-	70	544	614	213	1.066	2.067
46.	HALIM PERDANA KUSUMAH	43	-	-	604	604	194	641	1.482
47.	GEDONG	289	295	24	664	688	211	913	2.396
48.	LUBANG BUAYA	221	-	-	935	935	480	2.431	4.067
49.	PENGGILINGAN	95	932	-	27	27	290	49	1.393
50.	CAKUNG	157	2.178	-	353	353	145	-	2.833
	JAKARTA TIMUR	1.392	3.725	1.548	5.288	6.836	1.824	5.557	19.334
	JAKARTA TOTAL	5.495	8.522	7.838	25.767	33.605	4.600	13.184	65.406

5.3 Residential Population by Zone

5.3.1 Population in Kampung

For the transporation study, the population in Kampungs *) and in the rest of the residential areas are computed separately.

Notes: *) A Kampung is a district where low-income people reside under very poor housing conditions with extremely high population density.

Although there is no available data for the situation of Kampung except for the "Kampung Improvement Project", based on that report, the relevant population index is assumed to be as follows:-

a)	Kampung Population	3,095,700 persons
b)	Kampung Area	7,838 Ha
c)	Average Kampung Population Density	395 persons/Ha
d)	The maximum Zonal Kampung Population Density (Zone # 18)	662 persons/Ha
e)	The minimum Zonal Kampung Population Density (Zone # 20)	172 persons/Ha

Source: "DAFTAR NAMA-NAMA KAMPUNG PROYEK MUHAMMAD HUSNI THAMRIN DKI JAKARTA".

The density is already extremely high especially in Central Jakarta where it was 511 persons/Ha in 1976.

The future kampung population is unpredictable because it depends largely upon the effect of the "Kampung Improvement Project" and the policy of the Government.

In this study the total area of Kampung was assumed to be unchanging in the future while the population in kampung increases at the rate of 40% of the natural growth rate of the DKI Jakarta total.

Consequently, in the year 2000 the share of the kampung population will decline, down to 36.9% of the total DKI Jakarta population.

The total kampung population in 2000 will be 3,639.5 thousand as shown in Table 5.3. Assuming that the maximum kampung population density will be 600 persons/Ha, the kampung population is distributed over zones based on "DAFTAR PETA JAKARTA PLANNING ATLAS 1975, PROYEK MHT". The minimum population density as a result is 375 persons/Ha.

Table 5.3 Kampung Population

	1976	1980	1990	2000	2010
Residential Population in Kampungs (1000 persons)	3,095.7	3,190.9	3,421.4	3,639.5	3,840.9
Average Annual Growth Rates (% yr.)	-	0.76	0.72	0.62	0.54

5.3.2 Population in Residential Area Outside Kampung

Subtracting those residential populations in Kampungs, industrial areas, commercial and administrative areas and agricultural areas from the total population, the residential population in the residential areas outside the Kampungs is obtained.

The average population density in residential areas outside Kampung comes out to be 170 persons/Ha in 1976 and 200 persons/Ha in 2000.

5.3.3 Residential Population in Area of Other Uses

(1) Residential Population in Industrial Area

At present, there are supposed to exist a considerable number of small home within the industrial area. This type of industry will decrease along with an increase in large scale manufacturing enterprises within the industrial area.

In this report the residential population density in this area is assumed to decrease from 60 persons/Ha in 1976 to 30 persons/Ha 2000.

Table 5.4 Residential Population Density in Industrial Area

	1976	1980	1990	2000	2010
Residential Population Density	60	55	43	30	25

(2) Residnetial Population in Commercial/Administrative Area

There are many retailers on the ground floor with residential accommodation attached. The percentage of the residential portion to the total floor area in the commercial and administrative area is lower than the average in the CBD and higher than outside the CBD.

When the average floor area per resident, about 12 m^2/person, is applied, the above floor area of residential use, the average residential population density within the commercial and administrative area can be calculated.

In the future, a higher percentage of the floor area within the commercial and administrative area will be serving as shops and offices according to the specialization of landuse.

Therefore, in this report the average residential population density within the commercial and administrative area is assumed to remain the same in the future while the percentage of the residential portion in the total floor area within the commercial and administrative area will decrease both in the CBD and outside the CBD.

(3) Residential Population in Agriculture Area

As mentioned before almost all workers in the primary sector will reside within the agricultural area. There will, however, be a considerable number of residents working outside the agricultural area.

In this report the average residential population density within agricultural areas is assumed to be 5 persons/Ha at present, and is expected to remain the same in the future.

5.3.4 Residential Population by Landuse and By Zone

To summarize the residential population for different landuse it is shown in Table 5.5, and zonal future population in the years 1980, 1990, 2000 and 2010 is given in Table 5.10 through Table 5.12.

Table 5.5 Residential Population by Land Use

(Units: 1,000 Persons)

Landuse	1976	1980	1990	2000	2010
Industrial Area	92.6	148.8	241.4	255.3	285.8
Commercial/Administrative Area	524.4	574.4	699.3	824.3	949.8
Agricultural Area	140.5	116.7	69.2	23.0	8.8
Residential Area	5,097.5	5,720.1	7,380.1	8,757.4	10,065.6
Excluding Kampung	2,001.8	2,529.2	3,958.7	5,117.9	6,225.3
Kampung	3,095.7	3,190.9	3,421.4	3,639.5	3,840.3
Total:	5,855.0	6,560.0	8,390.0	9,860.0	11,310.0

5.4 Employed Population and Number of Jobs by Zone

5.4.1 Future Employed Population by Zone

The existing employment rate differs from zone to zone, because of unequal employment opportunity owing to the income level and social status of households.

The future employment rate, however, will be developed and nearly equalized in each zone based on the average rates of employment in the region.

Based on the above consideration, the zones with lower rates of employment are defined to attain more rapidly the regional average rate of employment than the zones with higher rates of employment.

Furthermore, the future employed population in the primary sector is assumed to have their work places in their residential zones. Accordingly, they are distributed to each zone area of agricultural landuse which is derived from the "DKI Jakarta Land Use, 2000".

By subtracting the agricultural employed population from the total employed population of the zone, a total of employed population in both secondary and tertiary sectors can be calculated as shown in Tables 5.10 through 5.12.

5.4.2 Estimation of Future Jobs by Zone

(1) Number of Jobs in Sector I

The density of employed labourers in the primary sector is calculated from the employed population in the primary sector. Since it is conceivable that work trips in the agricultural sector will be made within the residential zone the number of employed population is assumed to be equal to the number of jobs.

The density of the employed population in this sector would increase in the future due to the labour intensive nature of suburban agriculture aimed at producing higher value added for the market within the metropolitan area.

In the future, the size of agricultural areas in each zone is planned to decrease proportionally to the total agricultural area in the framework.

Primary sector jobs are distributed over zones applying the density of agricultural workers to the size of agricultural areas in each zone.

Table 5.6 Number of Jobs in Agricultural Areas in Jakarta

	1980	1990	2000	2010
Sector I Workers (1,000 persons)	57.1	36.0	15.0	7.0
Density (persons/Ha)	2.45	2.45	3.3	4.0
Agricultural Area(Ha)	23,333	14,694	4,600	1,750

(2) Number of Jobs in Sector II

Jobs in second sector would exist not only in industrial area but also in areas of other uses, and so, for the purpose of zonal distribution they are grouped into:

1) To be allocated within industrial area;

2) To be allocated within commercial and administrative area; and

3) To be allocated in proportion to the residential population.

The portion to be allocated within commercial and administrative areas is estimated to be 10% of the total number of the secondary sector in 1980 and is assumed to remain in the same proportion in the future.

The portion to the allocated in proportion to the residential population is estimated to be 30% in 1976 and 25% in 1980 the absolute number is assumed to increase along with the residential population. The rest is to be allocated within the industrial area.

Table 5.7 Division of Sector II Jobs for Zonal Allocation

(Unit: 1,000 Jobs)

	1980	1990	2000	2010
To be Allocated within Industrial Areas	243.8 (65.0%)	433.8 (70.6%)	683.2 (74.7%)	909.4 (76.5%)
To be Allocated within Commercial/ Administrative Areas	37.5 (10.0%)	61.5 (10.0%)	91.5 (10.0%)	118.9 (10.0%)
To be Allocated Proportionally to Residential Population	93.8 (25.0%)	119.5 (19.4%)	140.4 (15.3%)	161.1 (13.5%)
T o t a l :	375.1 (100.0%)	614.8 (100.0%)	915.1 (100.0%)	1,189.4 (100.0%)

(3) Number of Jobs in Sector III

Tertiary sector jobs would exist not only in the commercial and administrative area but also in areas of other uses, and so, for the purpose of zonal distribution they are grouped into:

1) To be allocated within commercial and administrative areas; and

2) To be allocated in proportion to the residential population.

The portion to be allocated in proportion to the residential population is estimated to be 30% of the total tertiary sector workers in 1980 and is assumed to be increasing along with the residential population. The rest, 70% in 1980, will be allocated within commercial and administrative areas.

Table 5.8 Division of Sector III Jobs for Zonal Allocation

(Unit: 1,000 jobs)

	1980	1990	2000	2010
To be Allocated within commercial/ Administrative Areas (%)	1,317.7 (70)	1,927.7 (70)	2,559.5 (70)	3,151.4 (70)
To be Allocated Proportionally to residential Population (%)	564.7 (30)	826.1 (30)	1,096.9 (30)	1,350.6 (30)
T o t a l : (%)	1,882.4 (100)	2,753.8 (100)	3,656.4 (100)	4,502.0 (100)

(4) Future Jobs by Sector and by Zone

The estimated future jobs in Sectors II & III by zone provide the weight factors for the zones so as to predict future work trip attraction.

On the contrary, the estimated future employed population in Sectors II & III is provided for the prediction of future work trip generation.

Thus, zonal planning parameters used for the future traffic demand forecast in the years 1990, 2000 and 2010 are estimated and summarized in Tables 5.10 through 5.12. and for making a comparison between the present and the future situation, the estimated present landuse by zone is also shown in Table 5.9.

Table 5.9 Residential Population, Employed Population, Number of Jobs, 1980

(Unit : 1,000 persons)

ZONE NO.	NAME OF ZONE	RESIDENTIAL POPULATION			EMPLOYED POPULATION			JOBS
		KAMPUNGS	OUTSIDE KAMPUNGS	TOTAL	SECTOR I	SECTOR II + III	TOTAL	I + II + III
1.	GAMBIR	85.3	95.8	181.1	-	76.1	76.1	100.8
2.	SAWAH BESAR	109.5	88.4	197.9	-	51.4	51.4	57.1
3.	KEMAYORAN	140.7	108.0	248.7	-	71.1	71.1	74.4
4.	SENEN	116.9	65.8	182.7	-	50.6	50.6	60.4
5.	CEMPAKA PUTIH	178.9	83.4	262.3	-	68.9	68.9	70.3
6.	MENTENG	74.8	88.0	162.8	-	63.3	63.3	84.1
7.	KEBON MELATI	187.3	61.5	248.8	-	88.3	88.3	96.7
8.	GELORA	7.7	3.2	10.9	-	9.9	9.9	10.3
	JAKARTA PUSAT	901.1	594.1	1495.2	-	478.7	478.7	554.1
9.	KANAL MUARA	-	8.8	8.8	1.0	1.7	2.7	4.0
10.	KAPUK MUARA	-	10.8	10.8	2.3	0.6	2.9	3.0
11.	PEJAGALAN	61.6	68.2	129.8	-	58.5	58.5	68.4
12.	MANGGA DUA UTARA	-	30.1	30.1	-	14.1	14.1	20.2
13.	PADEMANGAN	85.8	17.0	102.8	-	23.7	23.7	23.0
14.	SUNTER	-	42.8	42.8	1.2	16.5	17.7	27.6
15.	PEPANGGO	128.3	30.7	159.0	0.4	37.3	37.7	37.8
16.	TANJUNG PRIOK	-	38.4	38.4	-	20.3	20.3	30.4
17.	KOJA	11.9	61.6	73.5	-	18.2	18.2	20.4
18.	TUGU	136.1	20.2	156.3	0.7	32.2	32.9	32.1
19.	PEGANGSAAN II	-	25.3	25.3	3.0	8.4	11.4	8.6
20.	SEMPER	17.8	84.1	101.9	0.5	24.4	24.9	24.3
21.	SUKAPURA	-	27.0	27.0	4.2	0.5	4.7	4.9
	JAKARTA UTARA	441.5	465.0	906.5	13.3	245.8	259.1	304.6
22.	SEMANAN	-	41.2	41.2	1.0	10.6	11.6	12.0
23.	PEGADUNGAN	-	73.7	73.7	3.0	12.8	15.8	14.6
24.	CENGKARENG	36.0	83.7	119.7	1.6	27.7	29.3	26.0
25.	JELAMBAR	46.8	74.0	120.8	0.4	62.2	62.6	60.2
26.	TOMANG	64.4	22.7	87.1	0.1	48.7	48.8	46.4
27.	PALMERAH	136.5	44.1	180.6	0.1	88.1	88.2	86.2
28.	TAMAN SARI	103.4	92.3	195.7	-	52.9	52.9	59.6
29.	TAMBORA	213.4	67.7	281.1	-	62.4	62.4	63.1
30.	KEMBANGAN	3.5	74.4	77.9	3.3	21.1	24.4	24.2
31.	KEBON JERUK	38.9	61.4	100.3	2.2	25.7	27.9	26.5
	JAKARTA BARAT	642.9	635.2	1278.1	11.7	415.1	426.8	418.8
32.	TEBET	228.3	52.3	280.5	0.1	92.4	92.5	79.8
33.	SETIA BUDI	113.2	126.5	239.7	0.1	72.1	72.2	68.6
34.	MAMPANG PRAPATAN	84.1	123.7	207.8	1.0	66.9	67.9	74.8
35.	PEJATEN	13.5	136.8	150.3	2.7	43.7	46.4	41.0
36.	SERENGSENG SAWAH	4.1	70.9	75.0	2.7	11.3	14.0	13.6
37.	KEBAYORAN BARU	80.0	143.2	223.2	0.3	103.2	103.5	116.2
38.	GROGOL UTARA	60.3	102.1	162.4	1.4	41.2	42.6	42.7
39.	KEBAYORAN LAMA	43.4	79.5	122.9	1.5	30.3	31.8	28.0
40.	CILANDAK	13.7	91.4	105.1	1.4	25.8	27.2	25.3
	JAKARTA SELATAN	640.6	926.3	1566.9	11.2	486.2	497.4	490.0
41.	MATRAMAN	196.3	24.1	220.4	-	51.7	51.7	50.7
42.	PULO GADUNG	114.6	121.5	236.1	0.5	101.6	102.1	91.4
43.	CIPINANG BESAR	194.2	85.2	279.4	0.5	81.0	81.5	79.1
44.	KELENDER	30.1	52.3	82.4	2.5	35.3	37.8	28.5
45.	CILILITAN	22.4	157.1	179.5	2.2	72.9	75.1	70.9
46.	HALIM P. KUSUMAH	-	49.6	49.6	1.9	15.5	17.4	15.2
47.	GEDONG	7.2	88.6	95.8	2.6	24.3	26.9	24.6
48.	LUBANG BUAYA	-	74.9	74.9	5.2	11.0	16.2	15.5
49.	PENGGILINGAN	-	40.0	40.0	2.6	8.8	11.4	11.4
50.	CAKUNG	-	55.2	55.2	2.9	10.8	13.7	13.3
	JAKARTA TIMUR	564.8	748.5	1313.3	20.9	422.2	443.1	400.6
	JAKARTA TOTAL	3190.9	3369.1	6560.0	57.1	2,048.9	2,105.1	2,168.1

Table 5.10 Residential Population, Employed Population, Number of Jobs, 1990

(Unit : 1,000 persons)

ZONE NO.	NAME OF ZONE	RESIDENTIAL POPULATION			EMPLOYED POPULATION			JOBS
		KAMPUNGS	OUTSIDE KAMPUNGS	TOTAL	SECTOR I	SECTOR II+III	TOTAL	I+II+III
1	GAMBIR	83.4	96.8	180.2	-	73.8	73.8	183.6
2	SAWAH BESAR	106.6	96.5	203.1	-	65.3	65.3	80.6
3	KEMAYORAN	148.3	94.3	243.1	-	81.6	81.6	84.4
4	SENEN	120.9	50.3	171.2	-	56.6	56.6	74.0
5	CEMPAKA PUTIH	180.3	95.2	275.5	-	88.9	88.9	94.4
6	MENTENG	72.0	93.9	165.9	-	65.2	65.2	116.8
7	KEBON MELATI	188.4	59.1	247.5	-	92.5	92.5	106.8
8	GELORA	9.6	6.4	16.0	-	10.9	10.9	20.3
	JAKARTA PUSAT	909.5	593.0	1502.5	-	534.8	534.8	760.9
9	KANAL MUARA	-	36.0	36.0	0.3	12.3	12.6	4.0
10	KAPUK MUARA	-	33.8	33.8	1.7	9.4	11.1	4.5
11	PEJAGALAN	69.5	137.9	207.4	-	88.6	88.6	65.4
12	MANGGA DUA UTARA	-	26.8	26.8	-	11.4	11.4	17.4
13	PADEMANGAN	86.1	30.4	116.5	-	35.5	35.5	28.9
14	SUNTER	-	105.2	105.2	0.8	41.9	42.7	45.3
15	PEPANGGO	141.0	60.0	201.0	0.3	62.6	62.9	51.4
16	TANJUNG PRIOK	-	34.6	34.6	-	16.1	16.1	39.5
17	KOJA	13.2	47.0	60.2	-	19.1	19.1	47.6
18	TUGU	150.1	43.0	193.1	0.8	56.9	57.7	93.2
19	PEGANGSAAN II	-	44.0	44.0	1.7	17.0	18.7	16.0
20	SEMPER	19.7	105.0	124.7	0.5	39.0	39.5	64.8
21	SUKA PURA	-	75.3	75.3	2.0	18.7	20.7	16.2
	JAKARTA UTARA	479.6	779.0	1.258.6	8.1	428.5	436.6	494.2
22	SEMANAN	-	83.1	83.1	0.3	27.4	27.7	25.3
23	PEGADUNGAN	-	171.3	171.3	1.9	48.8	50.7	56.3
24	CENGKARENG	45.8	143.3	189.1	1.5	57.6	59.1	41.5
25	JELAMBAR	55.0	84.8	139.8	0.2	64.7	64.9	74.4
26	TOMANG	64.4	44.6	109.0	-	53.2	53.2	63.4
27	PAL MERAH	147.4	68.8	216.2	-	97.0	97.0	87.5
28	TAMAN SARI	103.8	100.6	204.4	-	66.8	66.8	71.5
29	TAMBORA	206.6	83.1	289.7	-	88.3	88.3	74.5
30	KEMBANGAN	4.6	177.2	181.8	2.1	61.6	63.7	31.8
31	KEBON JERUK	54.0	120.0	174.0	1.2	56.5	57.7	31.7
	JAKARTA BARAT	681.6	1.076.8	1.758.4	7.2	621.9	629.1	557.9
32	TEBET	251.7	62.1	313.8	-	113.1	113.1	79.9
33	SETIA BUDI	116.7	137.9	254.6	-	87.7	87.7	94.0
34	MAMPANG PRAPATAN	103.1	143.4	246.5	0.7	87.6	88.3	84.0
35	PEJATEN	18.0	211.5	229.5	1.7	78.2	79.9	51.6
36	SERENGSENG SAWAH	5.0	146.9	151.9	2.0	40.6	42.6	30.5
37	KEBAYORAN BARU	87.1	169.7	256.8	0.2	110.8	111.0	154.7
38	GROGOL UTARA	72.1	167.6	239.7	0.8	76.5	77.3	64.7
39	KEBAYORAN LAMA	51.6	145.9	197.5	0.9	62.5	63.4	35.2
40	CILANDAK	18.1	138.3	156.4	0.9	49.3	50.2	34.4
	JAKARTA SELATAN	725.4	1.323.3	2.046.7	7.2	706.3	713.5	629.0
41	MATRAMAN	203.9	40.9	244.8	-	76.3	76.3	56.8
42	PULO GADUNG	132.9	154.8	287.7	0.3	119.6	119.9	87.6
43	CIPINANG BESAR	217.5	101.5	319.0	0.3	107.9	108.2	75.5
44	KELENDER	38.5	153.0	191.5	1.6	80.7	82.3	46.8
45	CILILITAN	26.0	186.2	212.2	1.5	85.3	86.8	94.8
46	HALIM PERDANA KUSUMAH	-	85.5	85.5	1.3	30.5	31.8	18.5
47	GEDONG	8.5	136.2	144.7	1.6	46.5	48.1	50.1
48	LUBANG BUAYA	-	169.2	169.2	3.5	46.8	50.3	45.7
49	PENGGILINGAN	-	49.3	49.3	1.9	14.7	16.6	31.9
50	CAKUNG	-	119.9	119.9	1.5	36.1	37.6	150.8
	JAKARTA TIMUR	627.3	1.196.5	1.823.8	13.5	644.4	657.9	658.5
	JAKARTA TOTAL	3.421.4	4.968.6	8.390.0	36.0	2,935.9	2,971.9	3,100.5

Table 5.11 Residential Population, Employed Population, Number of Jobs, 2000

(Unit : 1,000 persons)

ZONE NO.	NAME OF ZONE	RESIDENTIAL POPULATION			EMPLOYED POPULATION			JOBS
		KAMPUNGS	OUTSIDE KAMPUNGS	TOTAL	SECTOR I	SECTOR II + III	TOTAL	I + II + III
1	GAMBIR	81.1	91.7	172.8	-	77.9	77.9	266.4
2	SAWAH BESAR	103.2	97.7	200.9	-	71.0	71.0	104.2
3	KEMAYORAN	155.6	73.2	228.8	-	84.5	84.5	94.6
4	SENEN	124.4	29.4	153.8	-	56.0	56.0	88.0
5	CEMPAKA PUTIH	181.1	97.4	278.5	-	98.9	98.9	118.7
6	MENTENG	69.0	93.8	162.8	-	70.4	70.4	149.6
7	KEBON MELATI	189.0	48.2	237.2	-	97.7	97.7	116.9
8	GELORA	11.4	9.0	20.4	-	15.3	15.3	30.4
	JAKARTA PUSAT	914.8	540.4	1.455.2	-	571.7	571.7	968.8
9	KANAL MUARA	0	68.1	68.1	-	26.2	26.2	4.1
10	KAPUK MUARA	0	59.6	59.6	0.8	21.1	21.9	6.1
11	PEJAGALAN	77.1	181.7	258.8	-	121.5	121.5	62.7
12	MANGGA DUA MUARA	3.0	8.1	11.1	0	5.4	5.4	16.8
13	PADEMANGAN	84.6	9.9	94.5	0	31.7	31.7	34.9
14	SUNTER	0	170.2	170.2	0.3	75.8	76.1	66.5
15	PEPANGGO	152.5	42.0	194.5	0.1	67.8	67.9	65.7
16	TANJUNG PRIOK	0	14.8	14.8	0	7.6	7.6	53.5
17	KOJA	14.3	5.8	20.1	0	7.1	7.1	76.5
18	TUGU	163.2	88.5	251.6	0.4	83.7	84.1	155.4
19	PEGANGSAAN	0	81.5	81.5	0.6	37.6	38.2	23.4
20	SEMPER	21.4	134.1	160.5	0.2	56.4	56.6	106.5
21	SUKAPURA	0	177.7	177.7	0.6	53.0	53.6	27.6
	JAKARTA UTARA	516.0	1.047.0	1.563.0	3.0	594.9	597.9	699.7
22	SEMANAN	0	135.3	135.3	0	49.6	49.6	38.8
23	PEGADUNGAN	0	298.2	298.2	0.8	96.2	97.0	98.3
24	CENGKARENG	54.9	209.0	263.9	0.7	90.0	90.7	57.1
25	JELAMBAR	61.8	78.5	140.3	0.1	71.7	71.8	88.8
26	TOMANG	82.4	39.1	121.5	0	65.3	65.3	80.7
27	PAL MERAH	153.5	73.9	227.4	0	112.2	112.2	88.9
28	TAMAN SARI	100.2	72.5	172.7	0	62.1	62.1	83.5
29	TAMBORA	190.8	47.6	238.4	0	81.2	81.2	83.2
30	KEMBANGAN	5.5	309.4	314.9	0.8	120.6	121.4	39.5
31	KEBON JERUK	68.6	191.0	259.6	0.5	94.1	94.6	37.1
	JAKARTA BARAT	717.7	1.454.5	2.172.2	2.9	843.0	845.9	695.9
32	TEBET	272.9	39.7	312.6	0	123.8	123.8	80.1
33	SETIA BUDI	117.3	117.5	234.8	0	88.9	88.9	119.7
34	MAMPANG PRAPATAN	123.6	141.6	265.2	0.3	104.3	104.6	93.6
35	PEJATEN	23.0	291.3	314.3	0.8	119.6	120.4	62.3
36	SERENGSENG SAWAH	5.9	240.3	246.2	0.8	75.1	75.9	47.5
37	KEBAYORAN BARU	93.1	172.6	265.7	0.1	126.1	126.2	193.2
38	GROGOL UTAMA	84.6	235.2	319.8	0.3	113.2	113.5	86.9
39	KEBAYORAN LAMA	60.1	220.6	280.7	0.4	98.6	99.0	42.4
40	CILANDAK	23.1	187.0	210	0.4	73.7	74.1	43.6
	JAKARTA SELATAN	803.6	1.645.8	2.449.4	3.1	923.3	926.4	769.3
41	MATRAMAN	207.9	15.6	223.5	0	77.7	77.7	61.3
42	PULO GADUNG	151.8	149.5	301.3	0.1	138.2	138.3	83.9
43	CIPINANG BESAR	240.3	64.0	304.3	0.1	113.4	113.5	72.1
44	KELENDER	47.8	279.2	327.0	0.7	153.6	154.3	57.5
45	CILILITAN	29.7	183.4	213.1	0.7	95.3	96.0	118.8
46	HALIM PERDANA KUSUMA	0	124.3	124.3	0.6	50.6	51.2	20.8
47	GEDONG	9.9	180.4	190.3	0.7	69.9	69.6	75.8
48	LUBANG BUAYA	0	285.5	285.5	1.6	91.7	93.3	76.0
49	PENGGILINGAN	0	52.4	52.4	1.0	18.4	19.4	52.5
50	CAKUNG	0	198.5	198.5	0.5	68.0	68.5	288.6
	JAKARTA TIMUR	687.4	1.532.8	2.220.2	6.0	875.8	881.8	907.3
	JAKARTA TOTAL	3,639.5		9,860.0	15.0	3,908.7	3,823.7	4,041.0

Table 5.12 Residential Population, Employed Population, Number of Jobs, 2010

(Unit : 1,000 persons)

ZONE NO.	NAME OF NAME	RESIDENTIAL POPULATION			EMPLOYED POPULATION			JOBS
		KAMPUNGS		TOTAL	SECTOR I	SECTOR II + III	TOTAL	I + II +III
1	GAMBIR	85.6	110.1	195.7	0	93.3	93.3	345.6
2	SAWAH BESAR	108.9	117.3	226.2	0	84.7	84.7	127.0
3	KEMAYORAN	164.2	87.9	252.1	0	98.6	98.6	109.0
4	SENEN	131.3	35.3	166.6	0	64.2	64.2	103.9
5	CEMPAKA PUTIH	191.1	116.9	308.0	0	115.8	115.8	143.2
6	MENTENG	72.8	112.6	185.4	0	85.0	85.0	181.6
7	KEBON MELATI	199.5	57.9	257.4	0	112.2	112.2	133.5
8	GELORA	12.0	10.8	22.8	0	18.1	18.1	38.7
	JAKARTA PUSAT	965.4	648.8	1,614.2	0	671.9	671.9	1182.5
9	KANAL MUARA	0	81.8	81.8	0	33.3	33.3	4.5
10	KAPUK MUARA	0	71.6	71.6	0.4	27.5	27.9	7.6
11	PEJAGALAN	81.4	218.2	299.6	0	149.3	149.3	67.1
12	MANGGA DUA UTARA	3.2	9.7	12.9	0	6.5	6.5	16.0
13	PADEMANGAN	89.3	11.9	101.2	0	35.9	35.9	41.4
14	SUNTER	0	204.4	204.0	0.1	96.4	96.5	86.7
15	PEPANGGO	160.9	50.4	211.3	0	78.5	78.5	79.1
16	TANJUNG PRIOK	0	17.8	17.8	0	9.6	9.6	66.8
17	KOJA	15.1	7.0	22.1	0	8.4	8.4	85.3
18	TUGU	172.1	106.3	278.4	0.2	99.0	99.2	215.3
19	PEGANGSAAN II	0	97.9	97.9	0.3	48.4	48.7	29.6
20	SEMPER	22.6	167.0	189.6	0.1	71.1	71.2	146.7
21	SUKAPURA	0	213.4	213.4	0.3	67.9	68.2	36.3
	JAKARTA UTARA	544.6	1,257.4	1,802.0	1.4	731.8	733.2	882.4
22	SEMANAN	0	162.5	162.5	0	63.1	63.1	49.7
23	PEGADUNGAN	0	358.1	358.1	0.4	123.0	123.4	130.5
24	CENGKARENG	57.9	251.0	308.9	0.3	112.5	112.5	70.9
25	JELAMBAR	65.2	94.3	159.5	0.1	86.4	86.5	105.1
26	TOMANG	87.0	46.9	133.9	0	76.3	76.3	97 8
27	PAL MERAH	162.0	88.7	250.7	0	131.1	131.1	98.1
28	TAMAN SARI	105.7	87.1	192.8	0	73.5	73.5	97.9
29	TAMBORA	201.4	57.2	258.6	0	93.8	93.8	90.8
30	KEMBANGAN	5.8	371.5	377.3	0.4	153.8	154.2	47.4
31	KEBON JERUK	72.4	229.3	301.7	0.2	116.3	116.5	43.4
	JAKARTA BARAT	757.4	1.746.6	2.504.0	1.4	1,029.5	1,030.9	831.6
32	TEBET	288.2	27.7	355.9	0	141.0	141.0	87.8
33	SETIABUDI	123.8	141.1	264.9	0	106.3	106.3	145.1
34	MAMPANG PRAPATAN	120.4	170.0	300.4	0.1	125.4	125.5	107.6
35	PEJATEN	24.3	349.8	374.1	0.4	151.4	151.8	73.9
36	SERENGSENG SAWAH	6.2	288.5	294.7	0.4	75.9	96.3	61.2
37	KEBAYORAN BARU	98.2	207.2	305.4	0	153.1	153.1	229.1
38	GROGOL UTARA	89.3	282.4	371.7	0.1	139.6	139.7	107.3
39	KEBAYORAN LAMA	63.4	264.9	328.3	0.2	122.5	122.7	59.2
40	CILANDAK	24.4	224.5	248.9	0.2	92.8	93.0	52.6
	JAKARTA SELATAN	848.2	1.976.1	2.824.3	1.4	1,128.0	1,129.4	914.8
41	MATRAMAN	219.4	18.7	238.1	0	88.1	88.1	65.0
42	PULO GADUNG	160.2	179.5	339.7	0.1	165.3	165.3	89.8
43	CIPINANG BESAR	253.6	76.8	330.4	0.1	130.4	130.5	77.9
44	KELENDER	50.4	335.2	385.6	0.3	191.9	192.2	69.3
45	CILILITAN	31.3	220.2	251.5	0.3	119.7	120.0	143.2
46	HALIM PERDANA KUSUMA	0	149.2	149.2	0.3	64.9	65.2	22.8
47	GEDUNG	10.4	216.6	227.0	0.3	97.3	98.0	97.0
48	LUBANG BUAYA	0	342.8	342.8	0.7	117.9	118.6	99.8
49	PENGGILINGAN	0	62.9	62.9	0.5	24.1	24.6	68.6
50	CAKUNG	0	238.3	238.3	0.2	86.9	87.1	391.3
	JAKARTA TIMUR	725.3	1.840.2	2,565.5	2.8	1,076.8	1,079.6	1,123.8
	JAKARTA TOTAL	3,840.9	7,469.1	11,310.0	7.0	4,638.0	4,645.0	4,935.1

CHAPTER 6

TRAFFIC DEMAND FORECAST

Chapter 6 TRAFFIC DEMAND FORECAST

6.1 Traffic Generation

6.1.1 Existing Trip Generation

(1) Origin and Destination Table in the Year 1980

Based on the results of the road-side OD survey, the vehicle origin and destination tables, were established.

Among eighty traffic zones, the summarized vehicle OD table is shown in Table 6.1. The total number of vehicle trips related to DKI Jakarta amounts to 1.3 million in 24 hours, 91 percent of which have origin and/or destination in DKI Jakarta. Out of 1.3 million trips, sedans used 0.5 million and motorcycles used 0.4 million for total of approximately 70 percent.

This vehicle OD table is then converted to person trip OD tables by using the average occupancy rates of vehicle supplemented by railway and bus studies. (See Appendix 6.1) Zones with a large difference between daily trips generated and attracted are adjusted to the average of those trips.

A total person trip generation (excluding intra-zonal trips) in Jakarta in the year 1980 resulted in about 4.5 million person trips per day. A summary of person trip OD is presented in Table 6.2 and the desire line is shown in Fig. 6.1.

According to Table 6.2 it was found that bus transportation plays an important role in the area and accounts for 51% of the total person trips generated in Jakarta.

In contrast, railway transportation occupies 0.5% of the total and it shows a lower percentage in urban transportation. Thus, railways in Jakarta at present serve mainly for inter-regional transportation.

The portion of motorcycle transportation is relatively high which indicates that motorcycles are even used for long distance trips.

(2) Evaluation of Vehicle and Person Trip Generation in DKI Jakarta

According to the vehicle OD table (80 zones), the total vehicle trips generated in Jakarta and daily vehicle trip rates are shown in Table 6.3.

Table 6.1 Summarized Vehicle Trip OD in 1980

(Unit: 1,000 vehicle trip ends/day)

		DKI JAKARTA		BOTABEK		OTHERS		TOTAL	
		Trip Ends	%	Trip Ends	%	Trip Ends	%	Trip Ends	%
DKI JAKARTA (Zone 1 - 50)	Motorcycle	611.2	29.2	50.6	27.4	2.6	11.3	664.4	28.9
	Sedan	946.8	45.3	45.5	24.6	6.4	27.5	998.7	43.4
	Truck	250.0	12.0	42.0	22.8	10.6	45.9	302.6	13.2
	Bus	283.2	13.5	46.5	25.2	3.5	15.2	333.2	14.5
	Total	2,091.2	100.0	184.6	100.0	23.1	100.0	2,298.9	100.0
BOTABEK (Zone 51 - 73)	Motorcycle	50.6	27.4	4.2	21.9	1.3	29.5	56.1	27.0
	Sedan	45.5	24.6	4.8	25.0	1.2	27.3	51.5	24.7
	Truck	42.0	22.8	10.2	53.1	1.9	43.2	54.1	26.0
	Bus	46.5	25.2	0.0	0.0	0.0	0.0	46.5	22.3
	Total	184.6	100.0	9.6	100.0	4.4	100.0	208.2	100.0
OTHERS (Zone 74 - 80)	Motorcycle	2.6	11.3	1.3	29.5	0.4	100.0	4.3	15.4
	Sedan	6.4	27.5	1.2	27.3	0.0	0.0	7.6	27.2
	Truck	10.6	45.9	1.9	43.2	0.0	0.0	12.5	44.8
	Bus	3.5	15.2	0.0	0.0	0.0	0.0	3.5	12.6
	Total	23.1	100.0	4.4	100.0	0.2	100.0	27.9	100.0
								Total	2,535.0

(Total Trips 1,267.5)

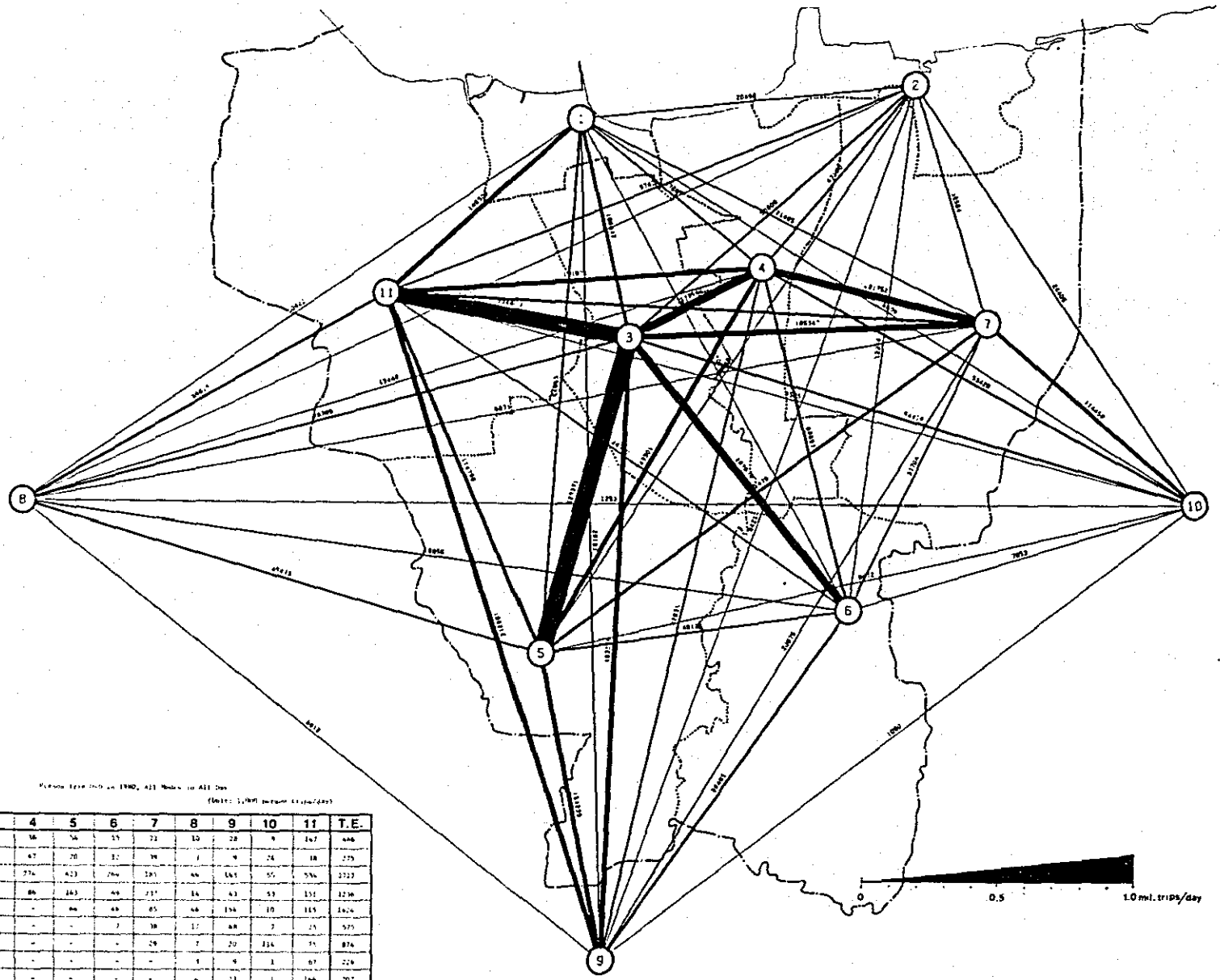
Table 6.2 Summarized Person Trip OD by Mode in 1980

(Unit: 1,000 person trip ends/day)

		DKI JAKARTA		BOTABEK		OTHERS		TOTAL	
		Trip Ends	%	Trip Ends	%	Trip Ends	%	Trip Ends	%
DKI JAKARTA (Zone 1-50)	Motor-cycle	848.4	10.7	71.9	7.0	3.9	3.7	924.2	10.2
	Sedan	2,336.6	29.5	123.6	12.0	16.8	15.9	2,477.0	27.4
	Bus	3,916.6	49.5	657.0	63.5	51.2	48.6	4,624.8	51.0
	Truck	804.8	10.2	147.9	14.3	33.4	31.7	986.1	10.9
	Railway	10.2	0.1	33.6	3.2	0.1	0.1	43.9	0.5
	Total	7,916.6	100.0	1,034.0	100.0	105.4	100.0	9,056.0	100.0
BOTABEK (Zone 51 - 73)	Motor-cycle	71.9	7.0	6.4	9.0	2.1	17.5	80.4	7.2
	Sedan	123.6	12.0	13.4	18.8	3.8	31.7	140.8	12.6
	Bus	657.0	63.5	0.0	0.0	0.0	0.0	657.0	58.8
	Truck	147.9	14.3	41.2	57.9	6.1	50.8	195.2	17.5
	Railway	33.6	3.2	10.2	14.3	0.0	0.0	43.8	3.9
	Total	1,034.0	100.0	71.2	100.0	12.0	100.0	1,117.2	100.0
OTHERS (Zone 74 - 80)	Motor-cycle	3.9	3.7	2.1	17.5	0.6	60.0	6.6	5.6
	Sedan	16.8	15.9	3.8	31.5	0.2	20.0	20.8	17.6
	Bus	51.2	48.6	0.0	0.0	0.0	0.0	51.2	43.2
	Truck	33.4	31.7	6.1	50.8	0.2	20.0	39.7	33.5
	Railway	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1
	Total	105.4	100.0	12.0	100.0	1.0	100.0	118.4	100.0
								Total	10,291.6

(Total Trips 5,145.8)

Fig. 6.1 Desire Line of Person Trip in 1980, All Modes for All Day



	1	2	3	4	5	6	7	8	9	10	11	T.E.
1	9	20	106	56	54	55	72	30	28	9	367	646
2	-	6	53	47	20	32	39	7	9	24	38	275
3	-	-	213	774	423	264	291	66	165	55	554	3722
4	-	-	-	86	263	46	237	36	63	53	351	1236
5	-	-	-	-	84	48	85	46	134	18	115	1424
6	-	-	-	-	-	7	38	17	68	7	23	575
7	-	-	-	-	-	-	29	7	20	334	71	874
8	-	-	-	-	-	-	-	1	9	1	67	229
9	-	-	-	-	-	-	-	-	23	1	146	707
10	-	-	-	-	-	-	-	-	-	33	4	380
11	-	-	-	-	-	-	-	-	-	-	80	1682
											T.E. Total	10,292

Table 6.3 Vehicle Trip Generation and Trip Rates in Jakarta, 1980

	Generated Trips* ($x10^3$ veh. trips/day)	Vehicle Ownership ($x10^3$ veh.)	Motorization (veh./1000 persons)	Vehicle Trip Rate* (Trip/veh.)
Motorcycle	332.2	436.1	66.5	0.76
Sedan	499.4	221.6	33.8	2.25
Truck	151.2	68.5	10.4	2.21
Bus	166.7	22.8	3.5	7.31
Total	1,149.5	749.0	114.2	1.53

Note: * Excluding intra-zonal vehicle trips.

Trip generation per person is to be compared with those in other cities in order to verify the results of the person trips survey in Jakarta.

However, as intra-zonal trips have been disregarded in the survey, these have to be supplemented by the home interview survey.

As a result, the intra-zonal trip rate in Jakarta was estimated to be 63.5% and the average number of trips per person more than 6 years of age was estimated at 2.09 trips per person.

Person trip analyses conducted in Manila in 1971 and Tokyo in 1978 indicated 1.73 trips (more than 7 years of age) and 2.53 trips per person respectively.

Compared with these studies, the estimated total person trips in Jakarta in 1980 was considered to fall in an acceptable range.

Based on the person trip analyses, work trip and peak-hour trip ratios are obtained as shown in Table 6.4.

Table 6.4 Work Trip and Peak Hour Ratios in Jakarta, 1980

	Generated	Attracted
a. All day all Purposes (10^3 P.T.)	4,504.8	4,552.5
b. Peak hour* all purposes (")	685.0	707.5
c. All day work trips (")	959.4	1,019.0
d. Peak hour* work trips(")	494.1	524.8
Peak hour* ratio (b/a)	0.152	0.155
Peak hour* work trip ratio(d/b)	0.721	0.742
Work trip peak hour ratio (d/c)	0.515	0.515

Note: * 7:00 - 9:00 a.m.
Work trip means a trip from home to work.

6.1.2 Framework of Future Traffic Generation

Estimation of future trip generation is based on the analysis of person trips for work purposes, which have a direct relationship with the employed population and the number of jobs in the area.

A flow chart for the estimation of future framework of trip generation is shown in Fig. 6.2 in the area.

A future framework of work trip generation in Jakarta is determined by assuming a ratio of effective working days, and excess in-flow of work trips to Jakarta as shown in Table 6.5.

For the estimation of future person trip OD tables, the total of intra-zonal work trips is extracted from the estimated total work trip generation in order to correspond to the 1980 person trip OD.

The existing inter-zonal work trip ratio in Jakarta is found to be 47.7% by the Home Interview Survey and it was assumed to rise as the future transportation network and car-owner ship are developed.

Subsequently, these inter-zonal work trips for all days are converted to those in peak-2 hours and expanded for all purposes in peak-2 hours and for all day. These conversion factors are determined in reference to examples for other cities as shown in Table 6.6.

Based on the above conversion factors, future person trips in all day and peak hours are estimated as shown in Table 6.7 and future person trip OD tables are shown in Tables 6.8 and 6.9.

Person trips in all day in the year 1990, 2000 and 2010 are estimated to be 7,632.1, 10,259 and 13,094.1 thousand person trips, respectively. By the year 2010, total person trips will be 2.5 times that for the year 1980.

Fig. 6.2 Estimation of Future Framework of Trip Generation in Jakarta

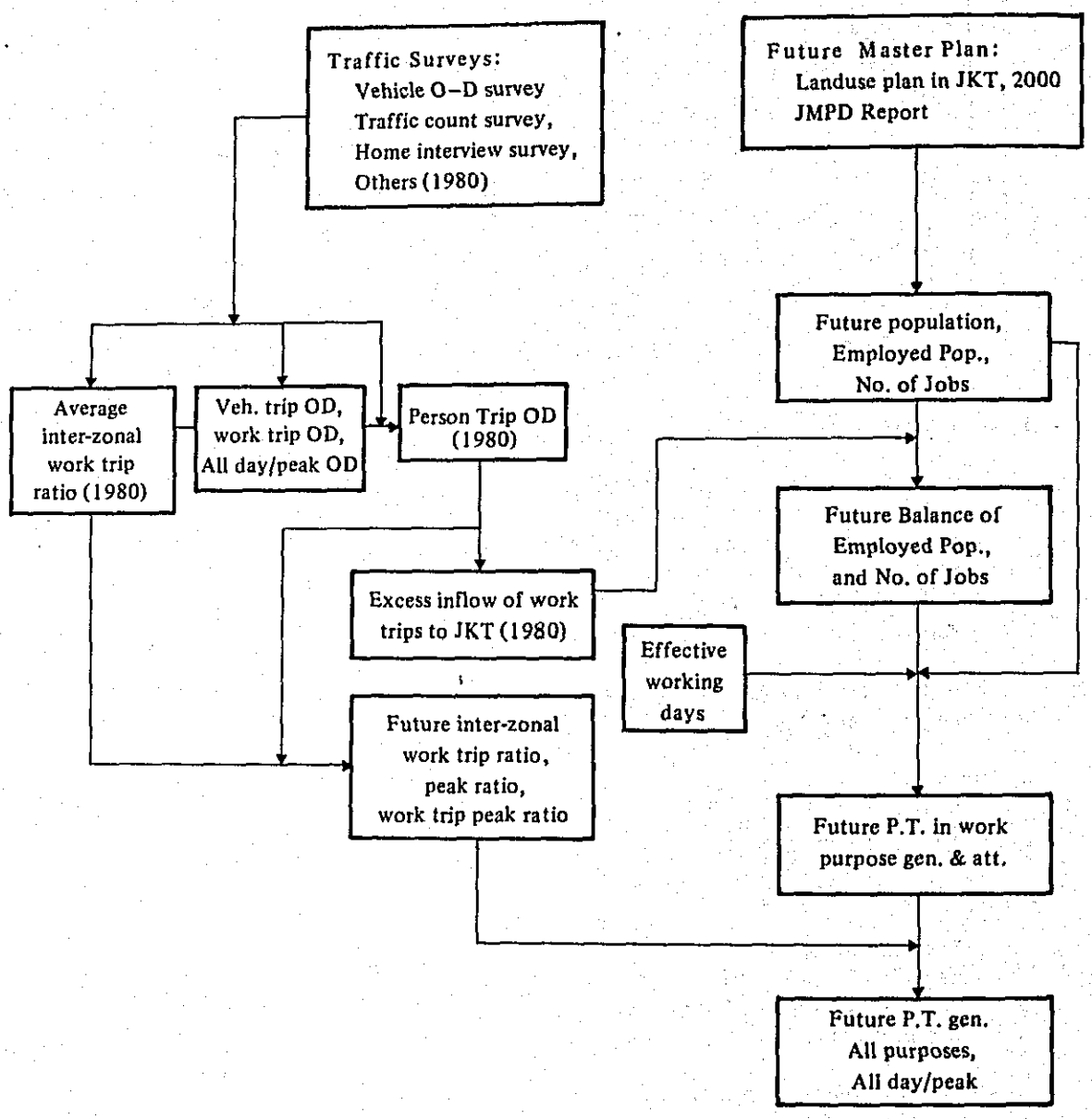


Table 6.5 Future Work Trip Generation and Attraction in Jakarta

	1980	1990	2000	2010
Population (x 1000 persons)	6,560.0	8,390.0	9,860.0	11,310.0
Employed population (x 1000 persons)	2,105.1	2,792.0	3,823.7	4,645.0
Number of Jobs (x 1000 persons)	2,167.5	3,100.5	4,041.0	4,935.2
Ratio of effective Working Days	0.956	0.93	0.90	0.90
Total work trip gen. (1000 person trips)	2,012.4	2,764.0	3,441.3	4,180.5
Total work trip att. (1,000 person trips)	2,072.1	2,883.5	3,636.9	4,441.7
Excess in-flow of work trips to JKT (1000 person trips)	59.7	119.5	195.6	261.2

Table 6.6 Estimation Factors for Future Trip Generation in Jakarta

	1980	1990	2000	2010
Interzonal work trip rate (%)	47.65	55.0	60.0	62.5
Peak hour* ratio	0.15	0.18	0.20	0.20
Peak hour work* trip ratio	0.73	0.75	0.75	0.75
Work trip peak hour ratio	0.515	0.55	0.60	0.60

* 7:00 - 9:00 a.m.

Person trips in the peak 2 hours in the year 1990, 2000 and 2010 are estimated to be 1,314.0, 1,948.8 and 2,479.4 thousand, respectively. Total person trips in the year 2010 will be 3.1 times that for the year 1980.

Desire lines of person trip for all day in the year 1990, 2000 and 2010 are shown in Figs. 6.3 through 6.5.

6.1.3 Zonal Traffic Generation

Zonal trip generation in future is estimated based on zonal planning parameters such as residential population, employed population and number of jobs by zone.

Inter-zonal work trip generation is estimated based on the existing ratios of intra-zonal work trips over the existing employment level or number of jobs in each zone.

Future employment levels and number of jobs are estimated referring to the future land use plan in DKI Jakarta, 2000 and JABOTABEK Metropolitan Development Planning, 1980.

Consequently, inter-zonal work trips by zone are estimated based on those trips which coincide with the determined control totals of future work trips in Jakarta.

Zonal work trips thereafter expanded to total trips for all purposes by using zonal trip factors such as the existing work trip ratios, peak-hour ratios, etc. These zonal trips are adjusted eventually to the future control totals.

An estimation flow of the future trip generation by zone is presented in Fig. 6.6. Zonal trip generation in all day in 1980, 1990, 2000 and 2010 are shown in Table 6.10 and zonal trip generation and attraction in peak 2 hours in each year are shown in Table 6.11.

Table 6.7 Future Trip Generation and Attraction in Jakarta

(Unit: 1,000 P.T./day)

		1980		1990		2000		2010	
		Generation	Attraction	Generation	Attraction	Generation	Attraction	Generation	Attraction
DKI Jakarta	All day work trips	959.4	1,019.0	1,520.2	1,639.7	2,064.8	2,260.4	2,612.8	2,874.0
	Peak-hour work trips	494.1	524.8	836.1	901.8	1,238.9	1,356.2	1,567.7	1,724.4
	Peak-hour all purposes	685.0	707.5	1,116.8	1,204.4	1,656.7	1,813.1	2,100.0	2,308.8
	All day all purposes	4,528.0	4,528.0	6,459.7	6,459.7	8,702.3	8,702.3	11,075.2	11,075.2
Botabek	All day work trips	148.5	89.1	237.7	118.8	351.3	156.7	455.6	195.7
	Peak-hour work trips	76.4	45.8	142.9	77.5	210.8	93.3	273.5	117.6
	Peak-hour all purposes	103.0	79.2	190.4	103.2	281.0	125.4	365.3	157.5
	All day all purposes	558.6	558.6	1,058.2	1,058.2	1,405.2	1,405.2	1,822.3	1,822.3
Others	All day work trips	5.9	5.6	9.5	8.9	13.8	12.8	17.7	16.4
	Peak hour work trips	3.1	3.0	5.2	4.9	8.3	7.7	10.6	9.8
	Peak hour all purposes	5.0	6.3	6.9	6.5	11.1	10.3	14.2	13.1
	All day all purposes	59.2	59.2	114.2	114.2	151.5	151.5	196.6	196.6
Total	All day work trips	1,113.8	1,113.7	1,767.4	1,767.4	2,429.9	2,429.9	3,086.1	3,086.1
	Peak hour work trips	573.6	573.6	984.2	984.2	1,457.2	1,457.2	1,851.8	1,851.8
	Peak hour all purposes	793.0	793.0	1,314.1	1,314.1	1,948.8	1,948.8	2,479.4	2,479.4
	All day all purposes	5,145.8	5,145.8	7,632.1	7,632.1	10,259.0	10,259.0	13,094.1	13,094.1

Table 6.8 Future Person Trip OD Table in All Day

(Unit: 1,000 person trip ends/day)

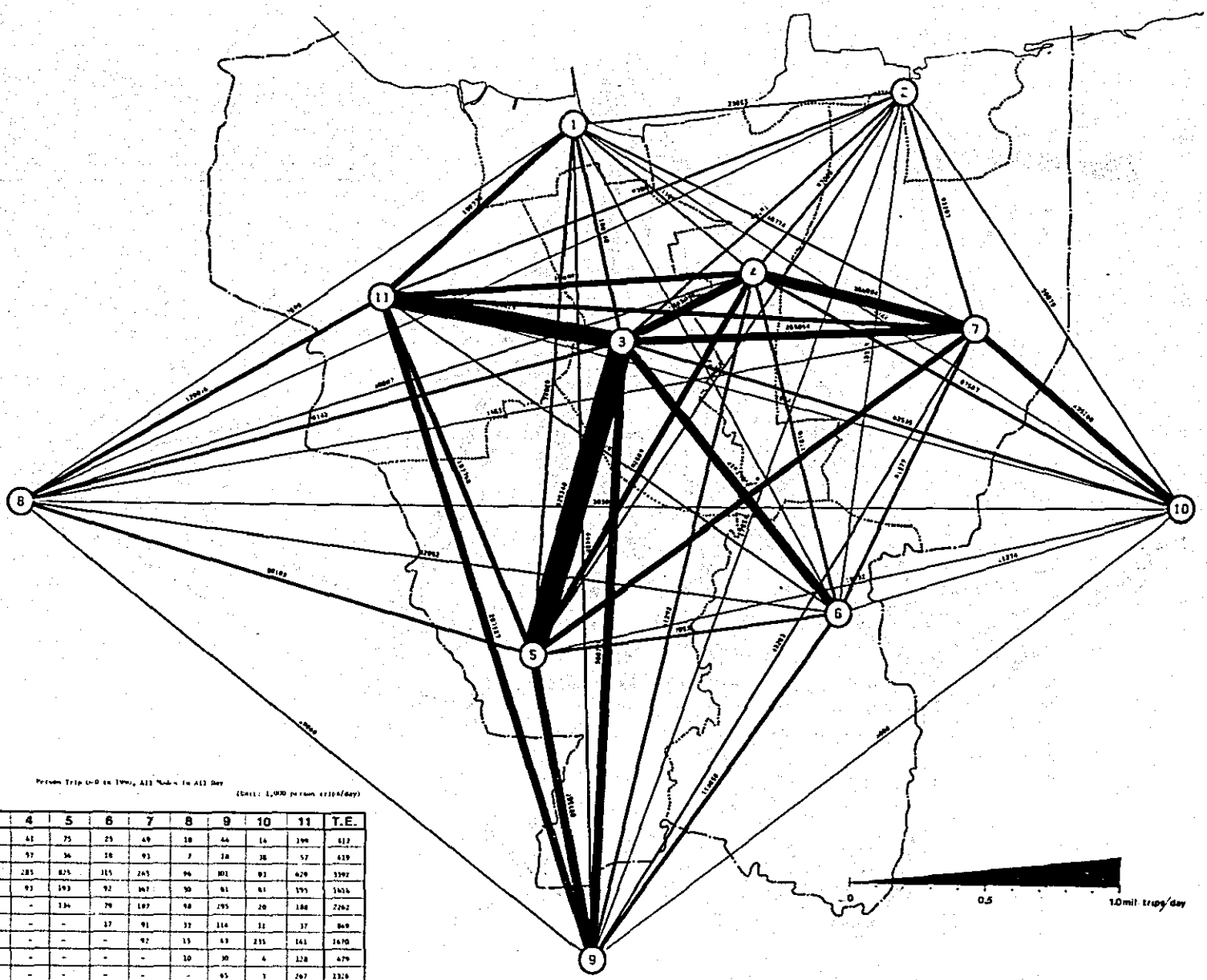
		DKI Jakarta		BOTABEK		OTHERS		TOTAL	
		Trip Ends	Growth Rate	Trip Ends	Growth Rate	Trip Ends	Growth Rate	Trip Ends	Growth Rate
DKI Jakarta (Zone 1-50)	1980	7,916.6	1.0	1,034.0	1.0	105.4	1.0	9,056.0 (4,528.0)	1.0
	1990	10,833.4	1.4	1,884.0	1.8	202.1	1.9	12,919.5 (6,459.8)	1.4
	2000	14,613.4	1.8	2,519.8	2.4	271.4	2.6	17,404.6 (8,702.3)	1.9
	2010	18,520.4	2.3	3,277.9	3.2	352.1	3.3	22,150.5 (11,075.3)	2.4
BOTABEK (Zone 51-73)	1980	1,034.0	1.0	71.2	1.0	12.0	1.0	1,117.2 (558.6)	1.0
	1990	1,884.0	1.8	208.6	2.9	23.8	2.0	2,116.4 (1,058.2)	1.9
	2000	2,519.8	2.4	262.0	3.7	28.7	2.4	2,810.4 (1,405.2)	2.5
	2010	3,277.9	3.2	329.6	4.6	37.1	3.1	3,644.6 (1,822.3)	3.3
OTHERS (Zone 74-80)	1980	105.4	1.0	12.0	1.0	1.0	1.0	118.4 (59.2)	1.0
	1990	202.1	1.9	23.8	2.0	2.4	2.4	228.3 (114.2)	1.9
	2000	271.4	2.6	28.7	2.4	3.0	3.0	303.0 (151.5)	2.6
	2010	352.1	3.3	37.1	3.1	4.0	4.0	393.1 (196.6)	3.3
AREA TOTAL	1980							10,291.6 (5,145.8)	1.0
	1990							15,264.2 (7,632.1)	1.5
	2000							20,518.0 (10,259.0)	2.0
	2010							26,188.2 (13,094.1)	2.5

Table 6.9 Future Person Trip OD Table in Peak Hour

(Unit: 1,000 person trips/peak 2 hours)

		DKI Jakarta		BOTABEK		OTHERS		TOTAL	
		Trips	Growth Rate	Trips	Growth Rate	Trips	Growth Rate	Trips	Growth Rate
DKI Jakarta (Zone 1-50)	1980	600.4	1.0	78.3	1.0	6.3	1.0	685.0	1.0
	1990	1,007.5	1.7	102.8	1.3	6.5	1.0	1,116.8	1.6
	2000	1,521.5	2.5	124.9	1.6	10.3	1.6	1,656.7	2.4
	2010	1,930.0	3.2	156.9	2.0	13.1	2.1	2,100.0	3.1
BOTABEK (Zone 51-73)	1980	102.2	1.0	0.8	1.0	0.0	-	103.0	1.0
	1990	190.1	1.9	0.3	0.4	0.0	-	190.4	1.8
	2000	280.6	2.7	0.4	0.5	0.0	-	281.0	2.7
	2010	364.8	3.6	0.5	0.6	0.0	-	365.3	3.5
OTHERS (Zone 74-80)	1980	4.9	1.0	0.1	1.0	0.0	-	5.0	1.0
	1990	6.8	1.4	0.1	1.0	0.0	-	6.9	1.4
	2000	11.0	2.2	0.1	1.0	0.0	-	11.1	2.2
	2010	14.0	2.9	0.1	1.0	0.0	-	14.1	2.8
TOTAL	1980	707.5	1.0	79.2	1.0	6.3	1.0	790.3	1.0
	1990	1,204.4	1.7	103.2	1.3	6.5	1.0	1,314.0	1.7
	2000	1,813.1	2.6	125.4	1.6	10.3	1.6	1,948.8	2.5
	2010	2,308.8	3.3	157.5	2.0	13.1	2.1	2,479.4	3.1

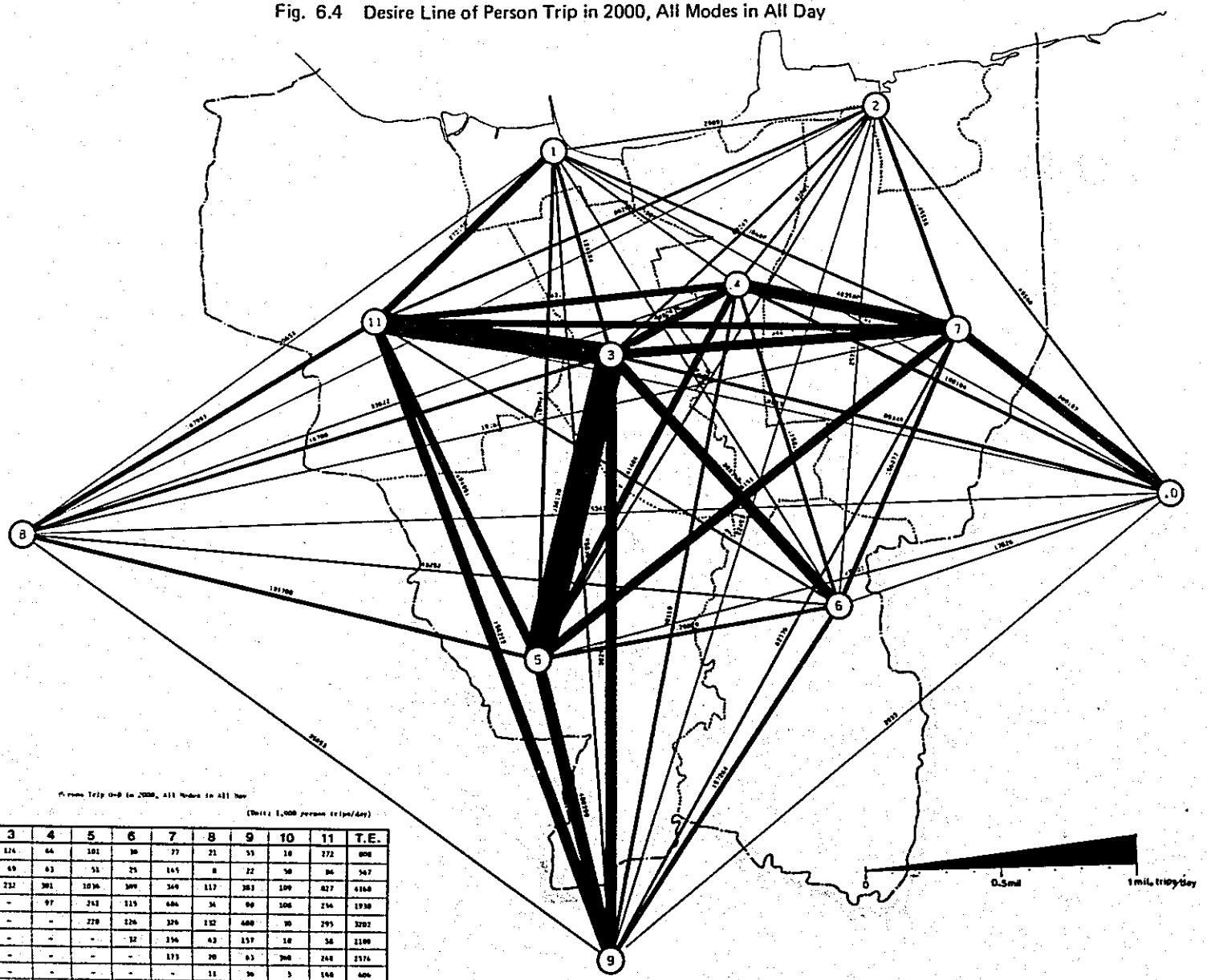
Fig. 6.3 Desire Line of Person Trip in 1980, All Modes in All Day



(Unit: 1,000 person trips/day)

	1	2	3	4	5	6	7	8	9	10	11	T.E.
1	30	24	108	61	75	25	69	18	44	14	199	613
2	-	7	59	57	36	18	93	7	18	38	57	419
3	-	-	213	285	825	315	265	96	801	93	629	3392
4	-	-	-	93	193	92	367	30	81	81	395	1616
5	-	-	-	-	134	79	187	98	295	20	188	2262
6	-	-	-	-	-	37	91	33	116	31	37	869
7	-	-	-	-	-	-	92	15	63	235	161	1670
8	-	-	-	-	-	-	-	30	30	6	128	679
9	-	-	-	-	-	-	-	-	95	7	267	1326
10	-	-	-	-	-	-	-	-	-	18	8	339
11	-	-	-	-	-	-	-	-	-	-	124	2097
											T.E. Total	15796

Fig. 6.4 Desire Line of Person Trip in 2000, All Modes in All Day



(Unit: 1,000 person trips/day)

	1	2	3	4	5	6	7	8	9	10	11	T.E.
1	13	30	124	44	101	30	77	21	53	18	272	808
2	-	9	69	63	51	25	165	8	22	58	86	567
3	-	-	232	381	1016	389	349	117	383	199	827	4168
4	-	-	-	97	243	119	686	36	90	106	256	1930
5	-	-	-	-	278	126	326	132	680	30	295	3202
6	-	-	-	-	-	32	256	63	157	18	56	2100
7	-	-	-	-	-	-	173	20	63	398	248	2376
8	-	-	-	-	-	-	-	11	36	3	168	606
9	-	-	-	-	-	-	-	-	61	4	256	1764
10	-	-	-	-	-	-	-	-	-	24	11	763
11	-	-	-	-	-	-	-	-	-	-	193	2062

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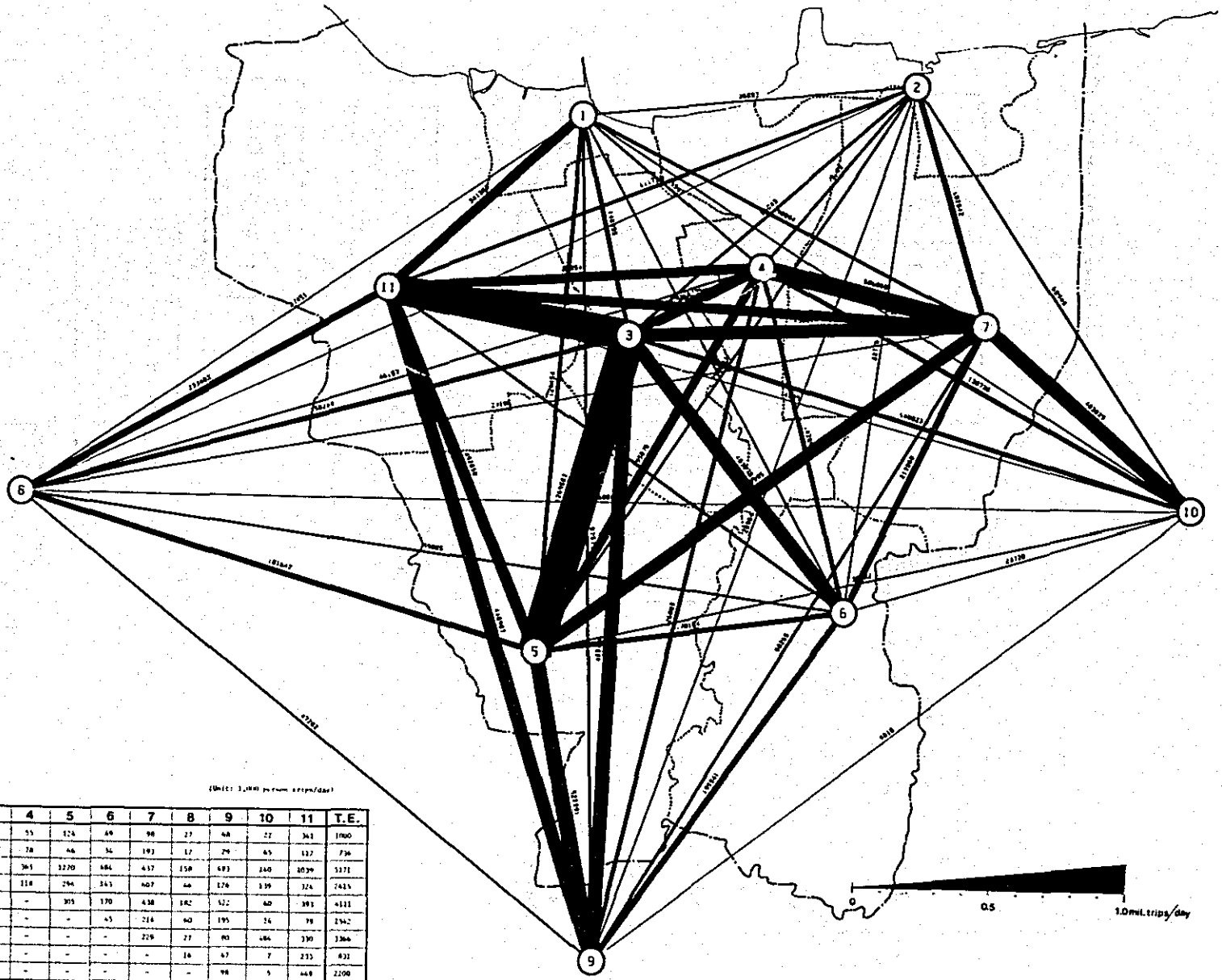
Fig. 6.5 Desire Line of Person Trip in 2010, All Modes in All Day



(Unit: 1,000 person trips/day)

	1	2	3	4	5	6	7	8	9	10	11	T.E.
1	15	37	349	55	124	69	98	27	68	27	361	1060
2	-	31	86	78	46	34	193	17	29	65	137	736
3	-	-	280	361	1270	684	457	150	693	260	8039	5171
4	-	-	-	118	294	363	807	66	176	139	326	2425
5	-	-	-	-	305	170	438	182	522	60	393	4111
6	-	-	-	-	-	65	214	60	195	36	98	2342
7	-	-	-	-	-	-	229	27	85	486	330	3366
8	-	-	-	-	-	-	-	16	67	7	233	831
9	-	-	-	-	-	-	-	-	98	5	448	2200
10	-	-	-	-	-	-	-	-	-	31	16	1002
11	-	-	-	-	-	-	-	-	-	-	251	5819
											T.E. Total	29188

Fig. 6.6 Flow of Estimation for Future Person Trip Generation by Zone

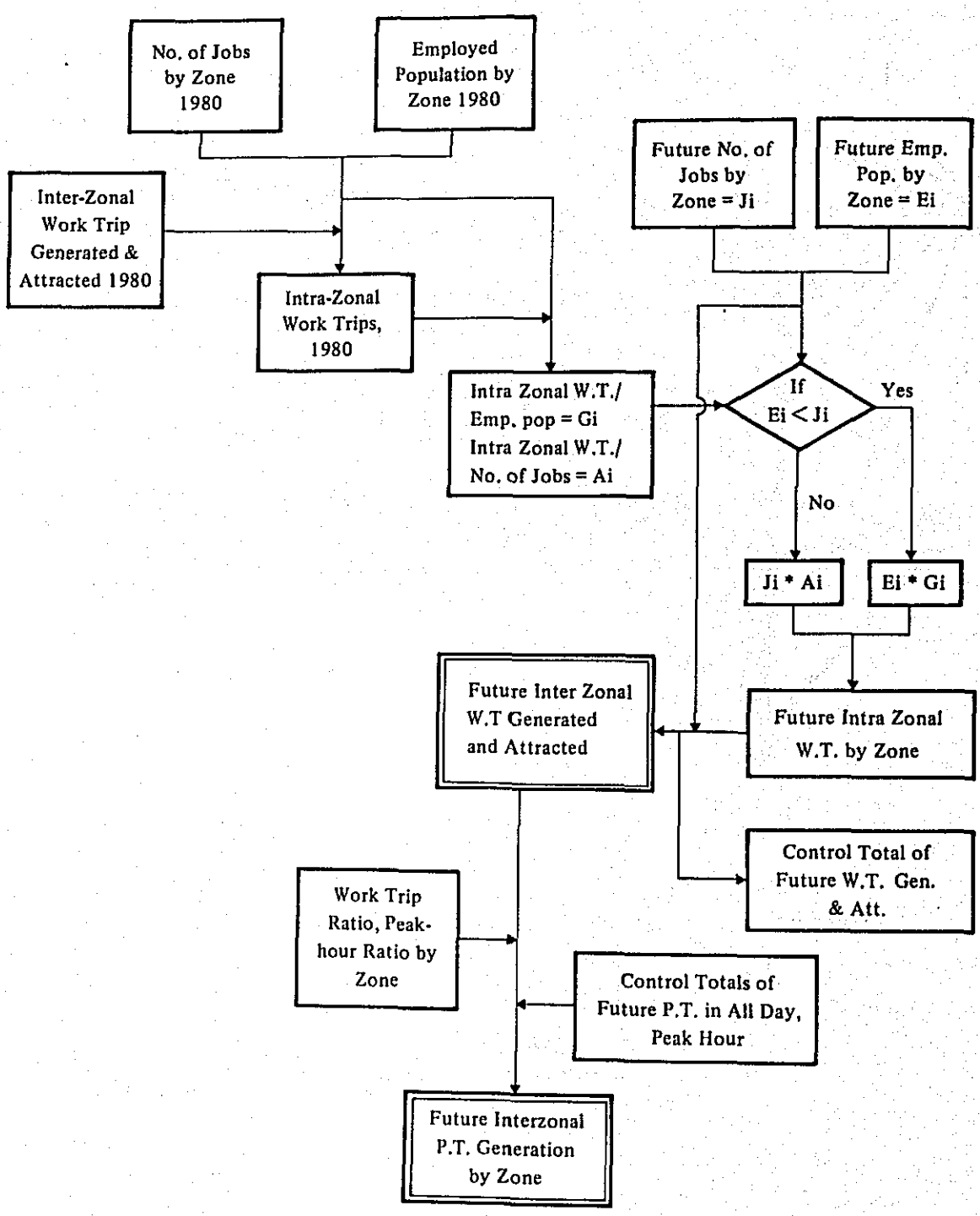


Table 6.10 Estimation of Future Trip Generation by Zone

(Unit: Person trips/day)

Zone No.	NAME OF ZONE	1980	1990	2000	2010
1.	GAMBIR	238,628	373,922	512,396	653,479
2.	SAWAH BESAR	95,067	130,671	165,901	215,082
3.	KEMAYORAN	126,930	135,919	151,125	183,126
4.	SENEN	112,088	135,120	157,049	191,904
5.	CEMPAKA PUTIH	114,459	153,190	196,498	250,069
6.	MENTENG	191,407	236,390	283,453	349,612
7.	KEBON MELATI	228,419	216,046	230,664	272,583
8.	GELORA	32,728	50,587	71,201	89,619
9.	KANAL MUARA	6,650	29,264	59,715	76,521
10.	KAPUK MUARA	4,439	6,364	9,261	11,822
11.	PEJAGALAN	187,288	235,730	303,564	372,587
12.	MANGGA DUA UTARA	47,894	73,030	100,094	127,652
13.	PADEMANGAN	27,186	41,935	32,238	39,861
14.	SUNTER	60,539	92,304	126,490	161,316
15.	PEPANGGO	44,680	68,127	93,358	119,059
16.	TANJUNG PRIOK	73,937	112,837	154,626	197,218
17.	KOJA	28,228	43,039	55,409	75,234
18.	TUGU	30,660	46,747	64,064	81,710
19.	PEGANGSAAN II	27,516	43,039	73,201	95,792
20.	SEMPER	34,549	52,669	72,198	92,077
21.	SUKAPURA	1,846	19,305	70,686	93,705
22.	SEMANAN	18,514	42,686	77,246	102,339
23.	PEGADUNGAN	13,059	82,867	151,577	251,810
24.	CENGKARENG	44,800	93,196	149,094	196,055
25.	JELAMBAR	193,694	208,994	237,589	287,332
26.	TOMANG	144,096	172,633	210,578	256,652
27.	PAAL MERAH	218,486	216,017	237,090	279,297
28.	TAMAN SARI	106,384	121,230	140,819	172,966
29.	TAMBORA	90,400	137,826	188,873	240,877
30.	KEMBANGAN	44,677	110,674	207,542	267,958
31.	KEBON JERUK	40,526	85,044	140,969	178,313
32.	TEBET	169,780	185,685	201,704	238,187
33.	SETIABUDI	131,661	159,143	199,993	250,957
34.	MAMPANG PRAPATAN	144,206	176,792	205,681	254,456
35.	PEJATEN	81,935	133,423	199,791	260,117
36.	SERENGSENG SAWAH	7,155	37,674	77,410	105,840
37.	KEBAYORAN BARU	285,425	462,704	634,114	808,666
38.	GROGOL UTARA	57,375	105,389	156,780	202,670
39.	KEBAYORAN LAMA	41,591	88,050	141,431	182,349
40.	CILANDAK	39,022	76,411	115,115	151,476
41.	MATRAMAN	77,823	118,648	162,602	207,356
42.	PULO GADUNG	266,729	263,251	291,541	351,998
43.	CIPINANG BESAR	153,557	197,810	206,517	246,480
44.	KELENDER	87,535	133,470	182,900	233,259
45.	CILILITAN	189,071	219,838	263,162	326,975
46.	HALIMPERDANA KUSUMAH	38,714	59,022	80,885	103,156
47.	GEDONG	44,910	88,803	134,639	181,354
48.	LUBANG BUAYA	17,107	56,847	116,517	159,925
49.	PENGGILINGAN	17,323	45,520	72,683	96,700
50.	CAKUNG	23,821	289,296	531,106	729,563
	D.K.I TOTAL	4,504,514	6,459,725	8,702,295	11,075,210
51.	TANGERANG	62,641	132,699	167,490	231,695
52.	TELUK NAGA	19,104	40,495	51,093	70,591
53.	MAUK	2,674	5,685	7,193	9,889
54.	CIKUPA	13,474	28,590	35,994	49,894
55.	SERPONG	3,085	6,492	8,189	11,388
56.	CIPUTAT	102,541	217,093	273,998	378,994
57.	SAWANGAN	7,508	11,490	15,492	18,387
58.	DEPOK	65,027	107,896	144,993	172,995
59.	CIBINONG	94,891	157,798	211,793	252,796
60.	CITEUREUP	7,975	13,195	17,798	21,195
61.	CILEUNGSI	2,954	4,888	6,590	7,894
62.	BOGOR	45,561	75,592	101,597	121,296
63.	CIAWI	8,767	14,587	19,596	23,289
64.	RUMPIN	1,505	2,484	3,384	3,987
65.	PARUNG PANJANG	62	88	89	90
66.	LEUWILIANG	4,523	7,489	10,093	11,992
67.	PONDOK GEDE	61,717	104,594	148,991	196,795
68.	BEKASI	50,874	86,294	122,890	162,492
69.	BABELAN	1,926	3,283	4,685	6,188
70.	TAMBUN	11,543	19,586	27,887	36,894
71.	CIKARANG	4,784	8,091	11,481	15,185
72.	SETU	5,720	9,684	13,785	18,185
73.	SUKATANI	69	86	189	184
	BOTABEK TOTAL	578,925	1,058,177	1,405,292	1,822,297
74.	WEST JAVA-1	13,302	24,383	32,387	41,991
75.	WEST JAVA-2	27,720	50,790	67,494	87,493
76.	WEST JAVA-3	16,195	29,689	39,285	51,086
77.	CENTRAL JAVA	2,781	5,085	6,787	8,791
78.	EAST JAVA	1,692	3,095	4,091	5,290
79.	SOUTH SUMATRA	0	0	0	0
80.	OUT OF JAVA	601	1,087	1,489	1,892
	OUTSIDE JABOTABEK TOTAL	62,291	114,129	151,533	196,543
	GRAND TOTAL	5,145,730	7,632,031	10,259,120	13,094,050

Table 6.11 Estimation of Future Trip Generation and Attraction by Zone in Peak Hour

Unit: Person trips/peak 2 hours

ZONE NO.	NAME OF ZONE	GENERATION				ATTRACTION			
		1980	1990	2000	2010	1980	1990	2000	2010
1	GAMBIR	27,513	44,423	60,255	75,708	61,271	121,921	195,313	251,028
2	SAWAH BESAR	11,120	14,273	16,886	21,482	15,266	25,267	39,866	50,563
3	KEMAYORAN	16,421	18,751	20,922	25,737	21,759	23,357	30,457	36,178
4	SENEN	17,540	19,618	20,933	25,413	19,284	26,369	37,245	45,579
5	CEMPAKA PUTIH	17,056	22,216	26,837	33,465	29,590	44,409	68,616	88,250
6	MENTENG	18,330	18,538	20,854	25,932	37,163	57,923	80,997	99,209
7	KEBON MELATI	36,597	37,346	41,844	49,813	23,707	27,560	32,647	38,047
8	GELORA	1,345	1,385	2,038	2,433	8,418	18,094	28,179	36,218
9	KANAL MUARA	406	3,343	7,672	9,824	2,585	2,604	2,768	3,096
10	KAPUK MUARA	664	1,066	1,455	1,829	1,096	2,176	3,482	4,485
11	PEJAGALAN	28,669	55,870	78,685	99,252	32,497	31,269	31,474	34,295
12	MANGGA DUA UTARA	4,258	6,866	9,323	11,701	11,106	22,103	35,435	45,536
13	PADEMANGAN	5,605	6,057	6,509	7,472	2,066	2,887	3,900	5,069
14	SUNTER	4,538	7,317	9,928	12,472	15,961	31,736	50,851	65,349
15	PEPANGGO	6,498	10,486	14,225	17,879	4,776	9,489	15,200	19,539
16	TANJUNG PERIOK	4,050	6,529	8,856	11,125	18,545	36,918	59,134	76,010
17	KOJA	2,572	4,143	5,629	7,067	8,375	16,653	26,698	34,309
18	TUGU	5,173	8,337	11,319	14,221	6,745	13,435	21,526	27,668
19	PEGANGSAAN II	3,687	5,428	13,891	18,014	2,678	5,092	7,956	10,472
20	SEMPER	3,463	5,572	7,569	9,509	6,857	13,617	21,817	28,049
21	SUKAPURA	0	4,573	20,686	26,528	574	2,434	5,033	7,893
22	SEMANAN	5,406	14,802	32,078	41,868	1,729	3,795	6,264	8,431
23	PEGADUNGAN	4,455	17,765	38,516	57,220	2,374	19,906	33,392	54,685
24	CENGKARENG	12,566	35,794	64,493	82,648	3,295	5,931	9,181	12,619
25	JELAMBAR	26,630	26,370	30,575	37,555	26,959	36,293	46,618	55,496
26	TOMANG	15,748	16,340	21,018	24,972	26,365	39,691	53,308	65,927
27	PAL MERAH	23,753	25,948	33,203	40,121	28,192	28,833	30,846	34,735
28	TAMAN SARI	11,691	14,839	14,928	18,726	18,387	21,603	33,318	40,070
29	TAMBORA	21,356	34,446	46,750	58,719	11,613	23,101	37,034	47,589
30	KEMBANGAN	13,042	50,890	112,817	145,559	1,777	2,418	3,205	4,028
31	KEBON JERUK	12,734	40,759	79,593	100,412	2,013	2,554	3,235	4,036
32	TEBET	35,819	50,131	61,078	72,519	12,701	13,355	14,465	16,724
33	SETIABUDI	25,396	30,452	33,138	41,519	26,019	42,870	68,953	86,337
34	MAMPANG PRAPATAN	17,333	24,950	32,539	41,111	24,667	28,379	33,553	39,835
35	PEJATEN	14,731	32,236	56,969	74,700	9,360	12,448	16,286	20,484
36	SERENGSENG SAWAH	1,685	14,100	32,159	42,074	60	174	345	550
37	KEBAYORAN BARU	24,222	39,069	53,022	66,609	66,954	133,225	213,421	274,294
38	GROGOL UTARA	15,373	35,011	59,199	75,430	3,897	6,291	9,188	12,045
39	KEBAYORAN LAMA	9,552	30,108	56,228	71,930	2,123	2,946	3,953	5,134
40	CILANDAK	8,129	21,316	37,039	46,847	4,205	6,198	8,628	11,244
41	MATRAMAN	16,182	26,097	35,420	44,497	5,688	11,307	18,108	23,276
42	PULO GADUNG	41,994	52,936	68,579	85,690	33,949	33,160	33,677	37,129
43	CIPINANG BESAR	30,328	53,153	62,041	75,519	12,661	12,692	13,078	14,720
44	KELENDER	20,643	33,307	45,192	56,763	5,154	10,256	16,435	21,132
45	CILILITAN	33,959	37,814	44,122	56,665	30,576	45,551	63,899	77,129
46	HALIM PERDANA KUSUMAH	6,640	10,694	14,529	18,243	4,069	8,076	12,944	16,634
47	GEDONG	10,024	17,914	27,967	37,315	4,125	10,656	18,108	24,467
48	LUBANG BUAYA	3,314	12,542	30,850	40,229	2,503	8,501	16,096	23,683
49	PENGGILINGAN	3,081	4,428	5,578	7,474	2,766	12,845	24,550	32,590
50	CAKUNG	3,675	10,397	20,741	28,355	2,978	85,980	172,432	236,993
	D.K.I TOTAL	684,966	1,116,745	1,656,677	2,099,965	707,478	1,204,348	1,813,114	2,308,858
51	TANGERANG	11,920	28,101	39,493	54,704	2,087	2,796	3,498	4,996
52	TELUK NAGA	1,838	4,296	6,097	8,395	6,322	8,497	10,797	15,298
53	MAUK	42	95	98	197	67	94	95	191
54	CIKUPA	4,727	11,194	15,603	21,695	6,734	9,101	11,397	16,297
55	SERPONG	473	1,093	1,598	2,194	646	897	1,095	1,596
56	CIPUTAT	13,873	32,794	45,901	63,696	18,519	24,900	31,396	44,702
57	SAWANGAN	3,793	6,396	9,600	11,393	97	94	188	192
58	DEPOK	14,219	23,998	35,903	42,903	3,552	5,102	6,294	6,494
59	CIBINONG	14,870	24,999	37,600	44,898	7,564	10,795	13,394	13,797
60	CITEUREUP	802	1,400	1,999	2,395	5,842	8,297	10,403	10,698
61	CILEUNGSI	50	90	95	194	0	0	0	0
62	BOGOR	7,669	12,998	19,398	23,102	10,363	14,694	18,403	18,896
63	CIAWI	571	993	1,395	1,695	265	392	495	499
64	RUMPIN	50	91	95	194	186	288	293	292
65	PARUN PANJANG	31	90	91	91	0	0	0	0
66	LEUWILIANG	50	90	95	194	0	0	0	0
67	PONDOK GEDE	16,490	24,500	38,899	51,501	6,423	6,597	6,694	8,995
68	BEKASI	8,567	12,801	20,297	26,600	8,500	8,595	8,893	11,794
69	BABELAN	184	295	395	595	166	188	192	191
70	TAMBUN	524	796	1,198	1,598	568	591	593	796
71	CIKARANG	2,172	3,150	5,021	6,788	1,149	1,197	1,190	1,693
72	SETU	54	94	93	191	62	88	93	94
73	SUKATANI	17	43	70	88	0	0	0	0
	BOTABEK TOTAL	102,986	190,397	281,032	365,301	79,184	103,203	125,403	157,511
74	WEST JAVA -1	491	692	1,092	1,391	881	892	1,388	1,797
75	WEST JAVA -2	3,698	5,099	8,096	10,397	1,329	1,394	2,195	2,695
76	WEST JAVA -3	318	395	693	894	3,746	3,796	6,192	7,792
77	CENTRAL JAVA	499	633	1,092	1,393	260	295	391	592
78	EAST JAVA	24	59	94	96	84	92	93	192
79	SOUTH SUMATRA	0	0	0	0	0	0	0	0
80	OUT OF JAVA	0	0	0	0	0	0	0	0
	OUTSIDE JABOTABEK TOTAL	5,030	6,878	11,067	14,171	6,320	6,469	10,259	13,068
	GRAND TOTAL	792,982	1,314,020	1,948,776	2,479,437	792,982	1,314,020	1,948,776	2,479,437

6.2 Modal Split and Traffic Distribution

6.2.1 Shares of Transport Modes

A procedure for estimating future OD tables by mode is shown in Fig. 6.7. Main stream of the estimation flow is as follows:

i) Assume a future share of mass transit (Bus and Railway), referring to the percentage share at present, past development trends of mass transit and future mass transit plan.

ii) Calculate future person trips by mass transit for DKI Jakarta and outside DKI Jakarta by taking into account the above assumption.

iii) Estimate railway trips (person trips) classifying zonal accessibility to railway by rank and give zones the ranks corresponding to the determined railway/mass transit trip ratios.

iv) Deduct (iii) from (ii) to calculate bus trips. Future bus OD tables (person trips) are obtained by the Frator method using present pattern.

v) Calculate person trip OD tables for other modes (motorcycle, sedan and truck) by deducting (ii) from the total person trip generation by zone and then by using Frator method with the present pattern of other modes.

vi) Estimate a diversion curve that explains relationship between distance and share of motorcycle trips (motorcycle/sedan + truck) trips), which are derived from the existing OD tables by mode and a distance of OD pairs.

vii) Determine the future share of motorcycle trips (person trips) as a control total. Zonal trip generation by motorcycle, which is temporarily estimated in item (vi) above are adjusted to the control total and the OD table is estimated by Frator method with present pattern of motorcycle person trips.

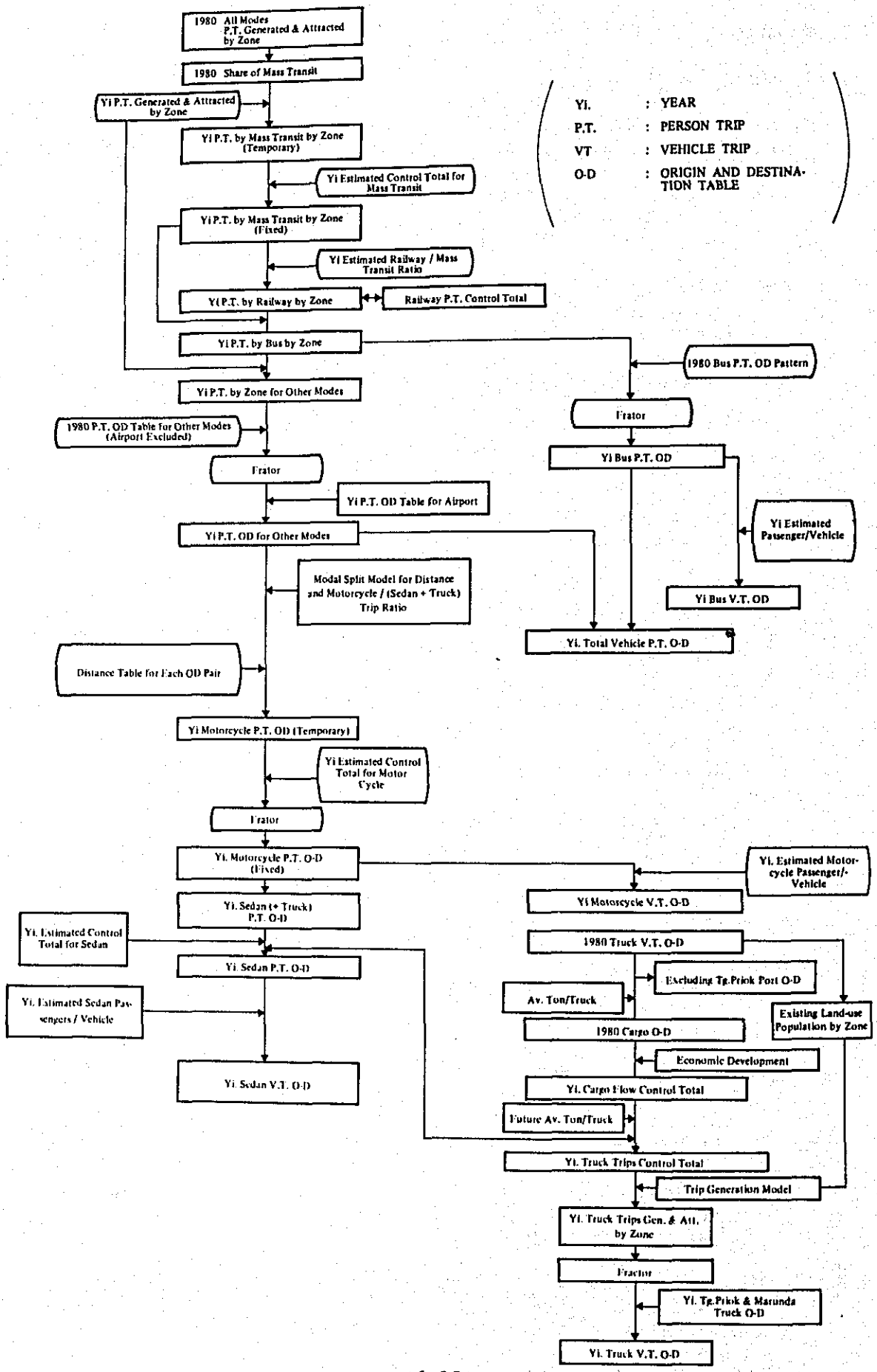
viii) Calculate sedan trip generation by estimating a share of sedan person trips and setting aside truck trips from (sedan + truck) trips and apply Frator method for estimating future sedan OD tables.

xi) Truck trip generation is separated from person trip analysis and estimated based on the future cargo flows (tons), which are finally converted to truck trips and distributed by Frator method with present pattern. (Please refer to Appendix 6.5)

x) Person trip OD tables for bus, motorcycle and sedan are converted to the vehicle trip OD tables by the estimated vehicle occupancy rates of those vehicles.

The above estimation was made for morning-peak hours (7:00 - 9:00 a.m.) and off-peak hours (9:00 a.m. - 24:00 - 7:00 a.m.) individually and these two hour-bands were added to form OD tables in all day.

Fig. 6.7 Estimating Flow for Future O D Tables by Mode



In the above-mentioned procedure, the number of passengers by mass transit and railway are estimated as shown in Tables 6.12 and 6.13. Number of bus passengers are calculated as shown in Table 6.14. The share of mass transit in all day in the year 1980 is 52.7 percent, which is estimated to be 55.7, 59.5 and 63.0 percent in the year 1990, 2000 and 2010, respectively. In peak hour, the share of mass transit will be increased to 66.1 percent in the year 2010 from 55.1 percent in the year 1980.

In order to allocate these railway passengers to each traffic zone, Table 6.15 was prepared.

The preliminary control total for person trips by motorcycle was assumed as shown in Table 6.16. This preliminary control total was established on the hypothesis that future person trips by motorcycle would be increased but the increasing rate would be decreased and that a considerable parts of person trips by motorcycle would be transferred to mass transit. With a diversion curve derived from the existing OD table, person trips excluding those of mass transit were distributed between motorcycle and (sedan + truck).

Person trips estimated for transportation mode other than railway are then converted to vehicle trips by using average occupancy per kind of vehicle as shown in Table 6.17.

Table 6.12 Passengers Estimated for Mass Transit

Unit: Thousand Passengers

		1990		2000		2010	
		Generated	Attracted	Generated	Attracted	Generated	Attracted
Peak 2 Hours	DKI	668.9	721.4	1,073.7	1,175.4	1,463.2	1,609.4
	Others	128.3	75.8	204.5	102.8	284.7	138.5
	Total	797.2	797.2	1,278.2	1,278.2	1,747.9	1,747.9
Off Peak Hours	DKI	2,871.3	2,818.8	4,116.6	4,014.9	5,669.8	5,523.6
	Others	633.9	686.4	885.5	987.2	1,229.6	1,375.8
	Total	3,505.2	3,505.2	5,002.1	5,002.1	6,899.4	6,899.4
All Day	DKI	3,540.2	3,540.2	5,190.3	5,190.3	7,133.0	7,133.0
	Others	762.2	762.2	1,090.0	1,090.0	1,514.3	1,514.3
	Total	4,302.4	4,302.4	6,280.3	6,280.3	8,647.3	8,647.3

Table 6.13 Estimated Railway Passengers

Unit: Thousand Passengers

		1990		2000		2010	
		Generated	Attracted	Generated	Attracted	Generated	Attracted
Peak 2 Hours	DKI	100.3	144.3	233.1	313.6	365.8	482.8
	Others	64.2	20.2	117.5	37.0	170.8	53.8
	Total	164.5	164.5	350.6	350.6	536.6	536.6
Off Peak Hours	DKI	287.1	281.9	710.6	693.3	1,134.0	1,104.7
	Others	190.2	195.4	341.0	358.3	491.8	521.1
	Total	477.3	477.3	1,051.6	1,051.6	1,625.8	1,625.8
All Day	DKI	387.4	426.2	943.7	1,006.9	1,499.8	1,587.5
	Others	254.4	215.6	458.5	395.3	662.6	574.9
	Total	641.8	641.8	1,402.2	1,402.2	2,162.4	2,162.4

Table 6.14 Estimated Bus Passengers

Unit: Thousand Passengers

		1990		2000		2010	
		Generated	Attracted	Generated	Attracted	Generated	Attracted
Peak 2 Hours	DKI	568.6	577.1	840.6	861.8	1,097.4	1,126.6
	Others	64.1	55.6	87.0	65.8	113.9	84.7
	Total	632.7	632.7	927.6	927.6	1,211.3	1,211.3
Off Peak Hours	DKI	2,584.2	2,536.9	3,406.0	3,321.6	4,535.8	6,418.9
	Others	443.7	491.0	544.5	628.9	737.8	854.7
	Total	3,027.9	3,027.9	3,950.5	3,950.5	5,273.6	5,273.6
All Day	DKI	3,152.8	3,114.0	4,246.6	4,183.4	5,633.2	5,545.5
	Others	507.8	546.6	631.5	694.7	851.7	939.4
	Total	3,660.6	3,660.6	4,878.1	4,878.1	6,484.9	6,484.9

Table 6.15 Temporary Weighting Factor for Railway Ratio Over Mass Transit

	1990		2000		2010	
Ranking	JKT	Outside JKT	JKT	Outside JKT	JKT	Outside JKT
I	0.35	0.60	0.55	0.80	0.55	0.80
II	0.30	0.50	0.50	0.40	0.40	0.70
III	0.10	0.15	0.15	0.50	0.15	0.50
IV	0.05	0.05	0.10	0.10	0.10	0.10

Ranking of Zones for Railway

Rank	JKT (1-50)	Outside JKT (51-80)
I	1,4,6,7,8,12,13,28,29,30,41	51,55,56,58,59,62,63,65,68, 70,71
II	2,3,14,15,16	52,54,60,67
III	5,9,10,11,22,23,24,27,32,33,34,35, 36,38,39,42,49,50	53,57,61,64,66,69,72,73
IV	17,18,19,20,21,25,26,31,37,40,45, 46,47,48	74,75,76,77,78,79,80

Table 6.16 Estimated Person Trips by Motorcycle

Unit: 1,000 trips

	1990	2000	2010
Peak 2 hours	94.3	105.8	114.6
Off Peak	478.8	495.4	511.9
All Day	573.1	601.2	626.5

Table 6.17 Average Occupancy Estimated

Unit: Person/vehicle

Motorcycle		1990	2000	2010
Peak 2 Hours	DKI Jakarta	1.30	1.30	1.30
	Outside JKT	1.30	1.30	1.30
Off Peak	DKI Jakarta	1.40	1.40	1.40
	Outside JKT	1.40	1.40	1.40

Sedan		1990	2000	2010
Peak 2 Hours	DKI Jakarta	2.35	2.30	2.30
	Outside JKT	2.55	2.50	2.50
Off Peak	DKI Jakarta	2.45	2.40	2.40
	Outside JKT	2.70	2.60	2.60

Bus		1990	2000	2010
Peak 2 Hours	DKI Jakarta	17.50	20.00	20.00
	Outside JKT	17.00	18.00	18.00
Off Peak	DKI Jakarta	15.00	17.00	17.00
	Outside JKT	15.00	18.00	18.00

Note: Peak Hour.....Morning Peak Hours (7:00-9:00)

Off Peak.....Other than Peak Hours

The result of the estimation is shown in Table 6.18. In all day, the share of motorcycle shows a decreasing trend and person trips by motorcycle in the year 2010 are estimated to be 626.5 thousand, which is equal to 4.8 percent of the total person trips.
The share of sedan also shows a decreasing trend and person trips by sedan in the year 2010 is estimated to be 3,820.3 thousand, which is equal to 29.2% of the total person trips.

On the other hand, the share of railway shows an increasing trend and person trips by railway in the year 2010 is estimated to be 2,162.4 thousand.

The share of railway in the year 1980 is less than 1.0 percent but this will be increased to 16.5 percent in the year 2010 on account of the improvement plan now in execution. In peak 2-hours, the estimated tendency is same as that of all day but the share of railway is estimated to reach 21.6 percent in the year 2010.

Table 6.18 Estimated Future Person Trips by Mode in DKI Jakarta

Unit: Thousand person trips

		1990		2000		2010	
		Person Trips	%	Person Trips	%	Person Trips	%
All Day (Incl. through traffic)	Motorcycle	573.1	7.5	601.2	5.9	626.5	4.8
	Sedan	2,756.6	36.1	3,377.5	32.9	3,820.3	29.2
	Bus	3,660.6	48.0	4,878.1	47.5	6,484.9	49.5
	Railway	641.8	8.4	1,402.2	13.7	2,162.4	16.5
	Total	7,632.1	100.0	10,259.0	100.0	13,094.1	100.0
All Day (Excl. through traffic)	Motorcycle	519.6	8.1	548.5	6.3	573.5	5.2
	Sedan	2,444.9	37.8	3,125.7	35.9	3,717.4	33.6
	Bus	3,088.6	47.8	4,053.0	46.6	5,240.8	47.3
	Railway	406.7	6.3	975.2	11.2	1,543.6	13.9
	Total	6,459.8	100.0	8,702.4	100.0	11,075.3	100.0
Peak 2 Hours (Incl. through traffic)	Motorcycle	94.3	7.2	105.8	5.4	114.6	4.6
	Sedan	422.5	32.1	564.8	29.0	616.9	24.9
	Bus	632.7	48.2	927.6	47.6	1,211.3	48.9
	Railway	164.5	12.5	350.6	18.0	536.6	21.6
	Total	1,314.0	100.0	1,948.8	100.0	2,479.4	100.0

6.2.2 Future Vehicle OD Matrices

Future person trip OD tables by transportation mode were converted to vehicle trip OD tables as described in the preceding section. The summarized vehicle trip OD tables in all day in the year 1990, 2000 and 2010 are shown in Tables 6.19 through 6.21.

The total number of vehicle trips in the year 1980 amounted to 1,267.6 trips. The total number of vehicle trips in the year 1990, 2000 and 2010 were estimated to be 1,966.1, 2,570.3 and 3,032.3 thousand respectively.

Compared with that of the year 1980, they are equal to 1.55, 2.03 and 2.39 times respectively. In the year 1980, the number of vehicle trips by motorcycles, sedan, truck and bus amounted to 362.4 (composition ratio 28.6%), 528.9 (41.7%), 184.6 (14.6%) and 191.7 (15.1%) thousand respectively, and they were estimated to be 453.8 (15.0%), 1,753.9 (57.8%), 478.4 (15.8%) and 346.2 (11.4%) respectively in the year 2010.

The future growth of vehicle trips by mode and future vehicle trip rates in DKI Jakarta are summarized in Table 6.22.

Table 6.22 Future Vehicle Trip Generation in DKI Jakarta

Unit: Thousand vehicle trips/day

		1980	1990	2000	2010
Vehicle Trip Generation* (1000 veh. trips/day)	All Vehicles	1,149.6	1,712.1	2,255.6	2,663.2
	Motorcycle	332.2	376.0	397.2	415.6
	Sedan	499.4	899.2	1,306.6	1,554.1
	Truck	151.3	234.6	317.3	396.1
	Bus	166.7	202.3	234.5	297.4
Growth of Vehicle Trip Generation (1980 = 1.00)	All Vehicles	1.00	1.58	1.96	2.31
	Motorcycle	1.00	1.13	1.20	1.25
	Sedan	1.00	2.00	2.62	3.11
	Truck	1.00	1.55	2.10	2.62
	Bus	1.00	1.21	1.39	1.80
Vihicle - Ownership (1000 vehicles)	All Vehicles	749.0	1,178.7	1,657.7	2,073.6
	Motorcycle	436.1	687.9	962.0	1,194.6
	Sedan	221.6	351.6	506.7	646.8
	Truck	68.5	104.1	139.8	172.6
	Bus	22.8	35.1	49.2	62.3
Average Vehicle Trip Rates* (veh. trips/veh.)	All Vehicles	1.53	1.54	1.36	1.28
	Motorcycle	0.76	0.55	0.41	0.35
	Sedan	2.25	2.84	2.58	2.40
	Truck	2.21	2.25	2.27	2.29
	Bus	7.31	5.76	4.77	4.77

* Excluding intra-zonal trips

Table 6.19 Estimation of Vehicle OD Table in All Day, 1990

(Unit: 1,000 Vehicle trip ends/day)

		DKI JAKARTA		BOTABEK		OTHERS		TOTAL	
		Trip Ends	%	Trip Ends	%	Trip Ends	%	Trip Ends	%
DKI JAKARTA (Zone 1-50)	Motorcycle	687.2	22.9	61.2	16.8	3.5	6.0	751.9	22.0
	Sedan	1,588.0	52.9	178.3	48.9	32.2	55.6	1,798.5	52.5
	Truck	390.8	13.0	63.3	17.3	15.0	25.9	469.1	13.7
	Bus	335.2	11.2	61.9	17.0	7.2	12.5	404.3	11.8
	Total	3,001.2	100.0	364.7	100.0	57.9	100.0	3,423.8	100.0
BOTABEK (Zone 51-73)	Motorcycle	61.2	16.8	10.6	18.6	0.9	8.8	72.7	16.8
	Sedan	178.3	48.9	30.6	53.7	7.1	68.9	216.0	50.0
	Truck	63.3	17.3	15.6	27.4	2.3	22.3	81.2	18.8
	Bus	61.9	17.0	0.2	0.3	0.0	0.0	62.1	14.4
	Total	364.7	100.0	57.0	100.0	10.3	100.0	432.0	100.0
OTHERS (Zone 74-80)	Motorcycle	3.5	6.0	0.9	8.8	0.0	0.0	4.4	5.8
	Sedan	32.2	55.6	7.1	68.9	0.8	80.0	40.1	52.5
	Truck	15.0	25.9	2.3	22.3	0.2	20.0	24.7	32.3
	Bus	7.2	12.5	0.0	0.0	0.0	0.0	7.2	9.4
	Total	57.9	100.0	10.3	100.0	1.0	100.0	76.4	100.0
								3,932.2	Total

(Total Trips 1,966.1)

Table 6.20 Estimation of Vehicle OD Table in All Day, 2000

(Unit: 1,000 vehicle trip ends/day)

		DKI JAKARTA		BOTABEK		OTHERS		TOTAL	
		Trip Ends	%	Trip Ends	%	Trip Ends	%	Trip Ends	%
DKI JAKARTA (Zone 1-50)	Motorcycle	730.4	18.4	60.2	13.4	3.8	4.8	794.4	17.6
	Sedan	2,325.6	58.4	239.9	53.4	47.7	59.8	2,613.2	57.9
	Truck	530.8	13.3	83.9	18.7	19.8	24.8	634.6	14.1
	Bus	395.0	9.9	65.6	14.6	8.4	10.5	469.0	10.4
	Total	3,981.8	100.0	449.6	100.0	79.7	100.0	4,511.2	100.0
BOTABEK (Zone 51-73)	Motorcycle	60.2	13.4	10.2	14.3	0.9	6.5	71.3	13.3
	Sedan	239.9	53.4	39.8	55.9	9.6	69.6	289.3	54.1
	Truck	83.9	18.7	21.2	29.8	3.3	23.9	108.4	20.3
	Bus	65.6	14.6	0.0	0.0	0.0	0.0	65.6	12.3
	Total	449.6	100.0	71.2	100.0	13.8	100.0	543.6	100.0
OTHERS (Zone 74-80)	Motorcycle	3.8	4.8	0.9	6.5	0.0	0.0	4.7	5.0
	Sedan	47.7	59.8	9.6	69.6	1.0	83.3	58.3	61.6
	Truck	19.8	24.8	3.3	23.9	0.2	16.7	23.3	24.6
	Bus	8.4	10.5	0.0	0.0	0.0	0.0	8.4	8.8
	Total	79.7	100.0	13.8	100.0	1.2	100.0	94.7	100.0
								5,140.5	Total

(Total Trips 2,570.3)

Table 6.21 Estimation of Vehicle OD Table in All Day, 2010

(Unit: 1,000 vehicle trip ends/day)

		DKI JAKARTA		BOTABEK		OTHERS		TOTAL	
		Trip Ends	%	Trip Ends	%	Trip Ends	%	Trip Ends	%
DKI JAKARTA (Zone 1-50)	Motorcycle	768.0	16.3	59.0	11.4	4.2	4.3	831.2	15.6
	Sedan	2,783.8	59.0	265.8	51.5	58.6	60.4	3,108.2	58.4
	Truck	663.4	14.1	105.8	20.5	23.0	23.7	792.2	14.9
	Bus	506.4	10.6	85.9	16.6	11.3	11.6	594.8	11.1
	Total	4,721.6	100.0	516.5	100.0	97.1	100.0	5,330.8	100.0
BOTABEK (Zone 51-73)	Motorcycle	59.0	11.4	11.0	12.6	1.0	5.6	71.0	11.4
	Sedan	265.8	51.5	48.8	56.1	12.5	70.2	327.1	52.6
	Truck	105.8	20.5	27.0	31.0	4.2	23.6	137.0	22.1
	Bus	85.9	16.6	0.2	0.2	0.1	0.6	86.2	13.9
	Total	516.5	100.0	87.0	100.0	17.8	100.0	621.3	100.0
OTHERS (Zone 74-80)	Motorcycle	4.2	4.3	1.0	5.6	0.2	10.0	5.4	4.6
	Sedan	58.6	60.4	12.5	70.2	1.4	70.0	72.5	62.0
	Truck	23.0	23.7	4.2	23.6	0.4	20.0	27.6	23.6
	Bus	11.3	11.6	0.1	0.6	0.0	0.0	11.4	9.8
	Total	97.1	100.0	13.8	100.0	2.0	100.0	116.9	100.0
								6,064.6	Total

(Total trips 3,032.3)

6.3 Traffic Assignment

6.3.1 Method of Traffic Assignment

(1) Road Network for Traffic Assignment

The future road networks for the year 1990, 2000 and 2010 were established based on a consideration of the future road network plans. An assumption was made that these plans will be completed by the year 2000, when the total length of the road network for the traffic assignment amounts to 2,020 kms. The future road networks in the year 2000/2010 are shown in Figs. 6.8 through 6.10. Please refer to Appendix 6.2 for the road network in each target year.

(2) Method of Traffic Assignment

The purpose of the traffic assignment is to simulate route choice, which is supposed to depend on individuals' selection so as to minimize their travel costs for a journey. In this study, the method is based on traffic capacity limitation (the Q-V method). Traffic is assigned to the network in six stages to build new networks with minimum routes for each OD pair reflecting the changes of Q-V conditions for each link.

A toll resistance, which is determined by a toll rate and time value, is incorporated into the assignment method in order to simulate the number of tollway users.

Toll rates are established within the limits of financial benefits that tollway users will receive. Following this principle toll rates and alternative tariff systems are selected as shown in Table 6.23.

Table 6.23 Toll Rates at 1980 Prices

Type of Vehicle	Flat Tariff	Distance Proportional Tariff
Sedan	Rp. 400	Rp. 30/km
Truck	800	60
Bus	800	60

Generally, the time value will arise as a real economy grows. Therefore, if the toll rate remains unchanged the toll resistance will decline and the use of tollway will be promoted accordingly.

The assignment method employed in this study considers that the enhancement of the future time value and toll rates will grow at the same rate so that the toll resistance level will not change in the future.

Fig. 6.8 Future Road Network in Jabotabek
in the Year 2000, 2010

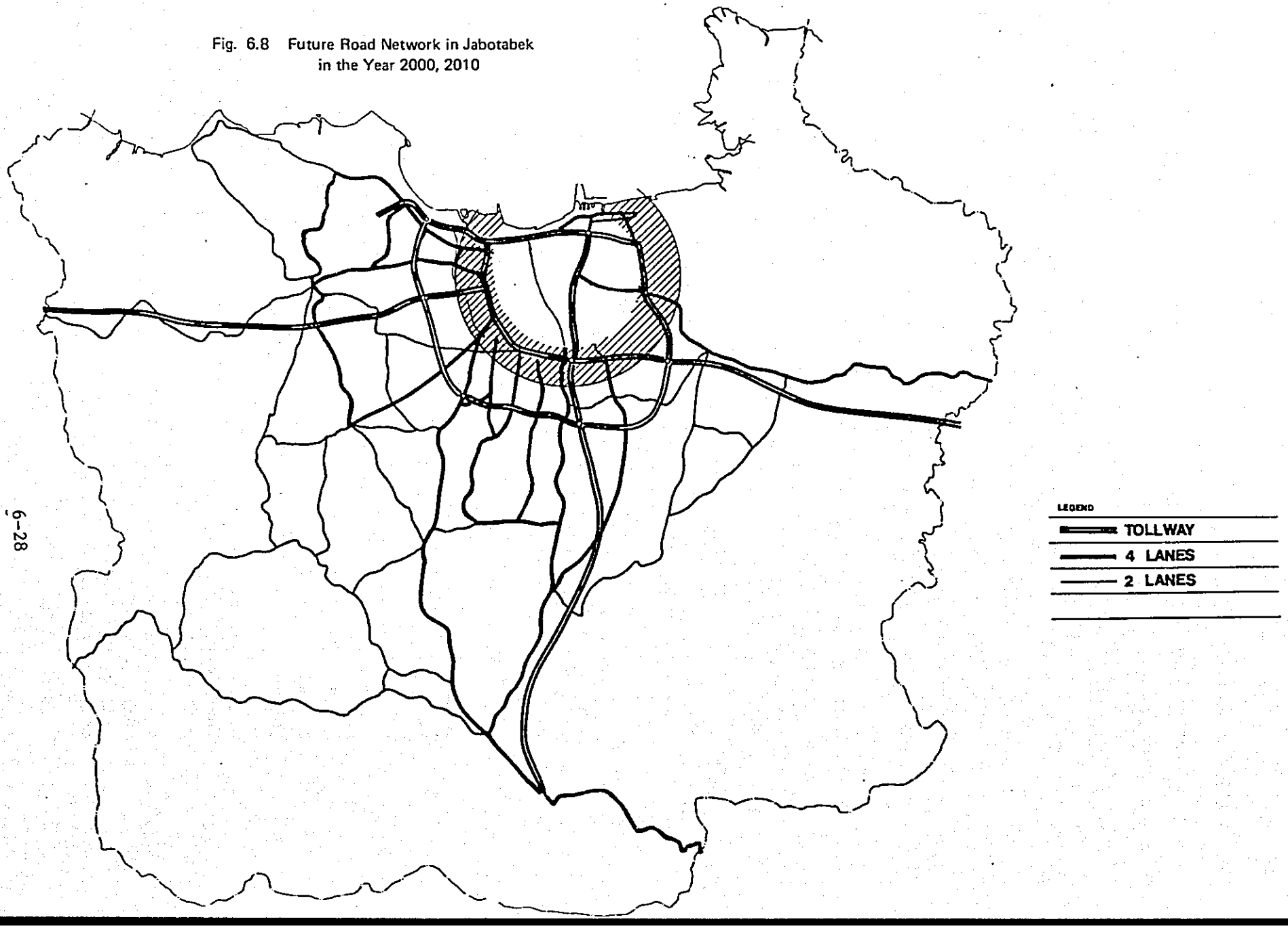


Fig. 6.9 Future Road Network in DKI Jakarta in 2000, 2010

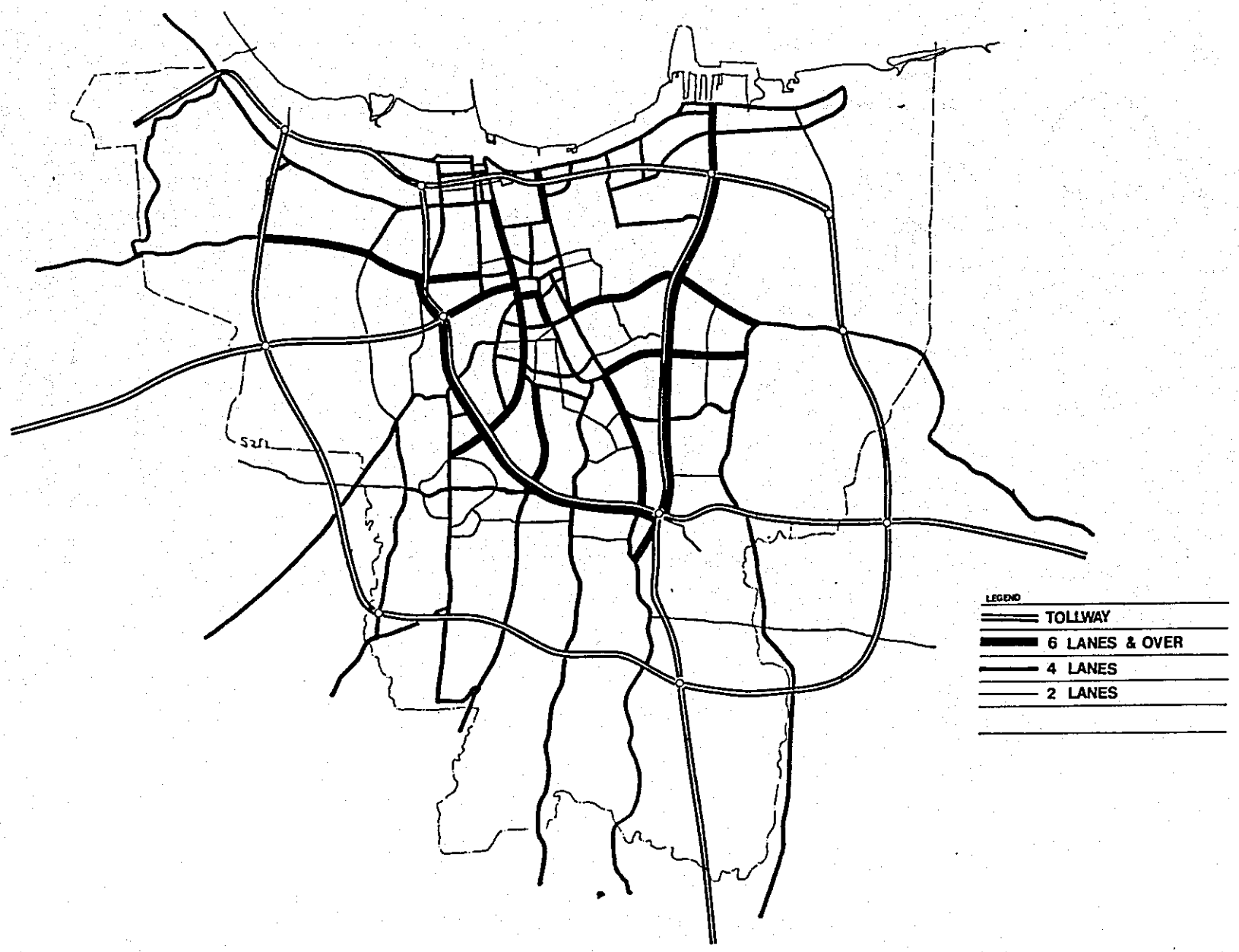
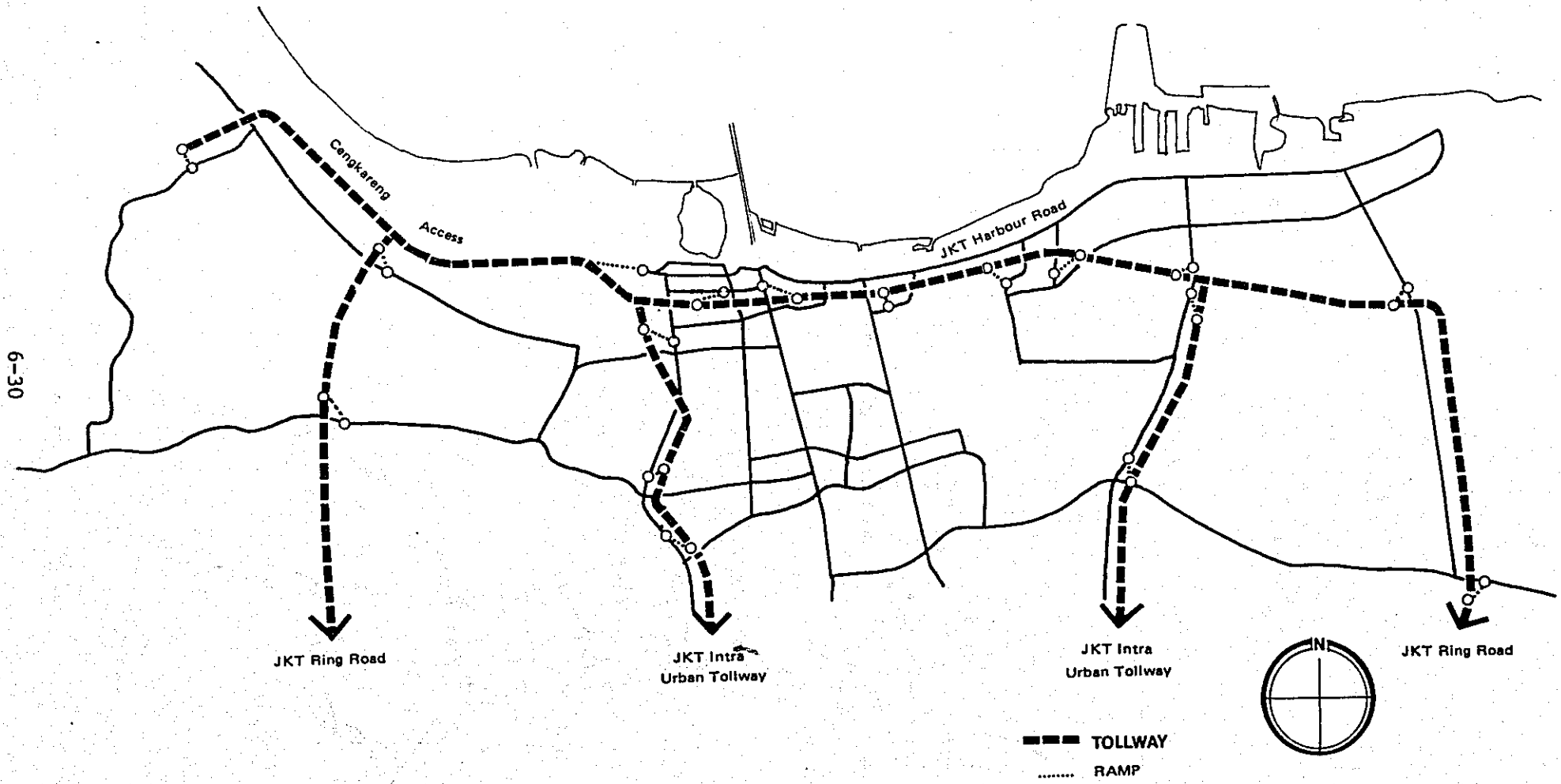


Fig. 6.10 Future Road Network along the Harbour Road in 2000, 2010



A time value is not a unique rate but differs among people and travel purposes as well. Therefore, it is not reasonable to use a sole time value in deciding toll resistance.

A time value for this study is estimated by using vehicle operating costs and a desired travel speed as an average rate of the time value as shown in Table 6.24.

The estimated average time value is designed at the traffic assignment stage to vary in 5 classes with higher and lower rates of the average value.

Table 6.24 Average Time Value.

Type of Vehicle	Average Time Value
Sedan	Rp.4,100/hour
Truck	7,200
Bus	9,400

(3) Traffic Assignment Alternatives

Alternative cases for the traffic assignment were considered from the viewpoint of toll levy system.

This project road functions as a bypass of CBD of DKI Jakarta for port traffic and also functions as an urban artery providing access to many of the urban facilities.

Considering those roles for the project road, two major alternatives are selected. One is a flat tariff system as a portion of Jakarta Intra Urban Tollway and the other is a distance proportional tariff as an element of the regional tollway system.

To summarize, the alternative tariff systems selected for the traffic assignment are shown in Table 6.25.

6.3.2 Assigned Traffic Volume on Project Road

Traffic assignment was carried out for every combination of toll levy system and target year.

In this section, a brief explanation will be made for the representative cases of traffic assignment, namely, every toll levy system in the year 2010 and every target year of toll levy system Case 1. The results of each assignment case are shown in Figs. 6.11 through 6.15.

Table 6.25 Traffic Assignment Alternatives

Case No.	Tollways	Tariff System
Case 1	Cengkareng Access	Flat Tariff (Independent)
	Harbour Road and Intra Urban Tollway	Flat Tariff (Common)
	Other Tollways	Distance Proportional Tariff
Case 2	Cengkareng Access	Distance Proportional Tariff
	Harbour Road	Distance Proportional Tariff
	Intra Urban Tollway	Flat Tariff (Independent)
	Other Tollways	Distance Proportional Tariff
Case 3	Cengkareng Access Harbour Road Intra Urban Tollway	Flat Tariff (Common)
	Other Tollways	Distance Proportional Tariff

1) Case 1 in the Year 2010

The toll levy system of Case 1 is a separate flat tariff system between Cengkareng Access and Harbour Road together with Intra Urban Tollway. In this case, a vehicle which passes through both Cengkareng Access and Harbour Road is requested to pay the toll twice. For this reason, the most conspicuous characteristic of Case 1 is that more than 60% of traffic volume on Cengkareng Access get on and off at Pluit IC. The traffic volume at Pluit West IC. amounts to 71,000 vehicles, which is supposed to cause tremendous load on arterial road.

Other characteristics of the Harbour Road trips are briefly described as follows:

(a) There is a small traffic flow between Cengkareng Access and Outer Ring Road, because drivers prefer to pass through arterial road parallel to Cengkareng Access without paying extra tariff.

(b) At the Junction of Harbour Road and S.W. Arc, Harbour Road traffic is tightly connected with S.W. Arc rather than with Cengkareng Access on this toll levy system.

(c) At the Junction of Harbour Road and N.S. Link Harbour Road traffic is most closely related to N.S Link.

(d) More than 18,000 vehicles pass through Harbour Road from Tg. Priok IC. to Cilincing IC., because there is no alternative route in the vicinity.

2) Case 2 in the Year 2010

The toll levy system of Case 2 is a distance proportional tariff for both Cengkareng Access and Harbour Road and a flat tariff for Intra Urban Tollway. On this toll levy system, Harbour Road traffic is heavily connected with Cengkareng Access, but has little connection with Intra Urban Tollway.

(a) Traffic flow between Cengkareng Access and Outer Ring Road is approximately double compared with Case 1, since there is no toll barrier between the two.

(b) At Pluit IC., the main traffic flow is through traffic, but about 63,000 vehicles get on and off at this interchange.

(c) At the Junction of Harbour Road and S.W. Arc, through traffic from Cengkaregn Access to Harbour Road is 2.4 times as heavy as that of Case 1 but Harbour Road - S.W. Arc traffic decreases to 16,000 vehicles, that is 30% of Case 1.

(d) At the Junction of Harbour Road and N.S. Link, Harbour Road - N.S. Link traffic decreases to 23,000 vehicles, that is 40% of Case 1.

(e) More than 35,000 vehicles use Harbour Road from Tg. Priok IC. to Cilincing IC., because a toll rate in this section is less than that of Case 1.

3) Case 3 in the Year 2010

The toll levy system of Case 3 is a single flat tariff which is available among Cengkareng Access, Harbour Road and Intra Urban Tollway. A conspicuous characteristics of this case, compared with Case 1, is that traffic volume at Pluit IC. decreases to 31,000 vehicles and the traffic volume between Cengkareng Access and S-W Arc increases to 48,000 vehicles, that is 2.6 times larger than that of Case 1. Other characteristics are relatively similar to those of Case 1.

4) Case 1 in the Year 2000

A principal characteristics of Case 1 in the year 2000, compared with Case 1 in the year 2010, is that traffic volume on Cengkareng Access is far less that that of 2010. This is mainly caused by the traffic related to Cengkareng Airport.

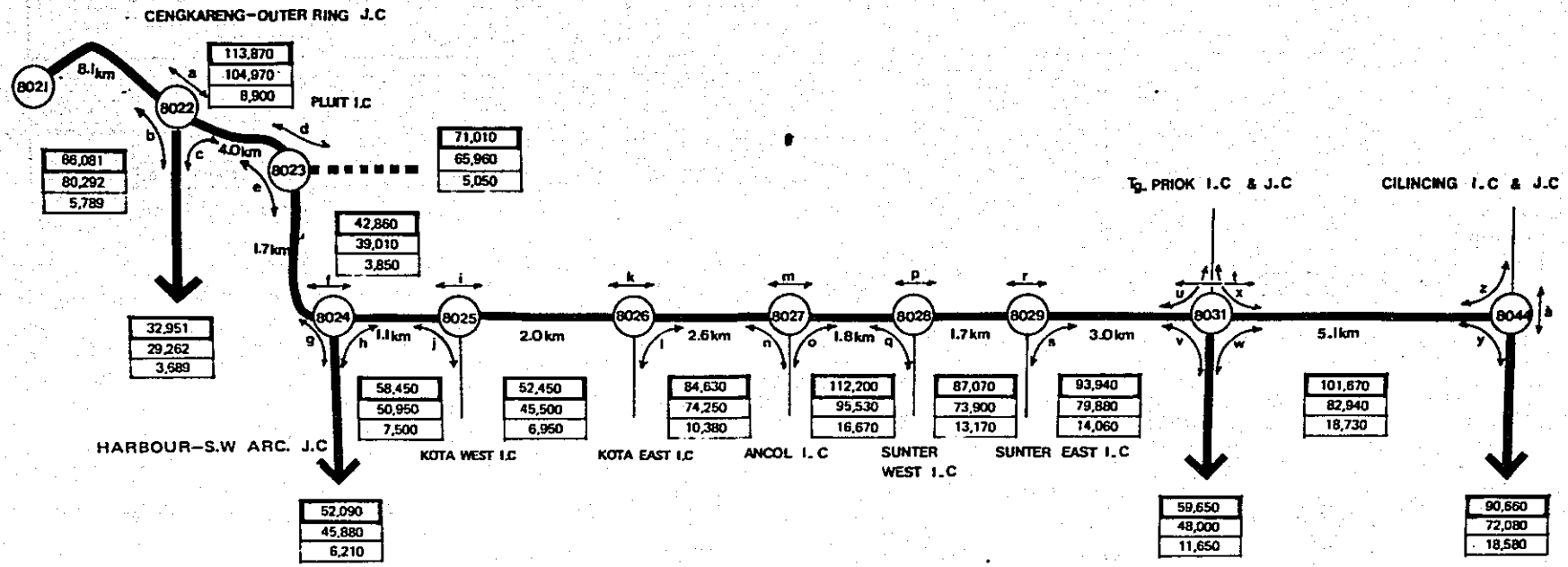
5) Case 1 in the Year 1990

In the year 1990, Cengkareng Access is not connected with Outer Ring Road, and Harbour Road which is open to traffic only for the section between the junction with Cengkareng Access and Tg. Priok IC. & JC. is not connected with S-W Arc. The traffic volume on Project Road is far less than Case 1 in the year 2000, accordingly.

More than 80% of traffic volume on Cengkareng Access get on and off at Pluit IC. and there is little through traffic between Cengkareng Access and Harbour Road. Harbour Road is closely connected with N-S Link.

The traffic assignment results of these representative cases (excluding case 3 in 2010) are shown in Appendix 6.3.

Fig. 6.11 Estimation of Link Traffic Volume on Project Road in 2010, Case-1

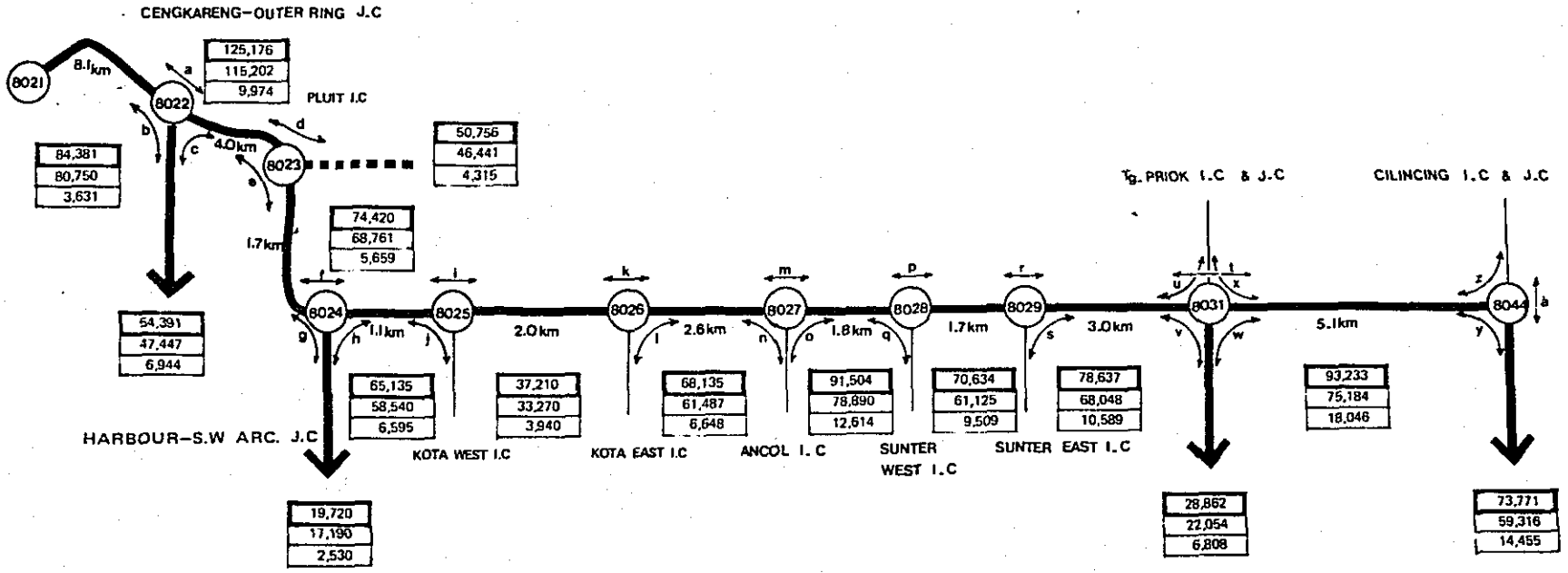


TRAFFIC VOLUME BY DIRECTION

	CENGKARENG-OUTER R. (8022)			PLUIT (8023)		HARBOUR-S.W (8024)			KOTA-W (8025)		KOTA-E (8026)	
	a	b	c	d	e	f	g	h	i	j	k	l
Total(Veh/day)	13,300	2,581	30,370	71,010	42,860	24,610	18,250	33,840	52,450	6,000	52,450	32,180
Sedan eq. (")	7,800	2,292	26,970	65,960	39,010	22,040	16,970	28,910	45,500	5,450	45,500	28,750
Larger (")	5,500	289	3,400	5,050	3,850	2,570	1,280	4,930	6,950	550	6,950	3,430

	ANCOL (8027)			SUNTER-W (8028)		SUNTER-E (8029)		Tg-PRIOK (8031)					CILINCING (8044)		
	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a'
Total (veh/day)	82,810	1,810	29,390	87,070	25,130	87,070	6,870	35,590	20,640	37,710	21,940	44,140	58,440	43,230	32,220
Sedan eq. (")	72,580	1,660	22,950	73,900	21,630	73,900	5,980	32,100	15,900	31,880	16,120	34,720	48,760	34,180	23,320
Larger (")	10,230	150	6,440	13,170	3,500	13,170	890	3,490	4,740	5,830	5,820	9,420	9,680	9,059	8,900

Fig. 6.12 Estimation of Link Traffic Volume on Project Road in 2010, Case-2

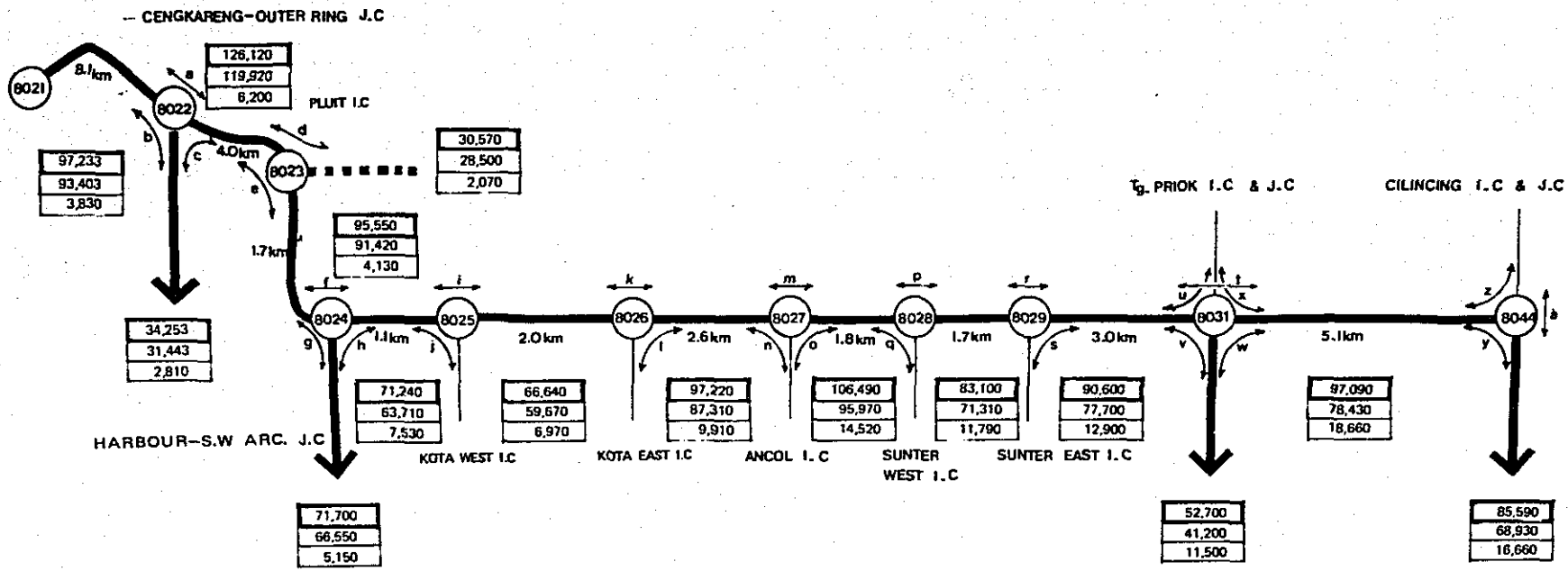


TRAFFIC VOLUME BY DIRECTION

	CENGKARENG-OUTER R. (8022)			PLUIT (8023)		HARBOUR-S.W (8024)			KOTA-W (8025)		KOTA-E (8026)	
	a	b	c	d	e	f	g	h	i	j	k	l
Total (veh/day)	77,583	6,798	47,593	50,756	74,420	59,918	14,502	5,217	37,210	27,925	37,210	30,925
Sedan eq. (")	74,252	6,498	40,950	46,441	68,761	55,055	13,705	3,484	33,270	25,270	33,270	28,217
Larger (")	3,331	300	6,643	4,315	5,659	4,863	797	1,733	3,940	2,655	3,940	2,708

	ANCOL (8027)			SUNTER-W (8028)		SUNTER-E (8029)		Tg-PRIOK (8031)					CILINCING (8044)		
	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a'
Total (veh/day)	49,688	18,447	41,816	70,634	20,870	70,634	8,003	29,133	22,121	27,383	1,478	62,622	45,546	47,687	28,225
Sedan eq. (")	47,039	14,448	31,851	61,125	17,765	61,125	6,923	27,795	19,552	20,702	1,351	46,041	38,753	36,434	20,562
Larger (")	2,649	3,999	9,965	9,509	3,105	9,509	1,080	1,338	2,569	6,681	127	16,581	6,793	11,253	7,663

Fig. 6.13 Estimation of Link Traffic Volume on Project Road in 2010, Case-2

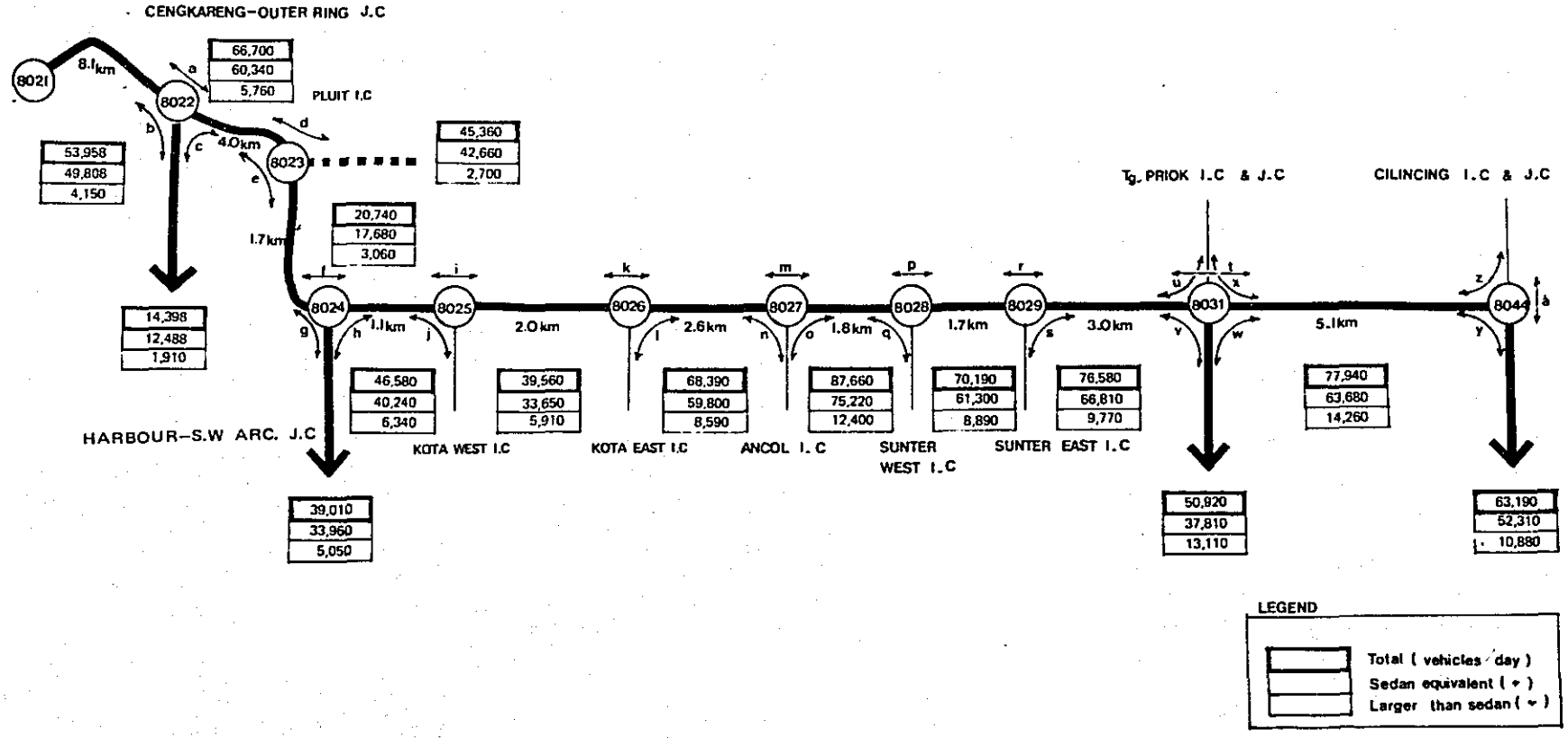


TRAFFIC VOLUME BY DIRECTION

	CENGKARENG-OUTER R. (8022)			PLUIT (8023)		HARBOUR-S.W (8024)			KOTA-W (8025)		KOTA-E (8026)	
	a	b	c	d	e	f	g	h	i	j	k	l
Total (veh/day)	94,550	2,683	31,570	30,570	95,550	47,550	48,000	23,680	66,630	4,600	66,630	30,590
Sedan eq. (")	90,940	2,463	28,980	28,500	91,420	44,290	47,130	19,410	59,660	4,040	59,660	27,650
Larger (")	3,610	220	2,590	2,070	4,130	3,260	870	4,270	6,970	560	6,970	2,940

	ANCOL (8027)			SUNTER-W (8028)		SUNTER-E (8029)		Tg-PRIOK (8031)					CILINCING (8044)		
	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a'
Total (veh/day)	85,500	11,720	20,980	83,100	23,390	83,100	7,500	38,850	21,990	29,760	22,940	35,300	40,900	56,190	44,690
Sedan eq. (")	75,660	11,650	16,300	71,310	20,660	71,310	6,390	35,300	17,960	24,440	16,760	26,370	35,290	43,140	33,640
Larger (")	9,840	70	4,680	11,790	2,730	11,790	1,110	3,550	4,030	5,320	6,180	8,930	5,610	13,050	11,050

Fig. 6.14 Estimation of Link Traffic Volume on Project Road in 2000, Case-1

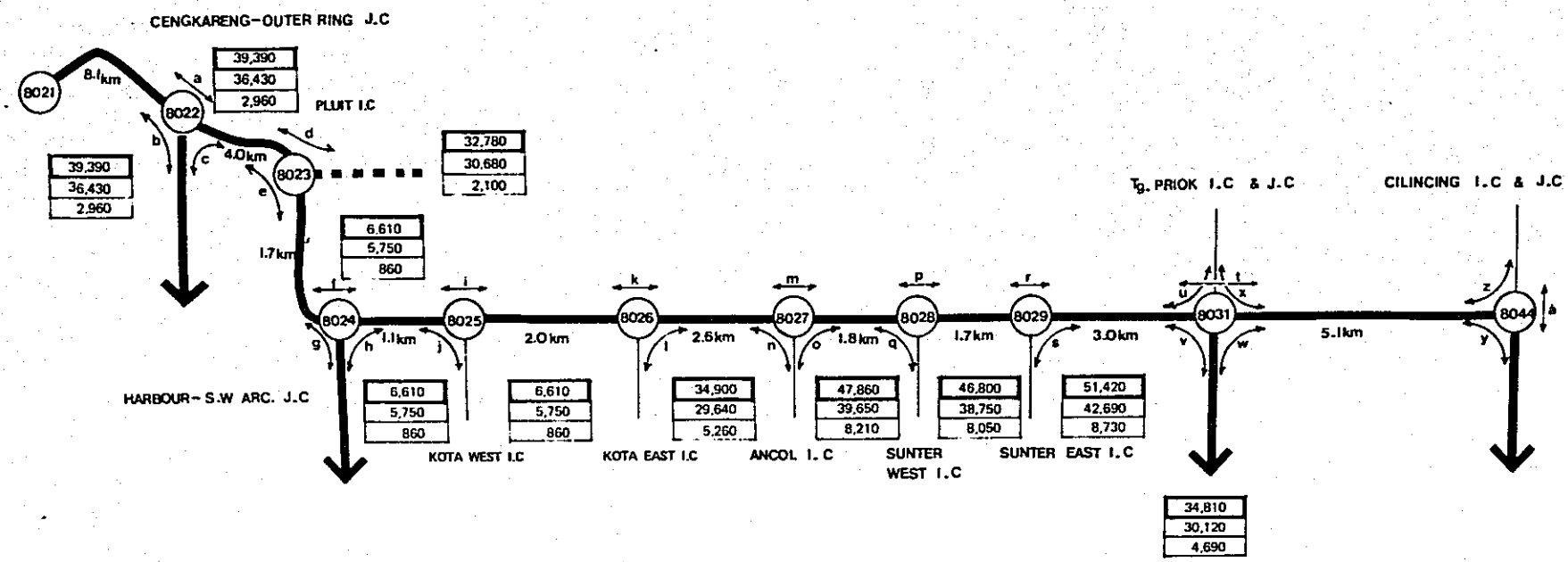


TRAFFIC VOLUME BY DIRECTION

	CENGKARENG-OUTER R. (8022)			PLUIT (8023)		HARBOUR-S.W (8024)			KOTA-W (8025)		KOTA-E (8026)	
	a	b	c	d	e	f	g	h	i	j	k	l
Total (veh/day)	52,830	1,128	13,270	45,360	20,740	14,160	6,590	32,420	39,560	7,020	39,560	28,830
Sedan eq. (")	48,830	978	11,510	42,660	17,680	11,980	5,700	28,260	33,650	6,590	33,650	26,140
Larger (")	4,000	150	1,760	2,700	3,060	2,180	890	4,160	5,910	430	5,910	2,690

	ANCOL (8027)			SUNTER-W (8028)		SUNTER-E (8029)		Tg-PRIOK (8031)					CILINCING (8044)		
	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a
Total (veh/day)	66,850	1,540	20,810	70,190	17,470	70,190	6,400	33,440	19,440	23,710	15,350	29,160	43,250	34,590	19,840
Sedan eq. (")	58,570	1,230	16,650	61,300	13,920	61,300	5,510	30,780	16,960	19,070	11,320	21,580	37,050	26,630	15,260
Larger (")	8,280	310	4,160	8,890	3,550	8,890	890	2,660	2,480	4,640	4,030	7,580	6,300	7,960	4,580

Fig. 6.15 Estimation of Link Traffic Volume on Project Road in 1990, Case-1



LEGEND

Total (vehicles / day)
Sedan equivalent (")
Larger than sedan (")

TRAFFIC VOLUME BY DIRECTION

	CENGKARENG-OUTER R. (8022)			PLUIT (8023)		HARBOUR-S.W (8024)			KOTA-W (8025)		KOTA-E (8026)	
	a	b	c	d	e	f	g	h	i	j	k	l
Total (veh/day)	39,390			32,770	6,620	6,620			6,610	0	6,610	28,290
Sedan eq. (")	36,430			30,680	5,750	5,750			5,750	0	5,750	23,890
Larger (")	2,960			2,090	870	870			860	0	860	4,400

	ANCOL (8027)			SUNTER-W (8028)		SUNTER-E (8029)		Tg-PRIOK (8031)					CILINCING (8044)		
	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a'
Total (veh/day)	34,900	0	12,960	47,330	1,060	46,800	4,620		16,610	34,810					
Sedan eq. (")	29,640	0	10,010	39,200	900	38,750	3,940		12,570	30,120					
Larger (")	5,260	0	2,950	8,130	160	8,050	680		4,040	4,690					

6.3.3 Travel Characteristics

Travel characteristics for the five representative cases of traffic assignment are summarized in Tables 6.26 and 6.27.

Among the three cases in the year 2010, Case 3 shows the largest cross-sectional traffic volume and vehicle-Kms which amount to 90,100 vehicles and 1,558.6 thousand vehicle-Kms in 24 hours respectively. Traffic congestion rate for Case 3 is, therefore, the highest, running up to 82.6% on an average. These three factors of Case 1 are 88,600 vehicles, 1,533.1 thousand vehicle-Kms and 81.3% respectively and are very close to those of Case 3. As to Case 2, each factor shows approximately 86% of Case 1.

Cross-sectional traffic volume, vehicle-Kms and traffic congestion rate of Case 1 in the year 2000 are 70,100 vehicles, 1,213.5 vehicle-Kms and 64.3% respectively and are 79% of those of Case 1 in the year 2010.

In the year 1990, these three factors remain very low because the tollway network is not completed in addition to the fact that the trip generation is far less than that of the year 2000 and 2010.

Table 6.26 Trip Characteristics of Harbour Road Users by Case in 2010

Case No.	Harbour Road Trips	Harbour Road Veh.-kms (x1000)	Average Trip Length on H.R. 1/ (km)	Average Cross-Sectional Traffic Volume (Vehicles)	Traffic Congestion Rate 2/ %	Average Trip Length of H.R. Users on I.U.T. 3/ (km)	Average Trip Length of H.R. Users on C.A. 4/ (km)	Average Trip Length of H.R. Users on All Roads (km)
1 (2010)	192,948	1,533.1	7.9	88,600	81.3	4.9	1.9	33.7
2 (2010)	201,693	1,319.4	6.5	76,266	70.0	2.3	2.2	31.5
3 (2010)	188,544	1,558.6	8.3	90,100	82.6	4.5	4.0	36.3

Table 6.27 Trip Characteristics of Harbour Road Users for Case 1 in 1990 and 2000

1 (2000)	147,339	1,213.5	8.2	70,100	64.3	4.6	1.2	33.9
1 (1990)	104,960	429.6	4.1	35,200	33.3	8.0	1.0	35.6

Notes: 1/ It stands for Harbour Road.

2/ A congestion rate was calculated under the condition of designed road width of Case 1, 2010 that is a capacity-kms of 1,885,900 veh.-kms.

3/ It stands for Intra Urban Tollway.

4/ It stands for Cengkareng Access.

CHAPTER 7

TOLLWAY ASPECTS

CHAPTER 7 TOLLWAY ASPECTS

7.1 Operation

7.1.1 *General*

The tollway network will be composed of three regional freeways and two circumferential tollways. The Harbour Road will function mostly as part of the Intra Urban Tollway. The proposed toll systems for this network are as shown in Table 7.1.

Table 7.1 Proposed Toll Systems for Jakarta Metropolitan Area

	Name of Tollway	Length(km)	Toll System
Regional (Radial)	Jagorawi Freeway	48	Zone Flat
	Jakarta-Cikampek Freeway	67	Distance Proportional
	Jakarta-Tangerang Freeway	20	"
Urban (Circum-ferential)	Jakarta Intra Urban Tollway	33	Flat
	Jakarta Ring Road	89	Distance Proportional
	Jakarta Harbour Road	17.4	Flat
	(Cengkareng Access)	15	Flat

For Harbour Road three alternative toll systems were compared as follows:

	Harbour Road	Cengkareng Access
Case-1	Flat	Flat
Case-2	Distance Proportional	Distance Proportional
Case-3	Flat	Flat

The characteristics of the different toll systems are listed as follows:

(1) Flat Tariff

- Flat tariff irrespective of travel distance,
- Smallest handling time and minimizing delays of users,
- Toll gates located only at on-ramps,
- Suitable system for urban area, and
- Smallest number of tollgates and largest volume of traffic handled.

(2) Zone Flat Tariff

- Flat tariff within a zone;
- Toll gates located on and off ramps (closed system) or on ramps (open system) as well as at boundaries of toll system;
- Suitable system where topographical or administrative boundaries occur; and
- Large sites necessary for the barrier toll gates.

(3) Distance Proportional Tariff

- Toll according to the distance travelled;
- Fair for users due to uniform toll rate;
- Suitable system for a wide fluctuation of travel distance; and
- Necessary on-ramps for ticket and off-ramps for payment (closed system).

For three alternative toll systems of Harbour Road, one barrier toll gate should be provided at the entrance of Jakarta Airport Cengkareng in order to secure the system. One additional barrier toll gates for case-1 is necessary to be located between Pluit IC and and Pluit JC.

The study for the operation and maintenance of the tollway based on many assumptions. When the Government executes the Project, a more precise study is required for the following items:

- Traffic control and information system;
- Organization and facilities required for the operation and maintenance work; and
- Location, facilities and size of Operation Center.

7.1.2 Toll Levy System

The toll levy system for case-1 (Harbour Road-Flat Tariff), Cengkareng Access-another Flat Tariff) is as shown in Fig. 7.1. As the system of Intra Urban Tollway, users must pay at on-ramps and need not stop at off-ramps within the section of Harbour Road.

(1) Toll Collection at Boundaries of Toll Systems

For the case-1 the traffic transferring between Harbour Road and Intra Urban Tollway can be handled easily, since both tollways are operated on the same toll system. Special consideration should, however, be given to the boundaries of a different toll system.

1) Harbour Road ←——→ Jakarta Airport Cengkareng

The method of toll collection is shown in Fig. 7.2. When a vehicle transfers from Harbour Road to Cengkareng Access, the toll for Cengkareng Access is paid at the Pliut barrier tollgate. When a vehicle transfers from the Airport to Harbour Road, the toll for Cengkareng Access is paid at the Airport barrier tollgate and paid again at the Pluit barrier tollgate for Harbour Road.

2) Harbour Road (Jakarta Airport Cengkareng) ←——→ Jakarta Ring Road

The method of toll collection is shown in Fig. 7.2. The traffic between Harbour Road and the Airport is handled as described above. When a vehicle transfers from Harbour Road (or the Airport) to Jakarta Ring Road, a transit card, showing the class of vehicle, the name or code number of the on-ramp, the date and time of issue,etc., is handled out at the on-ramps to the Jakarta Ring Road. When a vehicle transfers from Jakarta Ring Road to Harbour Road (or the Airport), the tolls for the section of the Ring Road and Cengkaren Access are paid at the same time at the Cengkareng Junction tollgate upon surrender of the transit card. At the Pluit or the Airport barrier tollgates the vehicle need not stop.

3) Harbour Road ←——→ Jakarta Ring Road (At Cilincing)

The method of toll collection is shown in Fig. 7.3. A transit card is handed out at the Cilincing barrier tollgate to the Ring Road. When a vehicle transfers from the Ring Road to Harbour Road, the tolls for the section of the Ring Road and Harbour Road are paid at the same time at the barrier tollgate upon surrender of the transit card.

(2) Location and Number of Tollgates

The location of ramps at junctions, interchanges and barrier tollgates is shown in Fig. 7.4. The number of tollgates is as shown in Table 9.6. The size of toll plazas varies with the number of tollgates required for each ramp.

Fig. 7.1 Method of Toll Collection on Harbour Road
(Uniform Toll System)

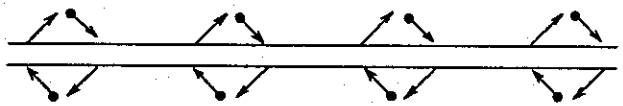


Fig. 7.3 Method of Toll Collection for Transfering
between Harbour Road and Jakarta Ring Road
at Cilincing
(Uniform Toll – Sectional Toll)

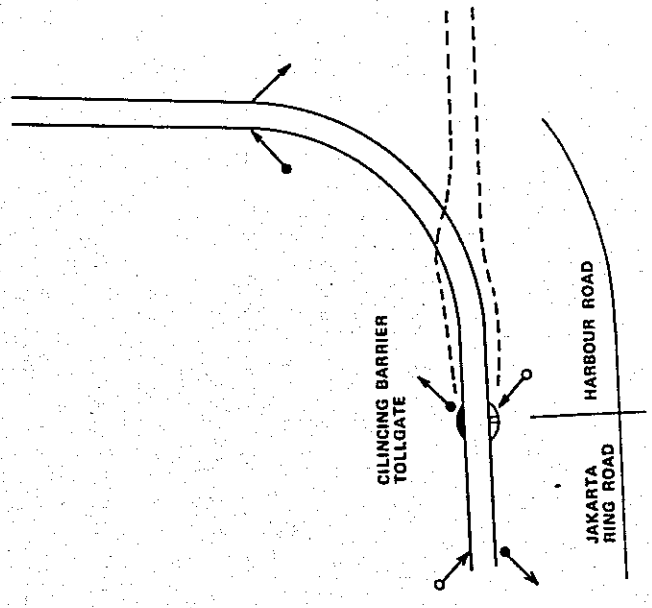


Fig. 7.2 Method of Toll Collection for Transfering
between Harbour Road (Cengkareng Access)
and Jakarta Ring Road
(Uniform Toll – Regional Toll - Sectional Toll)

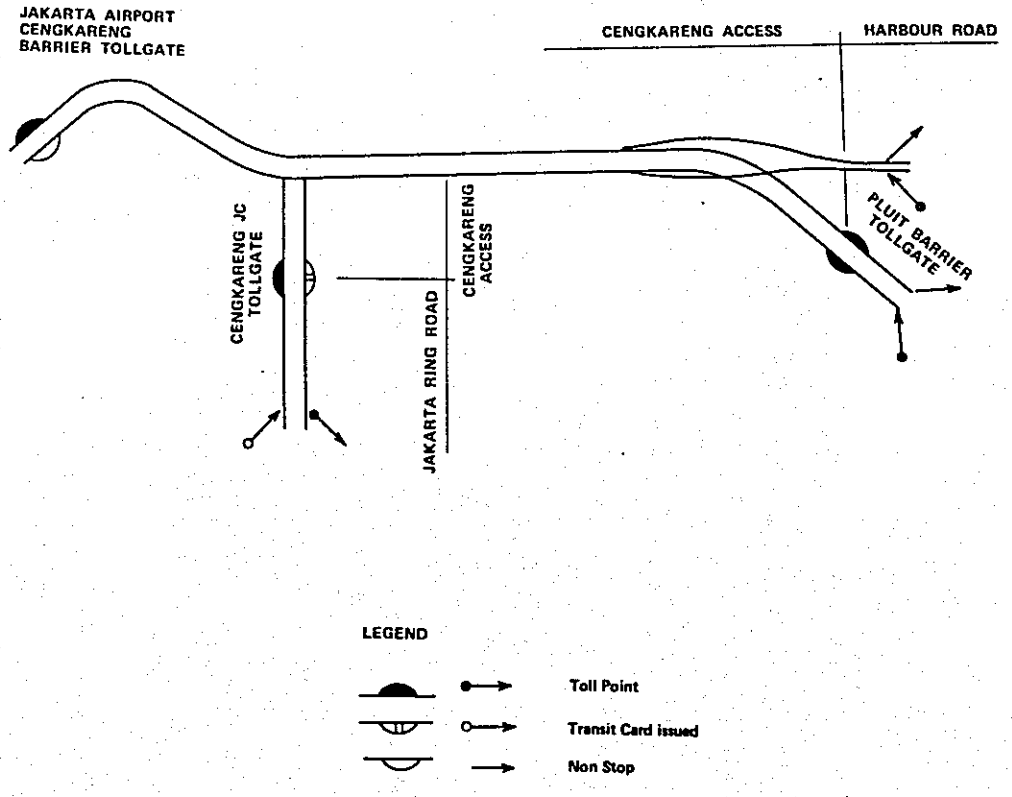
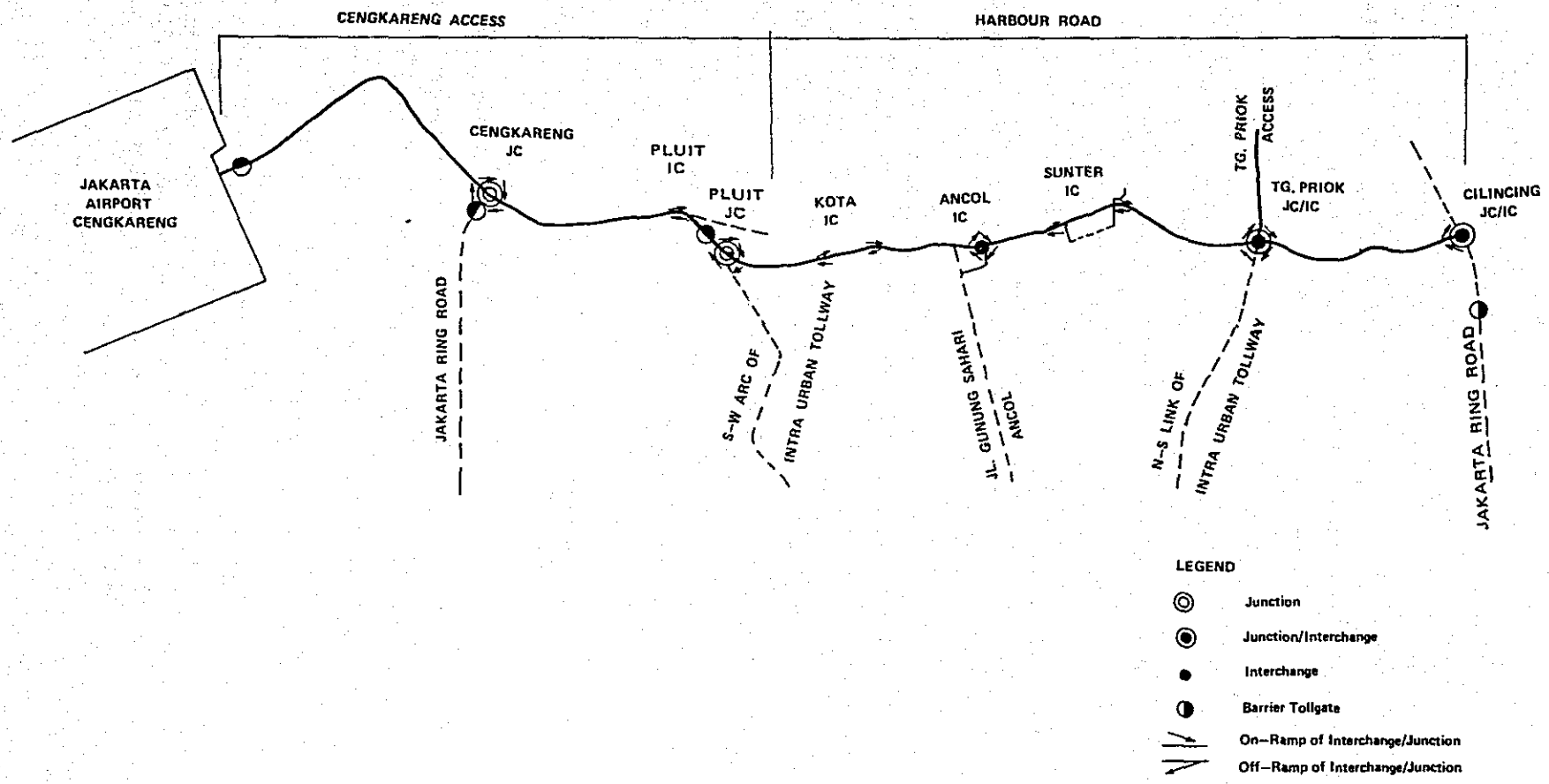


Fig. 7.4 Location of Junction/Interchange Ramps and Barrier Tollgates



7.1.3 Traffic Control and Information

(1) General

The traffic control and information system are required to maintain safe and smooth traffic flow on the tollways, to avoid traffic accidents or congestion and to resume normal conditions as soon as possible in event of trouble.

It contains work items such as:

- Detecting accidents, congestion, damage to tollway facilities, etc.;
- Collecting and providing information;
- Regulating the tollway traffic; and
- Maintaining security services.

(2) Tentative Location of Ancol Operation Center

The proposed location of tollway operation centers in the past is shown in Fig. 7.5.

According to the current information, the location of the operation center for Intra Urban Tollway has not yet been fixed. The operation center is tentatively provided at Ancol Interchange. It should be noted, however, that the operation cost, is estimated only for Harbour Road.

(3) Traffic Control System

The control center would be constructed during the construction stage for Harbour Road. The supervision of the traffic control system would be executed by the Operation Center's traffic control section. The traffic control facilities are listed below. These will be installed at a much later time according to the traffic volume and the budget for the operating body.

CCTV System	CCTV Monitor TV, etc.
Traffic Volume Detecting & Measuring System	Traffic detector (For throughway), minicomputer, etc.

(4) Information System

1) Information System for Harbour Road

Variable information indicators are installed around interchanges and along the tollway alignment at 2 km or 3 km intervals. These indicators are operated from the control desk in the Operation Center. The brightness of the electric letters must be adjustable to suit different lighting conditions.

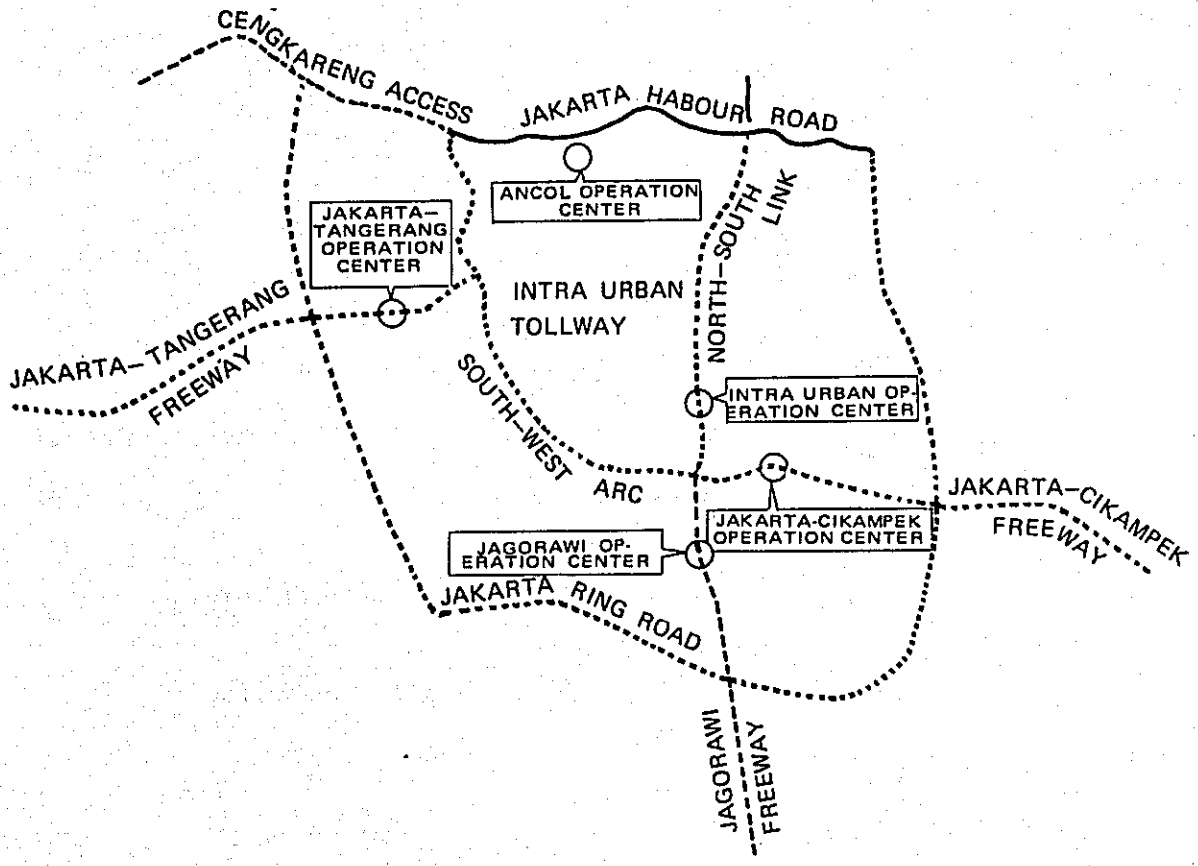
2) Information System for On-Ramps

The traffic flow directed towards congested areas is controlled by variable information indicators at the toll plazas thus encouraging drivers to voluntarily keep away from congested points when necessary. Traffic conditions can also be broadcast from radio stations.

3) Totalized Traffic Control and Information System

As hitherto mentioned, the traffic control system and the information system are closely related. They should be integrated as one system in the Operation Center. These systems will be installed at a future time.

Fig. 7.5 Tollway Operation Centers



7.2 Maintenance and Repair

The maintenance and repair works required for the tollway facilities and equipment include the items listed below.

(1) Tollway Facilities

1) Maintenance

- Highway Cleaning
  Machine Cleaning or Man-Power Cleaning (10 - 15 Times/Month)
- Traffic Signs and Guardrail (2 - 3 Times/Year)
- Drainage Facilities Cleaning (3 - 6 Times/Year)
  Ditches, Catch Basins Culverts
- Expansion Joint and Shoe (10 - 15 Times/Year)
- Weeding and Disinfection for slope and median (2 - 3 Times/Year)
- Extra Cleaning as required

2) Repair

- Pavement and shoulders:
  Pot hole, clack, rutting, partial overlay
- Bridge:
  Joint, shoe and painting
- Guard rail and Hand rail:
  Repair and painting
- Slope and green areas:
  Landslides and washed out parts
- Drainage facilities:
  Catch basin, pipe and box culvert and side ditch
- Traffic signs and road markings:
  Repainting or replacement of signs, repainting of markings

(2) Equipment

1) Maintenance

- Lighting Facilities Cleaning
- Electrical Information Facilities Cleaning
- Electricity Transformer Substations Maintenance
- Telecommunication Facilities Maintenance
- Traffic Control System Maintenance

2) Repair

- Lighting Facilities and Electrical Information Facilities: Replacement of bulbs and wiring, painting of poles, etc.
- Electricity Transformer Substations: Repair of electricity receiving and transforming devices, electric generators, indicators, wiring, etc.
- Telecommunication Facilities: Repair of emergency telephones, fire alarm devices, radio facilities, etc.
- Traffic Control System: Repair of traffic control panel, traffic volume detectors, closed circuit television cameras, wiring, etc.

The types of vehicles that will be used for maintenance and repair work are as follows:

- Patrol car
- Multi-purpose car
- Warning car
- Wrecker
- Sprinkler
- Sweeper
- Dump truck
- Line marker
- Mobile hydraulic platform
- Other construction equipment

These vehicles will be provided by the operating body of the tollway organization:

7.3 Maintenance and Operation Office

7.3.1 Maintenance and Operation Office Facilities

The maintenance and operation center for Harbour Road is tentatively located at Ancol interchange as described in 7.1.3.

The following facilities considered as the basic facilities for the tollway maintenance and operation are included in the Project cost.

Operation Office

- Office building (2 stories) 700 m^2
- VHF Radio Equipment Station (Key and Mobile Station)
- Electricity Transformer Sub-station
- Parking 900 m^2

Maintenance Office

- Office building	200 m^2
- Work shop, warehouse	100 m^2
- Material deposit	300 m^2
Green Area	2,800 m^2
Total Area	5,000 m^2

7.3.2 Office Organization

The tollway management includes:

- Supervision of tollway operations;
- Maintenance and repair of tollway facilities and equipment;
- Traffic Control and provision of information; and
- Administration.

The existing organization of the Indonesia Highway Corporation (Pt. Jasa Marga) which was set up in 1978 is presently situated in the Jagorawi Operation Center, (See Fig.7.5),since this is the only tollway in operation so far. Each of the future tollways is planned to have its own operation center for supervision of operation, maintenance and control services as mentioned earlier, and by that time the Indonesia Highway Corporation will carry out the supervision and coordination for the tollway operation centers and the administration for the whole tollway network. The operation centers should be under the direct control of the Director of Operations of the Indonesia Highway Corporation, as in Government Departments.

The evolution of the tollway management organization should follow the phasing of construction of the tollways.

Figs. 7.6 and 7.7 show the existing Organization of Indonesia Highway Corporation (Head Office and Branch Office).

Fig. 7.6 Existing organization of Indonesia Highway Corporation (Head Office)

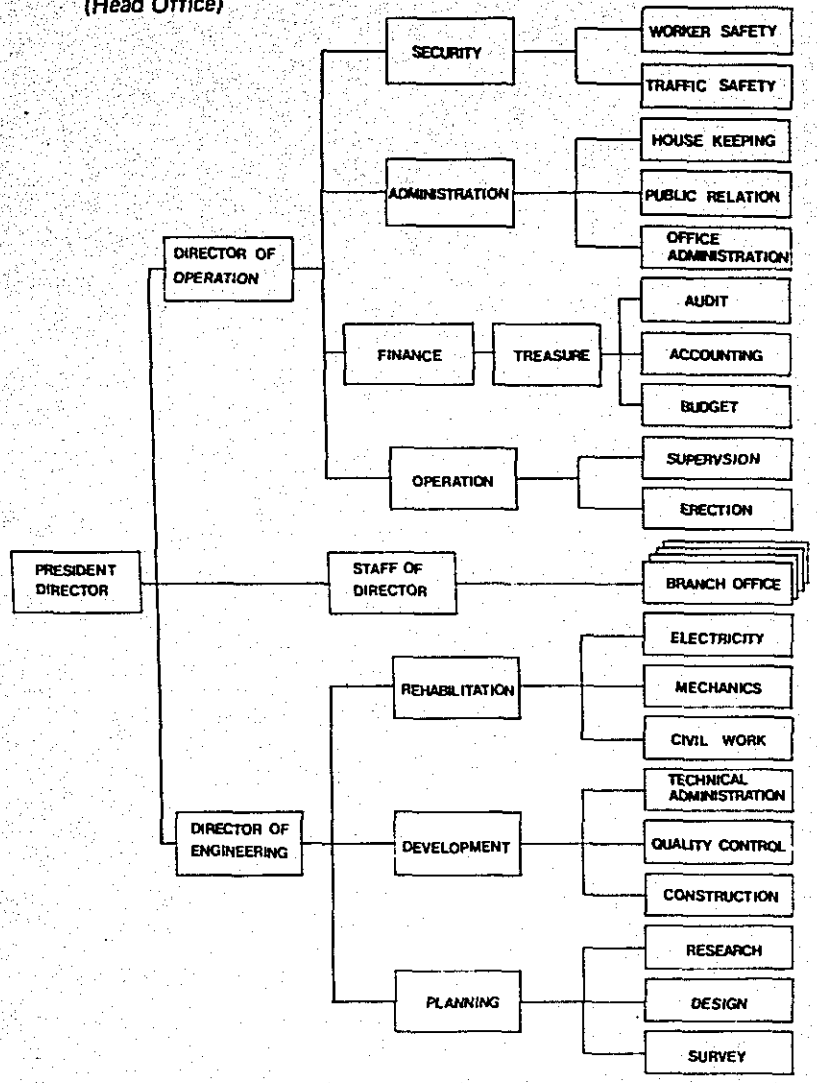


Fig. 7.7 Existing Organization of Indonesia Highway Corporation (Branch Office)