Table 3.4 Gross Regional Domestic Product (GRDP) of Jabotabek (1/2)

Area	Sector[1/]	GRDP 1975	GRDP 1980	GRDP 1985
		(GRDP in 10^6Rp., market prices)		
DKI Jakarta	I	29,448[2/]	57,239	126,395
	II	288,902[2/]	917,514	2,236,636
	III	1,071,937[2/]	3,013,318	7,514,006
	GRDP	1,390,287[2/]	3,988,071	9,877,037
			(in %)	
	I	2.1	1.4	1.3
	II	20.8	23.0	22.6
	III	77.1	75.6	76.1
	Total	100.0	100.0	100.0
		(GRDP in 10^6Rp., market prices)		
Kodya. Bogor	I	n.a.	2,250	3,569
	II	n.a.	19,195	34,448
	III	n.a.	45,013	91,888
	GRDP	n.a.	66,458	129,905
			(in %)	
	I	n.a.	3.4	2.7
	II	n.a.	28.9	26.5
	III	n.a.	67.7	70.8
	Total	n.a.	100.0	100.0
		(GRDP in 10^6Rp., market prices)		
Kab. Bogor	I	62,145[3/]	124,028	192,234
	II	50,145[3/]	241,530	373,077
	III	111,908[3/]	208,684	384,073
	GRDP	224,198[3/]	574,242	949,384
			(in %)	
	I	27.7	21.6	20.2
	II	22.4	42.1	39.3
	III	49.9	36.3	40.5
	Total	100.0	100.0	100.0

Table 3.4 Gross Regional Domestic Product (GRDP) of Jabotabek (2/2)

Area	Sector[1/]	GRDP 1975	GRDP 1980	GRDP 1985
		(GRDP in 10^6Rp., market prices)		
Kab. Tangerang	I	19,113	69,807	160,279
	II	12,174	94,388	336,249
	III	34,467	111,335	463,511
	GRDP	65,754	275,530	960,039
			(in %)	
	I	29.1	25.3	16.7
	II	18.5	34.3	35.0
	III	52.4	40.4	48.3
	Total	100.0	100.0	100.0
		(GRDP in 10^6Rp., market prices)		
Kab. Bekasi	I	20,735	57,680	149,472
	II	5,797	64,962	247,246
	III	21,597	77,052	226,103
	GRDP	48,129	199,694	622,821
			(in %)	
	I	43.1	28.9	24.0
	II	12.1	32.5	39.7
	III	44.8	38.6	36.3
	Total	100.0	100.0	100.0

1/ Sectors are composed of the following sub-sectors.
- I (Primary) : agriculture
- II (Secondary) : mining and quarrying, manufacturing, construction
- III (Tertiary) : electricity, gas and water supply, transport and communication, wholesale and retail trade, banking and other financial intermediaries, ownership of dwelling, public administrations and services

2/ Figures are for 1976.

3/ Figures are for 1978.

The structural change was most drastic in Kabupaten Bekasi with the primary sector declining nearly to half the 1975 level and the secondary sector increasing more than threefold in 10 years. The secondary sector increased substantially in Kabupatens Bogor and Tangerang as well. The economic sector that contributed most to the rapid growth of the secondary sector in these kabupatens is the manufacturing sector, especially for Kabupatens Tangerang and Bekasi. The real growth rates of the manufacturing sector were 20.4%/yr. and 30.3%/yr. between 1975 and 1985 for Kabupatens Tangerang and Bekasi respectively.

(3) GRDP Per Capita

Table 3.6 presents GRDP per capita of Jabotabek and their proportions to the national average (excluding Jabotabek). Table 3.5 below is its summary. GRDP per capita of Jabotabek grew faster than GDP per capita for Indonesia since 1980. In 1985, DKI Jakarta's GRDP per capita was 2.3 times higher than that of the rest of the country, while that of Botabek remained at 80% level.

Table 3.5 Comparison of GRDP Per Capita

(Indonesia = 100)

Area	1980	1985
Indonesia	100	100
DKI Jakarta	206	226
Botabek area	69	80

As Table 3.6 shows, growth was particularly fast in Kabupatens Tangerang and Bekasi in which overall economic growth was remarkably fast. Kabupaten Tangerang, whose GRDP per capita was almost 40% below the national average in 1980, surpassed the national level in 1985. GRDP per capita of Kabupaten Bekasi also rose rapidly reaching nearly 90% level of the national average in 1985. On the contrary, the relative per capita income level of Kabupaten Bogor lowered over five years from 77 to 63.

Table 3.6 GRDP per Capita of Jabotabek in Current Market Price

Area	1980 GDP p.c. (Rp.)	1980 Indonesia = 100[1/]	1985 GDP p.c. (Rp.)	1985 Indonesia = 100[1/]	Growth Rate of GRDP p.c. (%/yr.)
Indonesia	297,564	100	559,211	100	13.4
DKI Jakarta	613,266	206	1,261,596	226	15.5
Botabek area	206,156	69	449,308	80	16.9
(Kodya. Bogor)	(269,061)	(90)	(536,798)	(96)	(14.8)
(Kab. Bogor)	(230,249)	(77)	(349,939)	(63)	(8.7)
(Kab. Tangerang)	(180,203)	(61)	(568,743)	(102)	(25.8)
(Kab. Bekasi)	(174,710)	(59)	(485,820)	(87)	(22.7)

1/ GDP per capita for Indonesia excluding Jabotabek

3.1.3 Spatial Distribution of Socio-Economic Activities

Spatial distribution of socio-economic activities is presented in this sub-section.

(1) Population Density

Fig. 3.1 presents population densities of the Jabotabek kecamatans. Fig. 3.1 shows southern and central Jakarta and Kotamadya Bogor have the densities above 10,000 per km^2. Western, northern and eastern Jakarta have the density between 5,000 and 9,999 population per km^2. In Jabotabek as a whole, relatively high density kecamatans are situated along east-west and north-south axes in general. It is observed that kecamatans with more than 3,000 people per km^2 are situated in the areas adjacently surrounding DKI Jakarta, implying spillover of population from DKI Jakarta. They include Bekasi Barat, Bekasi Selatan and Bekasi Timur to the east, Ciledug and Tangerang to the west and Beji, Pancoran Mas and Sukma Jaya to the south. Kotamadya Bogor is another urban center surrounded by relatively high density suburban kecamatans such as Kedung Halang and Ciomas.

Population, area and population density of each kecamatan are presented in ANNEX 3-1.

(2) Present Distribution of Industrial and Service Activities

Present distribution of industrial and service activities was analyzed based on "Sensus Ekonomi 1986, Potensi Desa" conducted by Biro Pusat Statistik (BPS) in 1986 (hereinafter PODES 1986). PODES 1986 provides a wide variety of socio-economic data at desa level for all desas throughout the country.

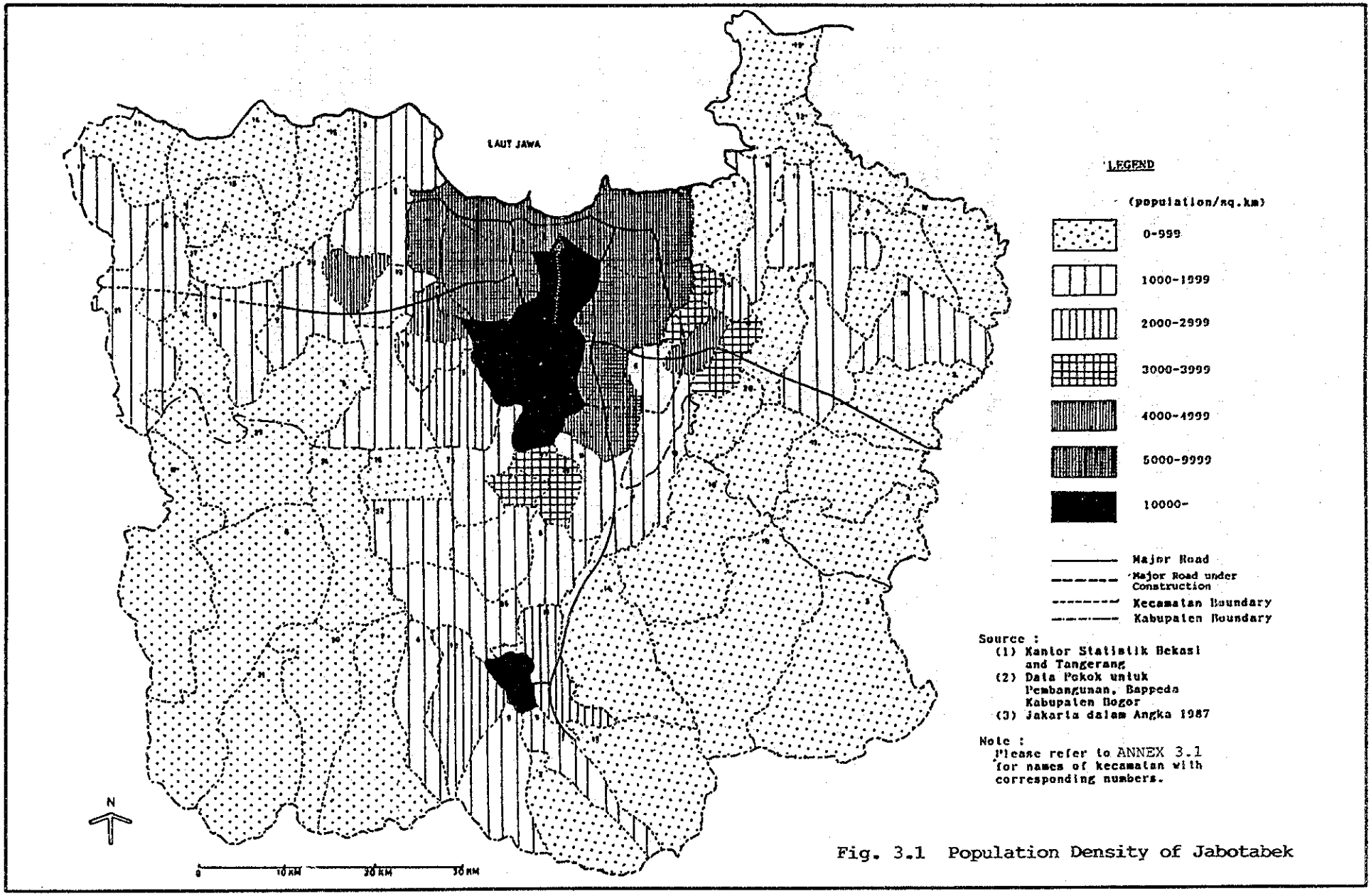


Fig. 3.1 Population Density of Jabotabek

Four factors were extracted for the analysis:

- number of closed markets;
- number of groups of shops;
- number of banks; and
- number of factories.

The following table summarizes the distribution of these facilities in Jabotabek.[1/]

Table 3.7 Distribution of Industrial and Service Activities

Area	Number of Closed Markets	Number of Groups of Shops	Number of Banks	Number of Factories
		(in number)		
DKI Jakarta	145	454	13	1,181
Botabek area	128	266	0	3,390
Total	273	720	13	4,571
		(in %)		
DKI Jakarta	53.1	63.1	100.0	25.8
Botabek area	46.9	36.9	0.0	74.2
Total	100.0	100.0	100.0	100.0

Table 3.8 gives the distribution of these facilities by kabupaten and kotamadya. Fig. 3.2 and 3.3 and ANNEX 3-2 show the distribution of the four factors by kecamatan.

1/ Figures obtained by PODES 1986 was collected based on interview surveys with village chieves. The figures therefore might not be compatible with the reality in a strict sense. It is judged, however, that the figures of PODES 1986 are reliable enough for the purpose of the study on grasping the general conditions of Jabotabek.

It is observed from the Table 3.7 that the majority of the tertiary activities (markets 53%, shops 63% and banks 100%) is in DKI Jakarta, while secondary activities (factories) are more evenly distributed throughout the Jabotabek area. The proportions of closed markets and groups of shops in DKI Jakarta (53% and 63%) are roughly in proportion to the population distribution (DKI Jakarta: 57% in 1985). This reflects the fact that markets and shops locate basically in areas where people live. As Fig. 3.2 shows, markets and shops are evenly scattered throughout the kecamatans within Botabek area. Most kecamatans fall within the range of 2 to 4 in terms of number of closed markets and groups of shops.

Table 3.8 Number of Closed Markets, Groups of Shops, Banks and Factories in Jabotabek

Area	Number of Closed Markets	Number of Groups of Shops	Number of Banks	Number of Factories
		(in number)		
DKI Jakarta	145	454	13	1,181
Kodya. Bogor	10	24	0	82
Kab. Bogor	42	93	0	1,331
Kab. Tangerang	48	88	0	1,232
Kab. Bekasi	28	61	0	745
Total	273	720	13	4,571
		(in %)		
DKI Jakarta	53.1	63.1	100.0	25.8
Kodya. Bogor	3.7	3.3	0.0	1.8
Kab. Bogor	15.3	12.9	0.0	29.1
Kab. Tangerang	17.6	12.2	0.0	27.0
Kab. Bekasi	10.3	8.5	0.0	16.3
Total	100.0	100.0	100.0	100.0

Source : Sensus Economi 1986, Potensi Desa, Cipta Karya

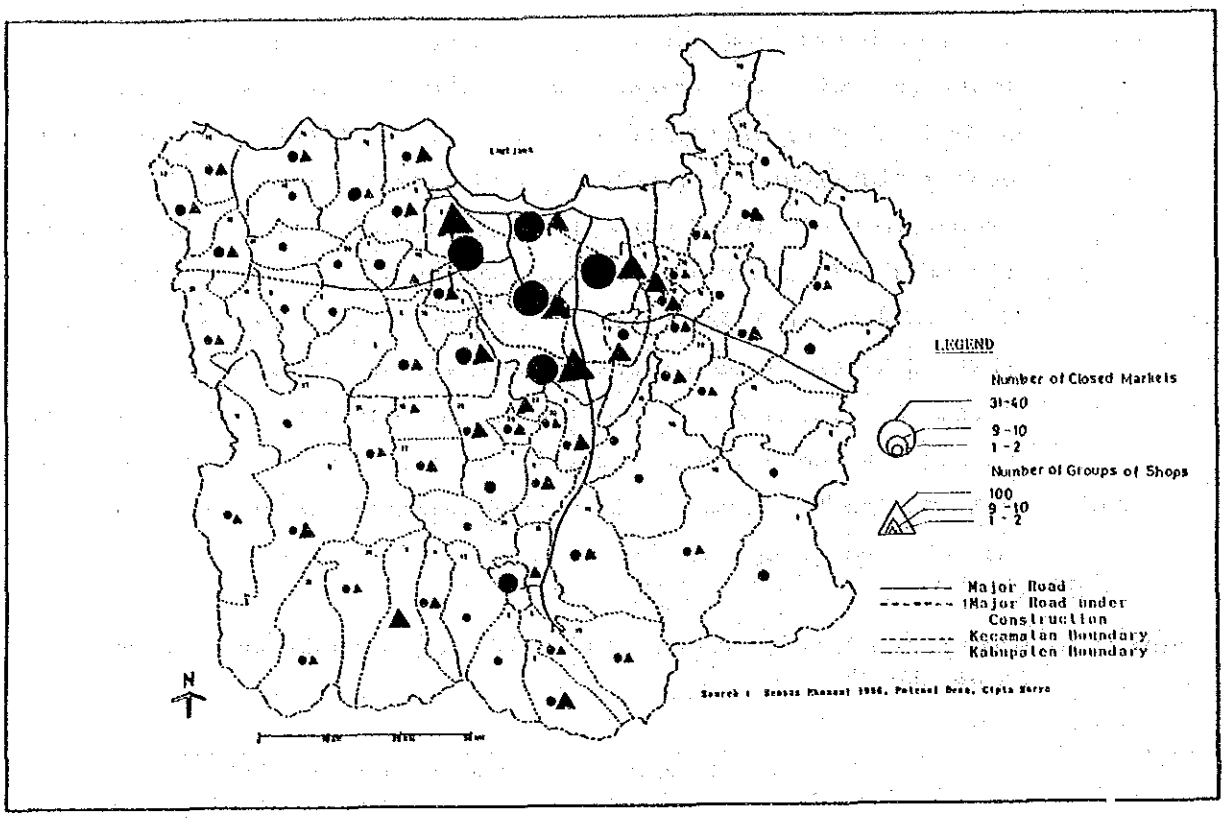


Fig. 3.2 Number of Closed Markets and Groups of Shops in Jabotabek

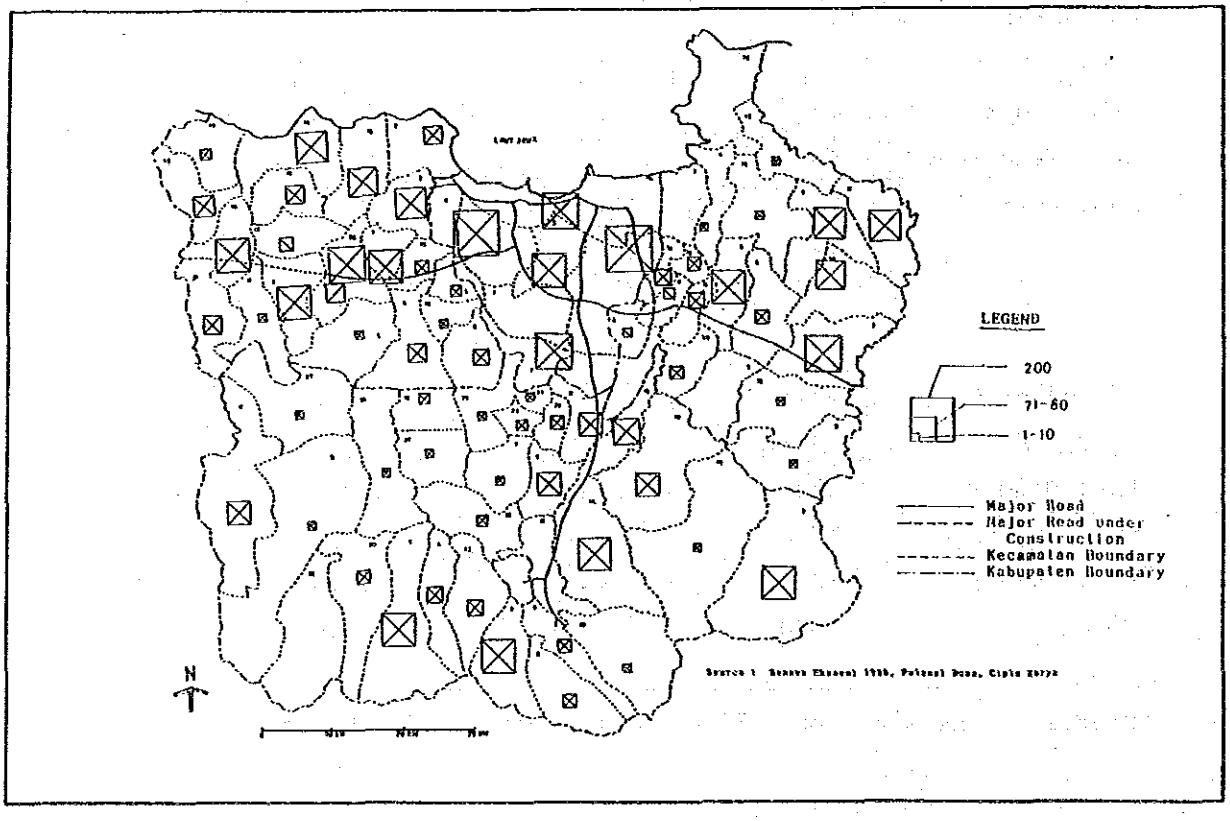


Fig. 3.3 Number of Factories in Jabotabek

In terms of number of factories, Botabek accounts for nearly three fourths of the total number. This is related with the fact that factories locate not only in urban areas where market exists but also in areas with resources. A large number of small to medium scale agro-processing industries in Botabek accounts for this aspect. In terms of GRDP share, however, the secondary sector of DKI Jakarta accounts for 69% of that of Jabotabek as opposed to only 26% of factories located in DKI Jakarta. This could be explained by major concentration of high value-added and large scale industries in DKI Jakarta.

Fig. 3.3 shows a certain degree of concentration of factory location within Botabek. The kecamatans having relatively large number of factories are those in the eastern part of Kabupaten Bekasi, those surrounding Kotamadya Bogor and about a half kecamatans in Kabupaten Tangerang. In short, industrial growth in Jabotabek has been taking place mainly toward east and west of Jabotabek and also centering around Kotamadya Bogor.

(3) Recent Development Trend of Housing and Industry

In recent years, housing and industries in Botabek have been developing in such a manner as to reinforce the government's east-west development strategy. Trend of housing and industrial growth at present and in the near future could be analyzed based on "Inventarisasi Pembangunan Perumahan dan Industri di Wilayah Botabek" which shows the areas given permission for housing and industrial development by the provincial government of West Jawa between 1983 and 1987 as presented in Table 3.10 and Fig. 3.4 and 3.5. The following Table 3.9 summarizes the total areas of housing and industrial development in Botabek.

Table 3.9 Recent Trend of Housing and Industrial Development (Summary)

Area	(ha.)	(%)
Kodya. & Kab. Bogor	2,802	9.5
Kab. Tangerang	24,239	82.4
Kab. Bekasi	2,386	8.1
Total	29,427	100.0

The major trends observed from Table 3.10, Fig. 3.4 and Fig. 3.5 are summarized as follows.

- Major growth trend is along an east-west axis both for housing and industrial development.

- The development momentum is directed particularly toward west. Kabupaten Tangerang far outweighs Kotamadya and Kabupaten Bogor and Kabupaten Bekasi.

- Growth to the west tends to extend further, while that to the east tends to concentrate around Kota Administratif Bekasi.

- Growth to the south tends to be dispersed, especially for industrial growth.

ANNEX 3-3 presents the areas for housing and industrial development in Botabek by kecamatan.

Table 3.10 Recent Trend of Housing and Industrial Development

Area	Housing Development	Industrial Development	Total
		(in ha.)	
Kodya. & Kab. Bogor	2,645	157	2,802
Kab. Tangerang	23,758	481	24,239
Kab. Bekasi	2,216	170	2,386
Total	28,619	808	29,427
		(in %)	
Kodya. & Kab. Bogor	9.2	19.5	9.5
Kab. Tangerang	83.0	59.5	84.8
Kab. Bekasi	7.8	21.0	5.7
Total	100.0	100.0	100.0

Source: "Inventarisasi Pembangunan Perumahan dan Industri di Wilayah Botabek" Oktober 1987 by Direktorat Tata Kota dan Tata Daerah Direktorat Jenderal Cipta Karya Departemen Pekerjaan Umum

Note : The areas above are those given permission for housing and industrial development by the provincial government of West Jawa between 1983 and 1987.

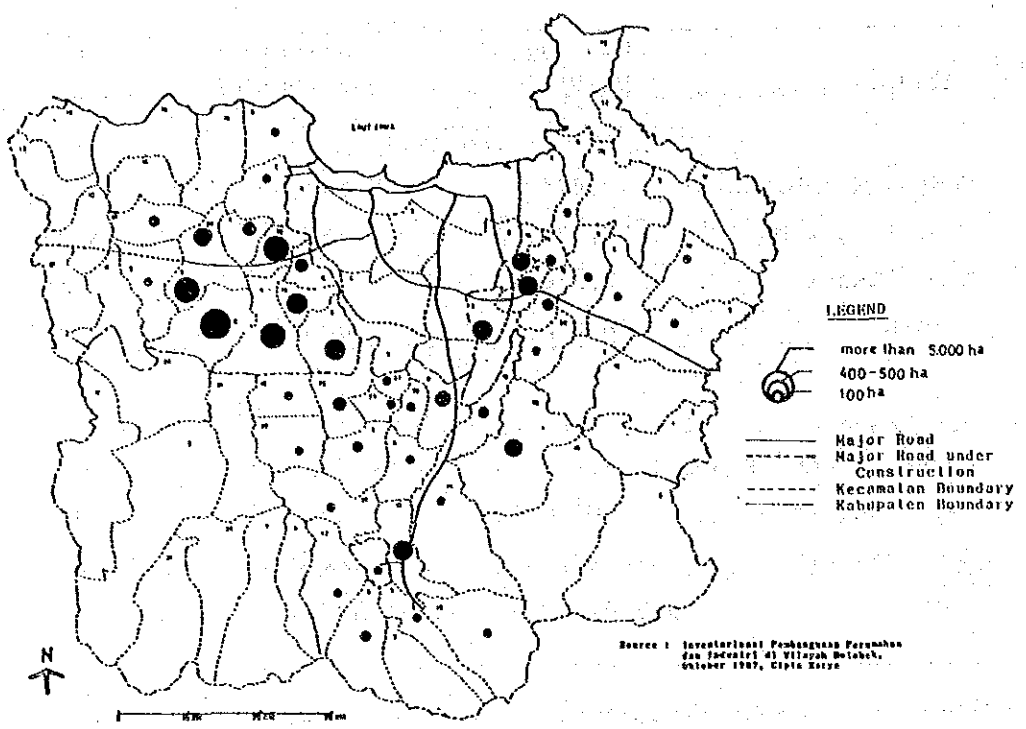


Fig. 3.4 Recent Trend of Housing Development in Botabek

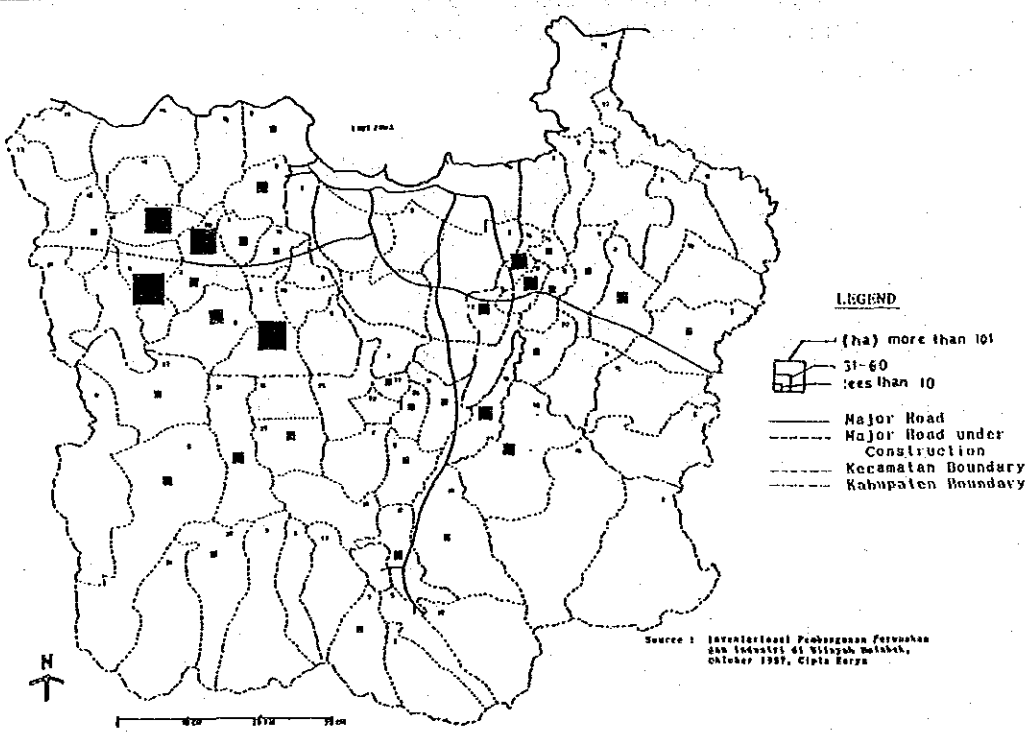


Fig. 3.5 Recent Trend of Industrial Development in Botabek

3.2 Regional Development Framework

3.2.1 Basic Development Policies of Jabotabek Area

The development frameworks of Jabotabek were set in terms of socio-economy and spatial structure of the region for the year 2005. The regional development frameworks serve as the basis of the Study in that the target telecommunications network to be proposed for 2004 will be prepared in accordance with the anticipated development pattern of Jabotabek in the coming decades.

The following three plans provide the basic development policies of Jabotabek area.

a) Jabotabek Metropolitan Development Plan

b) General Structure Plan for Jabotabek Region 2005 (Rencana Umum Tata Ruang Wilayah Jabotabek Th-2005)

c) The Structure Plan for DKI Jakarta 1985-2005 (Rencana Umum Tata Ruang DKI Jakarta 2005)

Jabotabek Metropolitan Development Plan (hereafter JMDP) was prepared in 1981 by Jabotabek Implementation Advisory Team and later approved by the government. It consists of the proposed development strategy, socio-economic projections and desired spatial development pattern of Jabotabek in the year 2003.

General Structure Plan for Jabotabek Region 2005 (hereafter Jabotabek Structure Plan) was prepared in 1985 by a planning team arranged by Jabotabek Development Cooperation Committee (Badan Kerja Sama Pembangunan Jabotabek, hereafter BKSP Jabotabek). The governors of West Jawa Province and DKI Jakarta agreed upon the development strategies of the plan. The basic ideas presented in Jabotabek Structure Plan are derived from JMDP.

The Structure Plan for DKI Jakarta 1985-2005 (hereafter Jakarta Structure Plan) was prepared by the government of DKI Jakarta in

1984. It presents development objectives and strategies, structure plan in 2005 and implementation guidelines for DKI Jakarta.

The three plans mentioned above were prepared so as to provide planning guidelines for implementing the principles laid down in INPRES (presidential decree) No.13 issued in 1976. The essence of INPRES No.13 is to promote a harmonious and balanced development of DKI Jakarta and surrounding Botabek area.

The basic development policies of Jabotabek are summarized in the following two points.

a) to guide development away from DKI Jakarta and promote faster growth in Botabek area

b) to guide development along an east-west axis from the point of view of environmental preservation

The first objective aims to relieve the growth pressures on DKI Jakarta, while making best use of growth potentials endowed with Botabek area. DKI Jakarta has experienced a rapid population growth (4.2%/yr. between 1961 and 1985) in the last decades, which has led to the surging of a number of urban problems such as:

- rising land prices;
- growth of unplanned and poorly serviced housing settlements;
- traffic congestion on major arterials;
- shortage of water supply; and
- deterioration of drinking water quality.

By guiding development away from DKI Jakarta to surrounding Botabek area, deterioration of urban environment of DKI Jakarta could be slowed down and the provision of basic infrastructure and social facilities becomes possible at lower cost and faster rate.

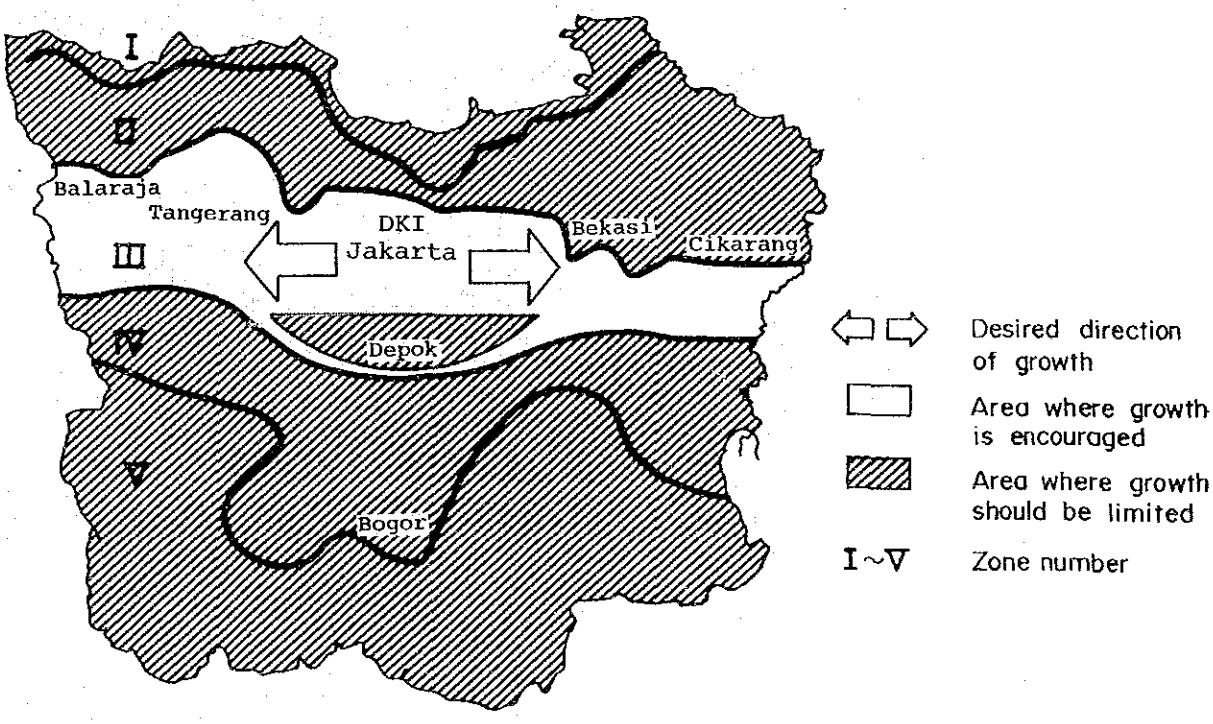
Growth of Botabek is to be promoted through enhancing the urban and economic functions of existing urban areas such as Kotamadya Bogor, Tangerang and Bekasi as the strategic growth centers. Faster growth

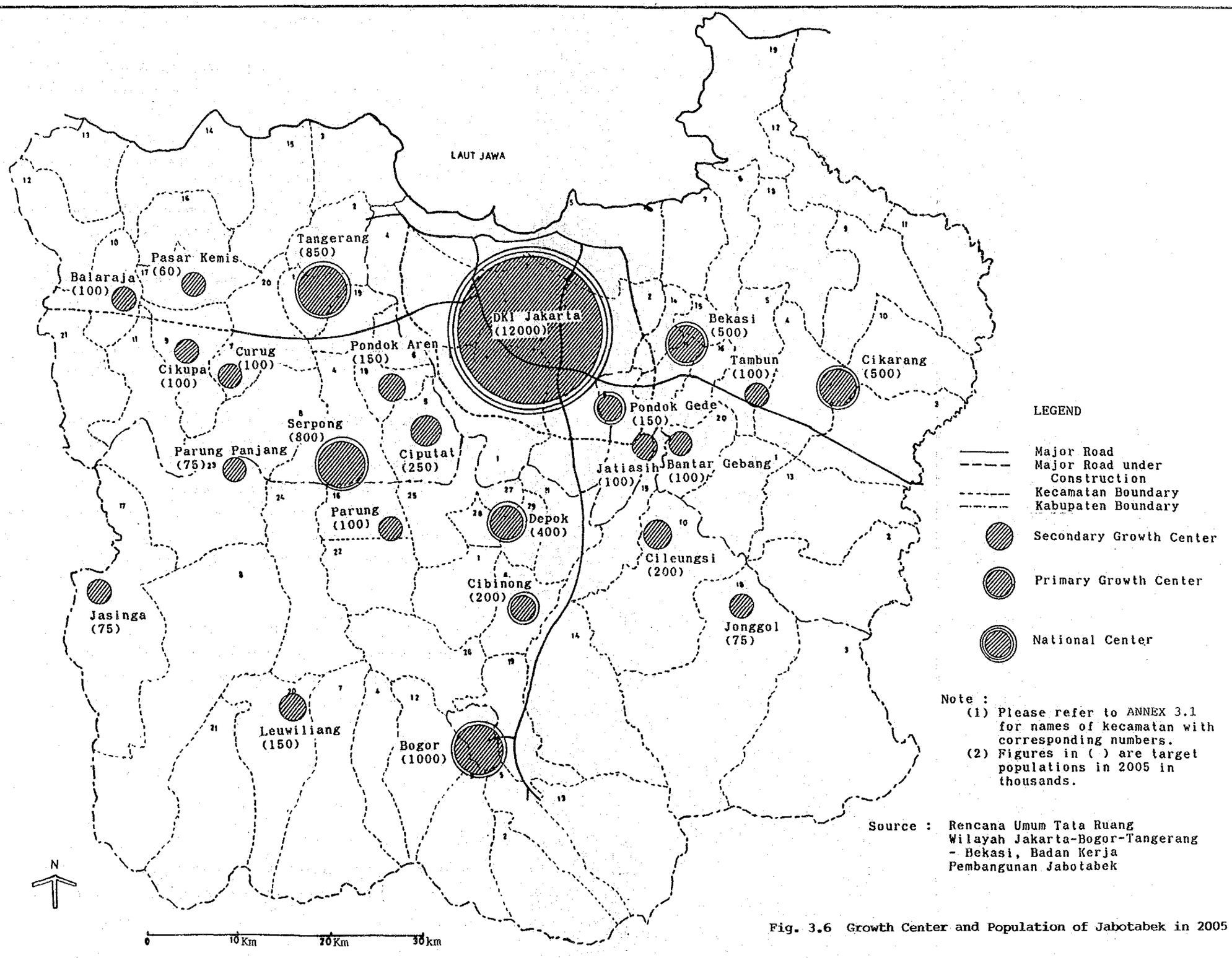
in employment and population in the growth centers is expected to create a balanced urban structure of Jabotabek. The following areas are designated as the growth centers of Botabek.

- Kotamadya Bogor
- Kabupaten Bogor:
  Kota Administratif Depok, Cibinong, Leuwiliang, Jasinga, Parung, Jonggol, Cileungsi, Parung Panjang
- Kabupaten Tangerang:
  Kota Administratif Tangerang, Serpong, Balaraja, Cikupa, Pasar Kemis, Ciputat, Pondok Aren, Curug, Tigaraksa
- Kabupaten Bekasi:
  Kota Administratif Bekasi, Cikarang, Pondok Gede, Jatiasih, Bantar Gebang, Tambun

Fig 3.6 presents locations of the growth centers.

With regard to the second objective, spatial development pattern of Jabotabek needs to be planned from the point of view of environment preservation as well as from regional economic growth. The figure below shows Jabotabek area divided into five zones according to the geographical conditions and potential resources.





Note :
(1) Please refer to ANNEX 3.1 for names of kecamatan with corresponding numbers.
(2) Figures in ( ) are target populations in 2005 in thousands.

Source : Rencana Umum Tata Ruang Wilayah Jakarta-Bogor-Tangerang - Bekasi, Badan Kerja Pembangunan Jabotabek

Fig. 3.6 Growth Center and Population of Jabotabek in 2005

The proposed functions of each zone is as follows.

Zone I : Tourism and seaboard activities
No urban development

II : Agriculture intensification
Limited urban development

III : Major urban development
Agriculture intensification

IV : Agriculture intensification
Limited urban development

V : Recreational activities and conservation of upland forest
No agricultural intensification

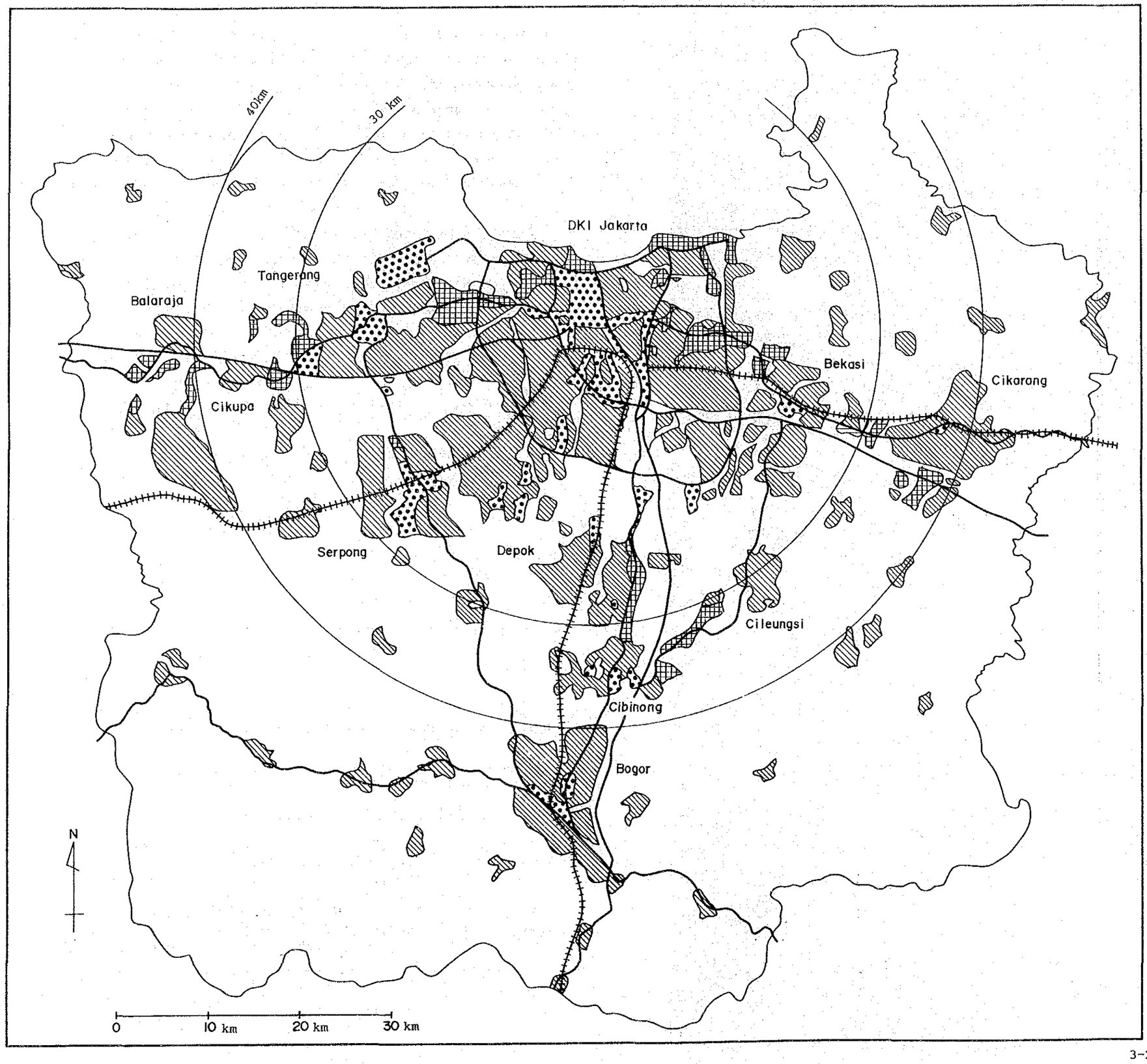
Zone III is suitable for major urban growth considering its good drainage, availability of groundwater resources, favorable soil conditions and poor potential in agriculture. Development in the southern part to DKI Jakarta, however, should be limited for safeguarding the aquifer recharge area, from which substantial proportion of water is being supplied to DKI Jakarta. The figure shows the recommended direction of growth toward east and west in zone III.

Urban growth is to be limited in Zone II, since this area is prone to flooding and has high potential in agriculture. Urban growth in Zone IV should also be limited due to limited groundwater resources and high potential in agriculture. Zones I and V are suited for recreational activities.

3.2.2 Regional Development Framework

(1) Land Use

Jabotabek Structure Plan provides the envisaged land use pattern of Jabotabek area in 2005 as shown in Fig. 3.7. This figure



Note:

The land use plan originally prepared by BKSP Jabotabek classifies land uses into more detailed level. For the Study, land use classification was simplified so as to focus on the distribution of population and economic activities.

Source :

Badan Kerja Sama Pembangunan (BKSP) Jabotabek

- Residential Area
- Commercial and Governmental Area
- Industrial Area
- Other Areas (Mainly Agricultural Areas)
- Major Arterial Road
- Railway

Fig. 3.7 Land Use Plan of Jabotabek in 2005

shows that major urban expansion takes place to the east in Kabupaten Bekasi and to the west in Kabupaten Tangerang, while urban areas expand moderately centering around Kotamadya Bogor. In Kabupaten Tangerang, urban growth to the west occurs along the freeway until Balaraja. Large commercial and housing areas are envisaged to grow in Serpong which is situated at the intersection of the railway and the north-south highway.

Urban growth in Kabupaten Bekasi takes place mainly around Bekasi and Cikarang. Compared with the present size, Cikarang is expected to go through a rapid urban growth to become a major urban agglomeration in the eastern part of Jabotabek. In Kabupaten and Kotamadya Bogor, urban expansion in the areas surrounding Kotamadya Bogor, especially the areas to the north and east of the city, is dominant. Other major urban growth are observed in Kota Administratif Depok, Cibinong and Cileungsi.

Overall, the urban structure of Jabotabek in 2005 could be summarized as being composed of a dominant east-west urban agglomeration centering around DKI Jakarta and a sub-regional center of Kotamadya Bogor.

(2) Population Targets and Growth Centers

The following Table 3.11 presents the population of Jabotabek in 1985 and population target for 2005 set forth by Jabotabek Structure Plan.

Table 3.11 Historical and Target Population of Jabotabek

Area	1985		2005		Growth Rate (%/yr.)
	(10^3)	(%)	(10^3)	(%)	
DKI Jakarta	7,829	56.9	12,000	51.1	2.2
Botabek area	5,925	43.1	11,500	48.9	3.4
(Kodya. Bogor)	(242)	(1.8)	(1,000)	4.3	(7.4)
(Kab. Bogor)	(2,713)	(19.7)	(3,870)	16.5	(1.8)
(Kab. Tangerang)	(1,688)	(12.3)	(3,730)	15.9	(4.0)
(Kab. Bekasi)	(1,282)	(9.3)	(2,900)	12.3	(4.2)
Jabotabek area	13,754	100.0	23,500	100.0	2.7

Anticipating the faster population growth in Botabek, the population of Botabek is expected to account for 49% of the total Jabotabek population in 2005 as opposed to 43% in 1985. Accordingly the proportion of DKI Jakarta is anticipated to fall from 57% in 1985 to 51% in 2005.

Jabotabek Structure Plan designates major urban areas as the growth centers and assumes the target population and urban functions as presented in Table 3.12. Population targets are currently in the process of finalization incorporating the comments of the local governments.

DKI Jakarta is expected to play a dominant role as the political, administrative and economic center of Indonesia. It will supply a wide variety of goods and services to surrounding Botabek area, while depending on it for supply of food, agricultural products and manufacturing products.

Primary growth centers are anticipated to play larger roles in accommodating large - medium scale industries and providing trade and service activities. To stimulate growth in jobs and population in the primary growth centers, a number of incentives need to be provided that would encourage industrial and business location in the primary growth centers.

Secondary growth centers are anticipated to grow into self-contained centers that would provide job opportunities for increasing rural laborforce. Potential activities for the secondary growth centers include agro-processing industries, hub of inter- and intra-regional transportation networks and district markets.

Table 3.12 Hierarchy, Target Population and Urban Function of Growth Centers in Jabotabek for 2005 (1/2)

Name	Hierarchy 1/	Target Population (10^3)	Urban Function
DKI Jakarta	N	12,000	National center of administration, trade and service
Kodya. Bogor and surrounding area	P	1,000	Center of research and agriculture education/center of regional trade/center of service business and average-small size industries/tourism
Kab. Bogor		3,870	
Kota Administratif Depok	P	400	Center of education and service business/residential area/tourism area
Cibinong	P	200	Kabupaten capital/center of service business and industry
Leuwiliang	S	150	mining/service business
Jasinga	S	75	residential area/service business
Parung	S	100	Center of regional trade, service business and cattle breeding
Jonggol	S	75	Center of local trade, business service and cattle breeding
Cileungsi	S	200	Center of pollution-free large and medium scale industries
Parung Panjang	S	75	Center of construction material industry and service business
Other areas		2,595	-
Kab. Tangerang		3,730	
Kota Administratif Tangerang	P	850	Kabupaten capital 2/ /center of education, regional trade and service business/gateway of air transport
Serpong	P	800	Center of government/research center/area for expansion of educational facilities/residential area
Balaraja	S	100	Center of regional trade, medium-scale light industries, construction material industries and service business
Cikupa	S	100	Center of large and medium-scale industries and service activities
Pasar Kemis	S	60	Center of medium scale pollution-free industries
Ciputat	S	250	Residential area/center of service business, local trade and special education
Pondok Aren	S	150	Residential area
Curug	S	100	Center of local trade and service business/medium-scale industry/aviational education facilities
Other areas		1,420	-

1/ N : National center
P : Primary growth center
S : Secondary growth center

2/ As described in Section 3.2.3, kabupaten capital is planned to be transferred to Tigaraksa by 1992. At the time of preparing Jabotabek Structure Plan, Kota Administratif Tangerang was assumed to be kabupaten capital in 2005.

Table 3.12 Hierarchy, Target Population and Urban Function of Growth Centers in Jabotabek for 2005 (2/2)

Name	Hierarchy 1/	Target Population (10^3)	Urban Function
Kab. Bekasi		2,900	
Kota Administratif Bekasi	P	500	Kabupaten capital/center of regional trade, service business and education
Cikarang	P	500	Center of regional trade, service business and small, medium and large industries
Pondok Gede	P	150	Residential area
Jatiasih	S	100	Residential area
Bantar Gebang	S	100	Center of service business, local trade and small industries
Tambun	S	340	Center of service business, local trade and small industries
Other areas		1,110	-
Jabotabek		23,500	

1/ N : National center
P : Primary growth center
S : Secondary growth center

(3) Urban and Rural Population

As far as the urban and rural population of Botabek are concerned, the Study integrated the target populations of the growth centers with the study results of "Arterial Road System Development Study (ARSDS)" prepared by the Japan International Cooperation Agency (JICA) in 1987. ARSDS is a master plan study on the arterial road system of Metropolitan Jakarta providing a number of socio-economic parameters useful for the analysis of the Study. ARSDS carried out a population projection of Botabek on a basis of planning zones. A planning zone corresponds to a kecamatan in urbanized areas or is composed of a number of kecamatans in less urbanized areas. For each planning zone, ARSDS projected the urban and rural population for the year 2005. The total population of kabupatens are in accordance with the framework of Jabotabek Structure Plan. The following table summarizes the urban and rural population of Botabek in 1985 and 2005.

Table 3.13 Urban and Rural Population of Botabek

(Unit: 10^3)

Area	1985			2005		
	Urban	Rural	Total	Urban	Rural	Total
Kodya. & Kab. Bogor	1,609	1,601	3,210	2,905	1,965	4,870
Kab. Tangerang	490	1,340	1,830	2,670	1,060	3,730
Kab. Bekasi	390	1,000	1,390	1,790	1,110	2,900
Total	2,489	3,941	6,430	7,365	4,135	11,500

ANNEX 3-4 presents the urban and rural population of Botabek by planning zone in 1985 and 2005.

(4) Income Distribution of DKI Jakarta

Data on income distribution shall be used for deriving the number of the population which is able to afford telephone services. In this sense, income distribution framework shall serve as a basis for telephone demand projection. The Study used some study results of ARSDS.

ARSDS provides the following figures for the expenditure distribution pattern of DKI Jakarta in 1985 and 2005.

Table 3.14 Expenditure Distribution of DKI Jakarta

Expenditure Group	Per Capita Expenditure Level (Rp.)	Percentage of Population (%) 1985	2005
High	Over 140,000	3.9	7.3
Upper middle	42,000 - 140,000	12.2	34.0
Lower middle	18,250 - 42,000	36.4	52.5
Low	Below 18,250	47.5	6.2
Total	-	100.0	100.0

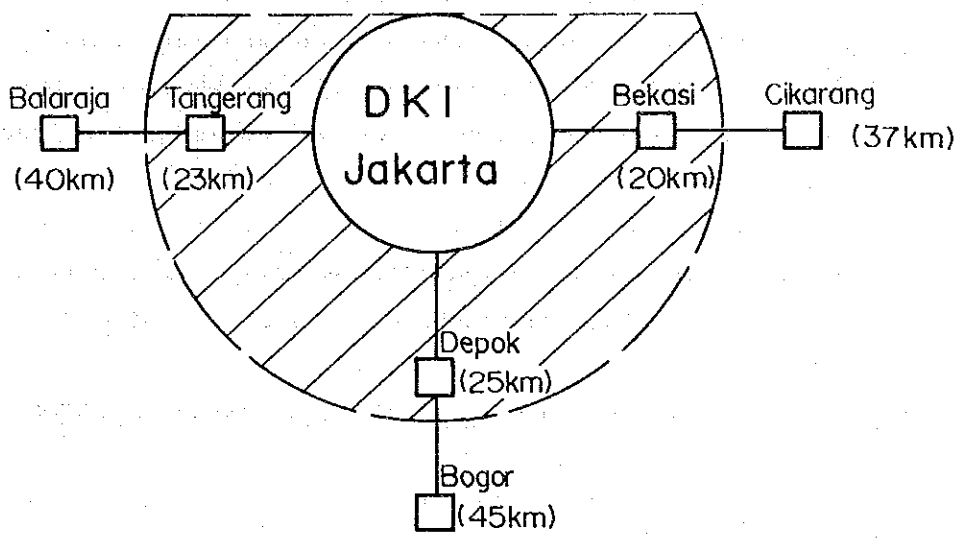
It is assumed that expenditure distribution closely represents income distribution of DKI Jakarta. The figures for 1985 were derived by extrapolating 1981 and 1984 SUSENAS[1/] data. The 2005 figures were derived from the 1985 figures assuming the annual growth rates of GRDP and per capita income at 8.5% and 3.7% respectively. Income distribution pattern was assumed to remain unchanged.

1/ SUSENAS: Social Economic National Survey conducted by BPS (the Central Bureau of Statistics)

(5) Concept of "Metropolitan Jakarta Area"

The Study proposes the concept of "Metropolitan Jakarta Area." Metropolitan Jakarta area is defined as the area within roughly 30 km from the central Jakarta as the following figure shows.

Metropolitan Jakarta Area



The concept is proposed based on the recent development trends of DKI Jakarta and the regional development policies. A prominent development trend of Jabotabek in recent years is the urbanization of Botabek area surrounding DKI Jakarta caused by spillovers of population and economic activities. It is anticipated that this trend continues in the coming decades particularly along the east-west corridor and such major urban areas in Botabek as Tangerang and Bekasi will be integrated into the expanding Jakarta urban area in the future.

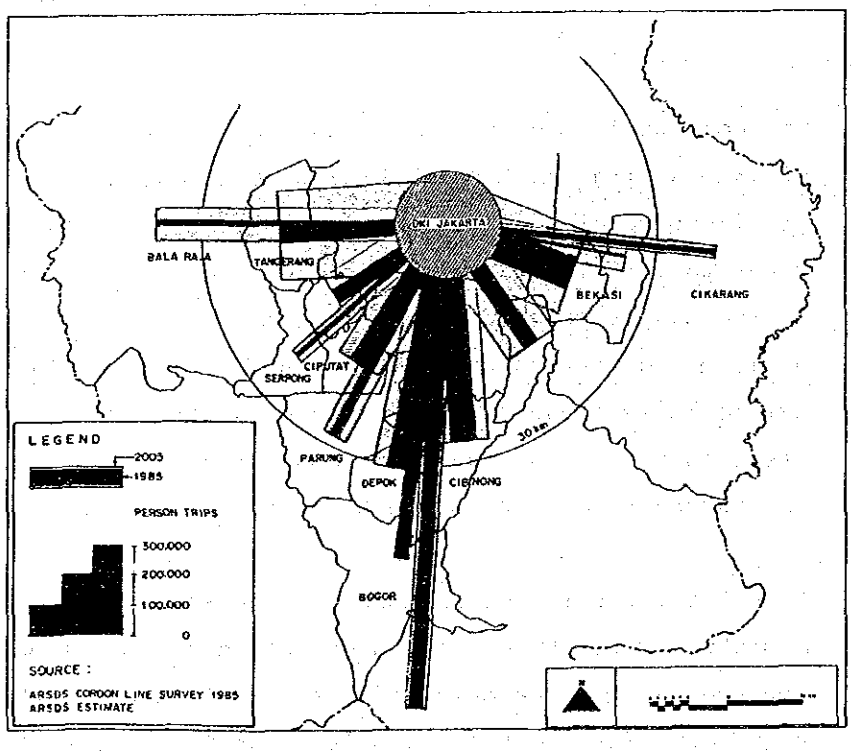
From the viewpoint of encouraging the maximum use of this growth momentum, mobility and means of communications should be enhanced within the Metropolitan Jakarta area. Enhancement of transportation and telecommunications facilities shall contribute to the vitalization of economic activities through attracting industrial and commercial activities in the Metropolitan Jakarta area.

Outside the Metropolitan Jakarta area, such growth centers as Balaraja, Cikarang and Bogor are to be developed as self-contained cities fairly independent of DKI Jakarta.

ARSDS carried out a person trip survey to analyze the present traffic volume and forecast the future trip pattern in Jabotabek. This data could be referred to as a basis for rough estimation of demand for telecommunications services. This is so because of the similarity of transportation and telecommunications services in that demands for both types of facilities take place among users at a number of different locations.

The following figure prepared by ARSDS presents person trip flows between Jakarta and Botabek in 1985 and 2005.

Person Trip Flows between DKI Jakarta and Botabek by ARSDS



This figure shows that in 1985 majority of person trips are directed to the south of Jabotabek, whereas those to east and west are relatively small in volume. In 2005, however, the trend reverses with the trips to east and west accounting for dominant part of the total trips. A common trend for the two years is that the number of person trips drastically falls as the distance from the central Jakarta surpasses 30 km. This implies that the limit of day-to-day frequent communications lies somewhere around 30 km from the central Jakarta. These findings imply that potential demand for telecommunications services is likely to follow the same pattern with the demand within 30 km radius accounting for dominant portion of the total demand. The concept of Metropolitan Jakarta area shall serve as a basis of the expansion of Jakarta multi-exchange area to be explained in Chapter 5.

3.2.3 Ongoing Projects and Plans

Interview surveys were carried out during the first field survey conducted between July and October, 1988 at central and local government officies to capture the progress of ongoing projects and plans in Jabotabek. While the regional development frameworks for the year 2005 serve as the long-range framework for telecommunications planning, information on ongoing projects and plans could be of use for shorter-term planning. The interviews were conducted at the following government offices:

- Cipta Karya, the Ministry of Public Works;
- Bappeda[1/] Kabupaten Bogor;
- Bappeda[1/] Kabupaten Tangerang; and
- Bappeda[1/] Kabupaten Bekasi.

Following are the findings of the interview surveys.

1/ Badan Perencanaan Pembangunan Daerah (Regional Development Planning Body)

(1) Kabupaten Bogor

a) Transfer of kabupaten office from Kotamadya Bogor to Cibinong will be partly implemented by October 1988. Construction of office buildings started in 1985 and is going on step by step. About 20% of the staff (about 240 out of 1,200) is planned to move to Cibinong in October. Kabupaten government is currently discussing the further implementation of the scheme on a joint-venture basis with private developers.

b) There is a plan to develop an industrial estate for labor intensive and pollution-free industries in Kecamatan Parung Panjang or Kecamatan Parung. The objective of the project is to stimulate development in the western part of the kabupaten. The project is planned to be initiated in the first year of Repelita V.

This project is planned in accordance with the kabupaten's policy to develop the eastern and western parts of the kabupaten and limit growth in the central kecamatans. Kabupaten Bogor has been adopting this policy following the presidential decisions (Keppres No. 48 in 1982 and No. 79 in 1985). Kecamatans where further growth should be limited are Ciawi, Cisarua, Kedung Halang, Semplak, Parung, Gunung Sindur, Sawangan, Cibinong, Cimanggis, Gunung Putri and Citeureup.

c) A new road project funded by the World Bank is planned that would connect Bekasi, Cileungsi, Jonggol, Cariu and Desa Ciranjang (outside Jabotabek). Survey is currently conducted.

d) New recreational development is planned in Kecamatan Cibung Bulang. The area will provide hot springs, waterfalls, panorama, camping facilities, etc. This project is aimed at tourists on daily excursions from Kotamadya Bogor or DKI

Jakarta. Therefore, no overnight accommodations are planned. The project is to be initiated during Repelita V.

(2) Kabupaten Tangerang

a) Bumi Serpong Damai (BSD) new town project in Serpong started in 1986 and the construction is currently going on in a 350 ha. area. In 2005, 400,000 inhabitants are expected to live in BSD.

b) Kabupaten office is planned to be transferred from Tangerang to Tigaraksa by 1992. At present the issue is waiting to be approved by the Ministry of Internal Affairs. The scheme is planned to be implemented on a joint-venture basis between Kabupaten Tangerang and private developers with the following role sharing.

Kabupaten Tangerang :
- already acquired 125 ha. land at Desa Kadu Agung
- pay for construction costs of office building

Private developers :
- construct government office
- develop housing units in surrounding areas
- construct a road connecting Cikupa and Desa Kadu Agung

(3) Kabupaten Bekasi

a) A new town project is going on in an area of 1,500 ha. in Bekasi Selatan. The new town is expected to accommodate 30,000 households (equivalent to about 150,000 population) in 2008. The new town is partly completed. Problems involved are drainage and land acquisition.

b) A private new town project started in 1986 in Bekasi Timur. A planned area is 1,500 ha., out of which 200 ha. will be for residential area and small-scale industries.

c) Private industrial estate projects are planned in Cibitung (2,000 ha.) and Cikarang (1,000 ha.). Lands will be purchased in the near future.

d) Real estate developments are planned in Cibitung (300 ha.), Bantar Gebang (700 ha.), Setu (300 ha.) and Tambun (700 ha.). Lands will be purchased in the next three years (1989 - 1991). The project will be completed up to 30% during Repelita V.

e) A review of "West Jawa Urban Development Project (WJUDP) in 1985" will start soon. WJUDP proposed a number of urban infrastructure projects for Kota Administratif Bekasi and Tangerang and Cikarang. The review will focus on priority assessment of the projects.

4. DEMAND/TRAFFIC FORECAST

4. DEMAND/TRAFFIC FORECAST

4.1 Demand Forecast

Demand forecasts for several telecommunications services are to be carried out to the following objective area and target years.

Objective area: Jabotabek area
Target years : 1994, 1999 and 2004

Regarding telephone demands in the objective area, the forecasts are made separately for DKI Jakarta and the remaining Botabek area.

4.1.1 Telephone Demand in DKI Jakarta

Telephone demand in DKI Jakarta is referred to and quoted from the study results prepared by PMC Option Services. The exchange macroscopic demands are summarized as follows.

	1994	1999	2004
DKI Jakarta[1/]	849,200	1,227,800	1,673,700

1/ Total 33 exchange areas based on present exchange boundaries, including CNE but excluding JIA.

Following are background information for the application of exchange macroscopic demands by PMC Option Services:

- microscopic demands by PMC Option Services justify, to a great extent, the exchange macroscopic ones;
- detailed design works for subscriber cable networks have been completed, based on the microscopic demand; and
- total macroscopic demand in 2004 coincides with reference demand estimated from the viewpoint of household affordability.

It is therefore suggested that the Study follows the exchange macroscopic demands in DKI Jakarta as well as at CNE exchange area,

which locates on the outskirts of DKI Jakarta, in order to harmonize the Study's framework with several ongoing and under-planning projects.

(1) Demand Estimates by PMC Option Services

PMC Option Services have estimated the telephone demands in DKI Jakarta by two approaches, i.e., macroscopic and microscopic ones. The exchange macroscopic demands estimate covers total 33 exchange areas, whereas the microscopic one, 17 exchange areas including additional two areas of KT3 and KL2.

a) Exchange Macroscopic Demand

Exchange macroscopic telephone demands by PMC Option Services were obtained by distributing city macroscopic demand, which had been approved by PERUMTEL through the Technical Meeting held on December 7, 1987, into each exchange area, in due consideration of present expressed telephone demand, population estimates, exchange area features and so forth.

ANNEX 4-1 presents the estimated results by exchange area in the years of 1992, 1997, 2002 and 2007.

b) Microscopic Demand

PMC Option Services executed microscopic demand forecasts for their objective areas. For that purpose, they first conducted in-depth field surveys as well as interviews to the specific customers to search the actual potential demands for telephone services. And then, they reviewed land use maps as of year 2005, which had been prepared by the municipality, to estimate the future trends. This kind of approach makes the study results reliable, to a great extent.

ANNEX 4-1 presents the microscopic demand values as well as the deviation rates of the exchange microscopic demand values to the macroscopic ones by exchange area.

When comparing both demand values, the discrepancies are found to be within the range of ±15% for all exchange areas where the in-depth surveys have been completed, as shown in ANNEX 4-1. Consequently, it is considered that the exchange macroscopic demands also be rather reliable and thus useful data, especially for long-term planning purpose.

Table 4.1 details the exchange-area-basis demand applied in the Study in 1994, 1999 and 2004. The demand values in each target year are obtained by applying an interpolation method to the original data by PMC Option Services given in ANNEX 4-1. Further modifications are made in the Study due to new establishment of exchange areas of KT3, KGP and KL2. Thus, the number of exchange areas is to increase by 3 to 36.

Table 4.1 Estimated Telephone Demand in DKI Jakarta

(Unit: x1,000)

Ex.	PMC Option Demand			From Botabek Area			Total		
Area	1994	1999	2004	1994	1999	2004	1994	1999	2004
KT1	16.0	18.9	21.8	0.0	0.0	0.0	16.0	18.9	21.8
KT2	46.5	60.5	77.5	0.0	0.0	0.0	46.5	60.5	77.5
KT3	54.9	62.9	71.8	0.0	0.0	0.0	54.9	62.9	71.8
PLT	37.4	45.8	52.0	0.0	0.0	0.0	37.4	45.8	52.0
CKG	26.5	38.9	55.0	0.0	0.0	0.0	26.5	38.9	55.0
ANC	21.9	36.5	54.8	0.0	0.0	0.0	21.9	36.5	54.8
GB1	54.1	57.5	60.0	0.0	0.0	0.0	54.1	57.5	60.0
GB2	41.6	59.2	80.2	0.0	0.0	0.0	41.6	59.2	80.2
SLP	33.6	47.6	64.9	0.0	0.0	0.0	33.6	47.6	64.9
SM1	30.5	47.1	64.0	0.0	0.0	0.0	30.5	47.1	64.0
SM2	44.2	71.0	96.0	0.0	0.0	0.0	44.2	71.0	96.0
PLM	33.3	49.2	67.5	0.0	0.0	0.0	33.3	49.2	67.5
KED	13.8	25.0	39.0	0.0	0.0	0.0	13.8	25.0	39.0
MER	8.2	17.1	28.1	0.0	0.0	0.0	8.2	17.1	28.1
TGA	5.3	7.4	10.2	0.0	0.0	0.0	5.3	7.4	10.2
CPP	32.7	47.7	65.8	0.0	0.0	0.0	32.7	47.7	65.8
RMG	37.6	54.0	67.4	0.0	0.0	0.0	37.6	54.0	67.4
KGD	19.8	29.0	36.6	0.0	0.0	0.0	19.8	29.0	36.6
KGP	3.0	3.0	3.0	0.0	0.0	0.0	3.0	3.0	3.0
PGG	9.8	20.9	41.4	0.0	0.0	0.0	9.8	20.9	41.4
TPR	18.0	27.5	39.0	0.0	0.0	0.0	18.0	27.5	39.0
CIL	7.0	14.0	25.0	0.0	0.0	0.0	7.0	14.0	25.0
KB	41.6	52.1	65.2	0.0	0.0	0.0	41.6	52.1	65.2
KBB	14.2	26.0	42.0	0.0	0.0	0.0	14.2	26.0	42.0
CPE	28.6	40.2	54.0	0.0	0.0	0.0	28.6	40.2	54.0
CNE	11.4	17.0	18.3	0.0	0.0	0.0	11.4	17.0	18.3
KL1	24.9	39.4	56.4	0.0	0.0	0.0	24.9	39.4	56.4
KL2	8.8	13.5	19.8	0.0	0.0	0.0	8.8	13.5	19.8
PSM	12.0	18.4	26.2	0.0	0.0	0.0	12.0	18.4	26.2
JAG	2.4	5.1	9.3	0.3	0.5	0.7	2.7	5.6	10.0
JT	37.0	51.8	70.0	0.0	0.0	0.0	37.0	51.8	70.0
CW	12.2	18.9	27.5	0.0	0.0	0.0	12.2	18.9	27.5
PSR	10.8	20.5	34.9	0.0	0.0	0.0	10.8	20.5	34.9
KLD	16.0	32.0	52.2	2.5	4.4	6.8	18.5	36.4	59.0
TB	27.6	41.0	58.5	0.0	0.0	0.0	27.6	41.0	58.5
GAN	6.0	11.2	18.4	0.2	0.3	0.5	6.2	11.5	18.9
Total	849.2	1,227.8	1,673.7	3.0	5.2	8.0	852.2	1,233.0	1,681.7

(2) Justification for Exchange Macroscopic Demands

The Study examines the following points for a rough justification of the exchange macroscopic demands estimated by PMC Option Services:

- population estimates by income group;
- monthly pulses per residential subscriber;
- affordability for telephone services; and
- non-residential telephone demand.

In this justification work, the Study focuses mainly on residential telephone demand and its future growth. This is because the penetration rate of residential telephones could be gradually raised in proportion to development of inhabitants' economic and social activities. Hence, a major and dominant factor in the case of long-term demand forecast.

As a result of this justification works, following are obtained for DKI Jakarta as of 1987 and 2004. Judged from these figures without large discrepancies, the exchange macroscopic demands by PMC Option Services are to be roughly justified as a whole from the economic aspect also.

	1987	2004
Exchange macroscopic demand:	451,000	1,650,000
Reference demand :	494,000	1,616,000

ANNEX 4-2 summarizes the comparison results between both demands by exchange area. The justification works are carried out by examining on several points described in the following.

a) Population Estimates by Income Group

As explained in Chapter 3, expenditure distribution data of ARSDS is used as a basis for deriving the number of population able to afford telephone services. The following table summarizes percent distribution of the DKI Jakarta

population by expenditure group in 2005. Expenditure distribution data is used as a proxy to the income distribution data.

Income Group	Per Capita Monthly Expenditure Amount (Rp.)	Percentage of Population(%) 1985	2005	Population (2005)
Low	below 18,250	47.5	6.2	741,600
Lower Middle	18,250 - 42,000	36.4	52.5	6,301,200
Upper Middle	42,000 - 140,000	12.2	34.0	4,078,800
High	over 140,000	3.9	7.3	878,400
Total		100.0	100.0	12,000,000

ANNEX 4-2 presents the estimated numbers of high and upper middle population by each exchange area in 1987 and 2004.

b) Monthly Pulses per Residential Subscriber

As a result of analyses on collected data from WITEL IV, the Study estimates the following range as monthly pulses per residential subscriber.

Estimated monthly pulses: 200 to 800 pulses per residential subscriber

Above figures are derived from the undermentioned findings.

Average monthly pulses per subscriber

Numbers of telephone subscribers in DKI Jakarta and total numbers of yearly produced pulses were as follows as of 1984.

Subscriber Category	No. of Sub. Lines	Total Yearly Pulses(x1,000)	Per-line Monthly Average
KREDIT	197,750	2,385,380	1,005
Payphone	1,344	60,537	3,753
DINAS	1,909	46,419	2,026
Total	201,003	2,492,336	(1,033)

The number of category "KREDIT" includes ordinary subscribers and PABX lines.

Originating traffic intensities

In order to estimate the numbers of monthly per-line pulses by ordinary subscriber and PABX line, the rate of originating traffic intensities of both lines is examined. Data on 26 switching units of PRX system in 1988 was referred to. The results are summarized below.

Subscriber Category	No. of PRX Sub. Lines	Originating Traffic (E)	Per-line Intensity(E)	Rate
Ordinary	174,936	8,942	0.051	1.00
PABX	13,960	2,483	0.178	3.49
Total	188,896	11,425	0.060	

The rate obtained above means one PABX line is traffic-wise equivalent to 3.49 ordinary subscribers. Therefore, 13,960 PABX lines could be treated as 48,720 ordinary subscriber lines. That is, total 188,896 PRX subscriber lines can be converted to 223,656 ordinary subscriber lines. In this case, the incremental rate of subscriber lines is 1.18 (223,656/188,896).

Upper limit in monthly per-line pulses

Assuming that there has not been a drastic change in the percent distribution of ordinary subscribers and PABX lines from 1984 to 1988, the incremental rate of 1.18 may well be applied to the aforementioned data in 1984. Based on this

assumption, the following results were obtained concerning the 1984 data.

- equivalent ordinary sub. : 233,350 (1.18 times)
- monthly pulses for ordinary sub.: 852
- monthly pulses for PABX lines : 2,973 (3.49 times)

Considering the present low telephone density in DKI Jakarta, large amount of ordinary telephones are highly likely being used for the purpose of business activities. Therefore this average number of pulses may well be treated as an upper limit of the residential subscribers.

Lower limit in monthly per-line pulses

Apart from the preceding analysis, ANNEX 4-3 presents the numbers of monthly pulses produced per subscriber of each existing switching unit. The data as of 1984 are summarized as follows. The existing exchange areas are classified by a parameter of relative residential area ratios, which are quoted from Basic Design Reports by PMC Option Services.

Residential Area Ratio (%)	Average Monthly Pulses per Subscribers
100 - 75	386 (CPA) - 1,234 (GAN)
75 - 50	510 (ANC) - 1,018 (CPP)
50 - 25	1,306 (GB2) - 1,555 (GB2)
25 - 0	698 (KT2) - 1,866 (GB1)

The following findings are derived from the above.

- Case of CPA;
  Even from pure residential telephone, minimum 200 - 300 pulses could be expected to be produced.

- Case of GAN;
  Even in the area with very high residential ratio, low penetration and/or extreme shortage of telephones could raise the average pulses.

- Case of GB2;
  GB2 exchange area has considerably stable traffic sources such as governmental offices and public administrations.

- Case of KT2;
  From KT2 exchange area, where commercial activities are dominant, large amount of pulses may not be produced, contrary to general expectations.

In the result, the Study estimates 200 pulses as a lower limit in monthly produced pulses from pure residential telephone, in due consideration of the case of CPA.

c) Minimum Payment for Calling Charge

As for calling charge per pulse, the rate has been changed in recent years as follows:

In 1979 : from Rp. 20 to Rp. 40
In 1980 : from Rp. 40 to Rp. 50
In 1981 : from Rp. 50 to Rp. 60
In 1985 : from Rp. 60 to Rp. 75

Minimum payment for calling charge in 1984 is estimated to be around Rp. 12,000 per subscriber per month, based on:

- Rp. 60 as the rate per pulse, and;
- 200 pulses per subscriber as minimum production.

d) Affordability for Telephone Services

In order to examine the affordability for telephone services, personal expenditure pattern is analyzed. Fig. 4.1 illustrates per capita monthly expenditure patterns in 1984 by urban and rural areas of Indonesia.

The payment for monthly calling charge of telephone services as well as commodities' expense and daily transportation fare is considered to be covered by the expenditure on miscellaneous goods and services. Table 4.2 gives expenditure on miscellaneous goods and services per person and per household and percent distribution of population in 1984. In Table 4.2, one household is assumed to have 4.4 members on average.

Judging from the preceding minimum payment of Rp. 12,000 for calling charge and the household expenditure amounts on miscellaneous goods and services, following potentialities to pure residential telephone demand are expected.

Per Capita Expenditure Class (Rp.)	Household Expenditure Amount on Miscellaneous Goods/Services (Rp.)	Potentiality for Telephone Demand
below 40,000	-	impossible
40,000-59,000	35,446	highly conditional
60,000-79,000	57,944	fairly conditional
over 80,000	103,699	non-conditional

The Study assumes per capita expenditure class of Rp. 40,000 as minimum level at which inhabitants might be able to afford telephone services. Table 4.2 shows the proportion of the population or households able to afford telephone services would be 24% at most in 1984.

In reality, the proportion would likely be lower. For the third highest class (Rp. 40,000 - 59,000), monthly payment of Rp. 12,000 for telephone services is equivalent to about 34% of household expenditure (Rp. 35,446) on miscellaneous

goods and services. Considering the relatively high importance of expense to transportation and commodities, it would not be easy for households of this class to afford telephone services. It would be therefore likely that only a limited portion of this class which keenly needs telephone services are actually willing and able to afford telephone services.

The Study estimates that both upper middle and high income groups by ARSDS projection have possibility of being able to afford telephone services. For these two groups, per capita monthly income is over Rp. 42,000. The Study, therefore, assumes the following inhabitants' affordability for telephone services in DKI Jakarta.

In 1984: around 16% of population or households
In 2004: around 40% of population or households

e) Non-Residential Demand Ratio

The Study examines the relation between the telephone demand potentialities from residential area and from office/commercial/industrial areas. In this regard, JTP '79 Report (JICA) gives the useful and detailed base data, which were obtained by in-depth survey for all exchange areas, e.g., telephone demands and the numbers of population, official buildings, commercial buildings and residential houses.

The Study selects the population and the total number of office-use, commercial-use and industrial buildings en bloc as explanatory variables and then executed a regression analysis. The derived equation is as follows.

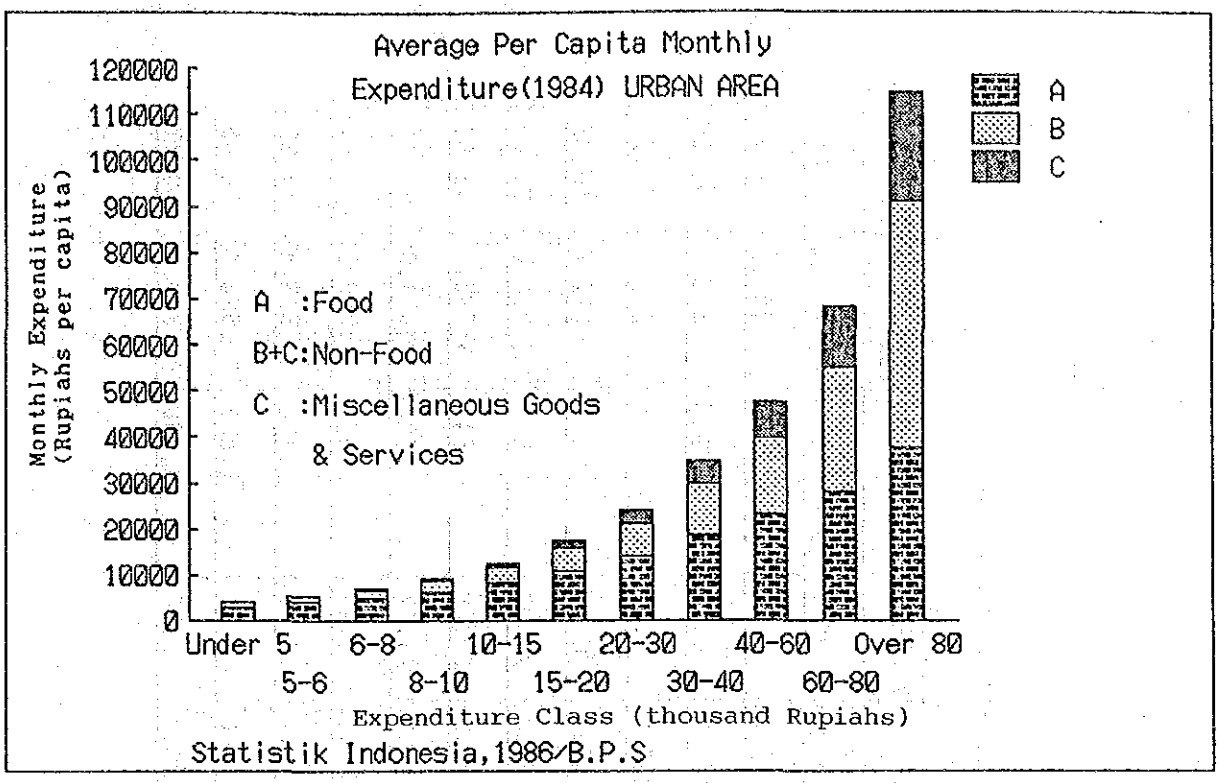
$$DMND = -482.8975 + 3.2477 \times (BLD) + 0.0155 \times (POP) + 15241.758 \times (DMY) \quad (r = 0.9679)$$

where, DMND: Telephone demand value estimated
BLD : No. of official/commercial/industrial buildings
POP : No. of population
DMY : Dummy variable for GB1 and GB2 exchange areas (1 for GB1 and GB2, 0 for others)
r : Correlation coefficient

ANNEX 4-4 illustrates the results as well as the base data quoted from JTP '79 Report.

Comparing two estimated values demanded from population source and the number of several buildings source, the relative contribution degree of both parameters is to be obtained, because the constant term of the above regression model is negligibly small. The values obtained from dummy term for GB1 and GB2 exchange areas are to be added to those from several buildings source, due to the specific features of GB1 and GB2 exchange areas.

By using these demand-increasing-rates, which convert residential demands into total demands, the Study estimates the reference demands in each exchange area in 1987 and 2004, as shown in ANNEX 4-2.



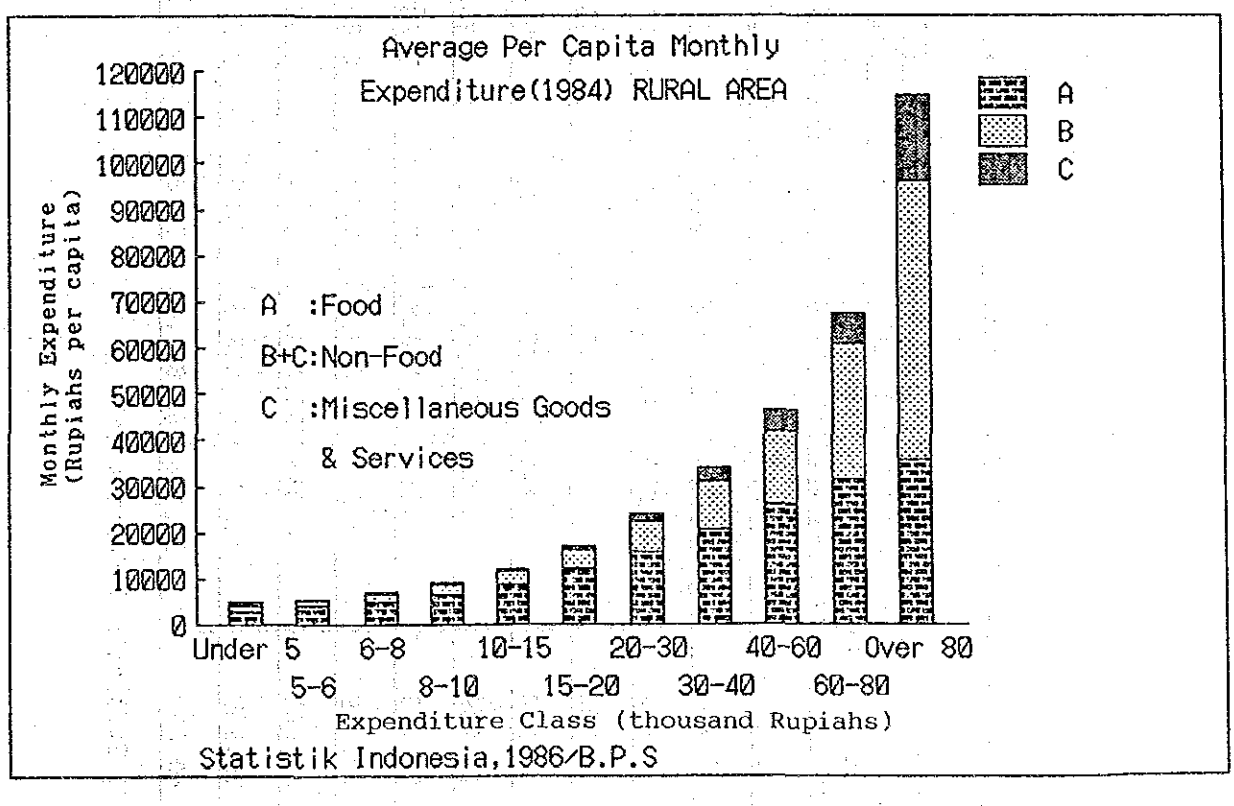


Fig. 4.1 Per Capita Monthly Expenditure Pattern

Table 4.2 Per Capita Expenditure Amount on Miscellaneous Goods and Services

Expenditure Class (Rupiahs per capita per month)	Expenditure on Miscellaneous Goods and Services (Rupiahs per month per capita)								
	DKI Jakarta			Jawa Barat (Urban)			Jawa Barat (Rural)		
	Personal Expenditure	Household Equivalent	% POP.	Personal Expenditure	Household Equivalent	% POP.	Personal Expenditure	Household Equivalent	% POP.
below 5,000	121	532.4	0.00	121	532.4	0.18	98	431.2	0.70
5,000 - 5,999	193	849.2	0.00	193	849.2	0.45	155	682.0	1.60
6,000 - 7,999	325	1,430.0	0.15	325	1,430.0	2.47	221	972.4	7.68
8,000 - 9,999	488	2,147.2	0.26	488	2,147.2	6.69	312	1,372.8	15.45
10,000 - 14,999	949	4,175.6	7.91	949	4,175.6	22.22	500	2,200.0	37.83
15,000 - 19,999	1,708	7,515.2	17.29	1,708	7,515.2	20.23	849	3,735.6	18.99
20,000 - 29,999	2,982	13,120.8	32.19	2,982	13,120.8	24.97	1,585	6,974.0	12.81
30,000 - 39,999	4,956	21,806.4	17.88	4,956	21,806.4	9.95	2,950	12,980.0	3.04
40,000 - 59,999	8,056	35,446.4	14.84	8,056	35,446.4	8.08	4,736	20,838.4	1.38
60,000 - 79,999	13,169	57,943.6	5.65	13,169	57,943.6	2.40	6,521	28,692.4	0.35
Over 80,000	23,568	103,699.2	3.83	23,568	103,699.2	2.35	18,600	81,840.0	0.17

Source : Statistik Indonesia 1986

4.1.2 Telephone Demand in Botabek Area

At present, telephone services are not rendered by PERUMTEL in almost all Botabek area, except relatively big cities/towns like Bogor, Tangerang and Bekasi. It is therefore impossible to use the past records concerning telephone demand for its estimation except such big cities/towns. Thus, the Study intends to apply the same procedures as taken for justification of PMC Option Services' estimates in DKI Jakarta to the demand projection for Botabek area.

The results estimated by the Study are summarized below and detailed in Table 4.3.

	1994	1999	2004
Kodya. & Kab. Bogor	81,900	136,500	203,200
Kab. Tangerang[1/]	61,200	116,200	188,800
Kab. Bekasi	42,200	78,400	125,500
Total Botabek	185,300	331,100	517,500

1/ Including JIA exchange area.

The following sub-sections explain the assumptions and processes taken for the estimation of telephone demand in Botabek area. The outputs of each process are also included in Table 4.3.

Table 4.3 Demand Forecast and Population Estimates in Botabek Area
(Kotamadya Bogor & Kabupaten Bogor) (1/3)

No.	Kecamatan	Population 1985		Pop.1994	Pop.1999	Pop.2004	Residential Demand			Incr.	Total Demand		
		Total	(Urban)	(Urban)	(Urban)	(Urban)	1994	1999	2004	Rate	1994	1999	2004
1	Kodya Bogor	245,000	245,000	311,316	348,158	385,000	8,490	13,452	19,250	2.2	18,678	29,594	42,350
2	Semplak	123,000	102,000	129,474	144,737	160,000	3,531	5,592	8,000	1.0	3,531	5,592	8,000
3	Kedung Halang	132,000	109,000	138,368	154,684	171,000	3,774	5,976	8,550	1.1	4,151	6,574	9,405
4	Ciomas	217,000	180,000	228,789	255,895	283,000	6,240	9,887	14,150	1.0	6,240	9,887	14,150
5	Jasinga	67,000	3,000	37,105	56,053	75,000	1,012	2,166	3,750	1.0	1,012	2,166	3,750
6	Cigudeg	86,000	4,000	15,842	22,421	29,000	432	866	1,450	1.1	475	953	1,595
7	Parung Panjang	69,000	3,000	37,105	56,053	75,000	1,012	2,166	3,750	1.1	1,113	2,383	4,125
8	Rumpin	61,000	3,000	11,526	16,263	21,000	314	628	1,050	1.1	345	691	1,155
9	Leuwiliang	96,000	25,000	41,579	50,789	60,000	1,134	1,962	3,000	1.1	1,247	2,158	3,300
10	Cibung Bulang	144,000	37,000	62,105	76,053	90,000	1,694	2,938	4,500	1.0	1,694	2,938	4,500
11	Ciampea	101,000	26,000	36,421	42,211	48,000	993	1,631	2,400	1.0	993	1,631	2,400
12	Nanggun	45,000	12,000	16,737	19,368	22,000	456	748	1,100	1.0	456	748	1,100
13	Cijeruk	99,000	71,000	84,737	92,368	100,000	2,311	3,569	5,000	1.1	2,542	3,926	5,500
14	Ciawi	89,000	64,000	76,789	83,895	91,000	2,094	3,241	4,550	1.0	2,094	3,241	4,550
15	Cisarua	104,000	74,000	88,684	96,842	105,000	2,419	3,742	5,250	1.0	2,419	3,742	5,250
16	Caringin	59,000	42,000	50,526	55,263	60,000	1,378	2,135	3,000	1.0	1,378	2,135	3,000
17	Jonggol	110,000	11,000	41,316	58,158	75,000	1,127	2,247	3,750	1.0	1,127	2,247	3,750
18	Cariu	62,000	6,000	19,737	27,368	35,000	538	1,057	1,750	1.0	538	1,057	1,750
19	Citeureup	116,000	35,000	41,632	45,316	49,000	1,135	1,751	2,450	1.1	1,249	1,926	2,695
20	Gunung Putri	59,000	18,000	33,632	42,316	51,000	917	1,635	2,550	1.2	1,100	1,962	3,060
21	Cileungsi	100,000	31,000	111,053	155,526	200,000	3,029	6,009	10,000	1.1	3,332	6,610	11,000
22	Cimanggis	112,000	57,000	70,263	77,632	85,000	1,916	2,999	4,250	1.1	2,108	3,299	4,675
23	Cibinong	80,000	64,000	76,316	83,158	90,000	2,081	3,213	4,500	1.2	2,497	3,856	5,400
24	Sukma Jaya	123,000	98,000	146,316	173,158	200,000	3,990	6,690	10,000	2.2	8,778	14,718	22,000
25	Beji	41,000	33,000	49,105	58,053	67,000	1,339	2,243	3,350	2.2	2,946	4,935	7,370
26	Pancoran Mas	81,000	65,000	97,211	115,105	133,000	2,651	4,447	6,650	2.0	5,302	8,894	13,300
27	Bojong Gede	98,000	43,000	51,526	56,263	61,000	1,405	2,174	3,050	1.0	1,405	2,174	3,050
28	Parung	100,000	8,000	51,579	75,789	100,000	1,407	2,928	5,000	1.1	1,548	3,221	5,500
29	Gunung Sindur	39,000	3,000	15,789	22,895	30,000	431	885	1,500	1.0	431	885	1,500
30	Sawangan	102,000	8,000	42,105	61,053	80,000	1,148	2,359	4,000	1.0	1,148	2,359	4,000
Total		2,960,000	1,480,000	2,214,683	2,622,843	3,031,000	60,398	101,336	151,550		81,877	136,502	203,180

Table 4.3 Demand Forecast and Population Estimates in Botabek Area
(Kabupaten Tangerang) (2/3)

No.	Kecamatan	Population 1985		Pop.1994	Pop.1999	Pop.2004	Residential Demand			Incr.	Total Demand		
		Total	(Urban)	(Urban)	(Urban)	(Urban)	1994	1999	2004	Rate	1994	1999	2004
1	Tangerang	135,000	135,000	230,684	283,842	337,000	6,291	10,967	16,850	2.4	15,098	26,321	40,440
2	Cipondoh	73,000	57,000	97,263	119,632	142,000	2,653	4,622	7,100	1.1	2,918	5,084	7,810
3	Batu Ceper	97,000	85,000	139,000	169,000	199,000	3,791	6,530	9,950	1.2	4,549	7,836	11,940
4	Serpong	83,000	16,000	316,316	483,158	650,000	8,627	18,667	32,500	1.2	10,352	22,400	39,000
5	Ciputat	154,000	87,000	164,211	207,105	250,000	4,478	8,002	12,500	2.0	8,956	16,004	25,000
6	Ciledug	95,000	18,000	33,158	41,579	50,000	904	1,606	2,500	1.0	904	1,606	2,500
7	Pondok Aren	56,000	11,000	76,842	113,421	150,000	2,096	4,382	7,500	1.0	2,096	4,382	7,500
8	Teluknaga	98,000	7,000	16,474	21,737	27,000	449	840	1,350	1.1	494	924	1,485
9	Kresek	56,000	4,000	9,684	12,842	16,000	264	496	800	1.0	264	496	800
10	Kronjo	55,000	4,000	9,684	12,842	16,000	264	496	800	1.0	264	496	800
11	Mauk	92,000	7,000	16,474	21,737	27,000	449	840	1,350	1.0	449	840	1,350
12	Sepatan	114,000	9,000	21,316	28,158	35,000	581	1,088	1,750	1.0	581	1,088	1,750
13	Rejeg	52,000	4,000	9,684	12,842	16,000	264	496	800	1.0	264	496	800
14	Curug	45,000	1,000	47,895	73,947	100,000	1,306	2,857	5,000	1.1	1,437	3,143	5,500
15	Legok	76,000	2,000	58,842	90,421	122,000	1,605	3,494	6,100	1.1	1,766	3,843	6,710
16	Cikupa	76,000	2,000	48,421	74,211	100,000	1,321	2,867	5,000	1.2	1,585	3,440	6,000
17	Pasar Kemis	57,000	2,000	29,474	44,737	60,000	804	1,728	3,000	1.2	965	2,074	3,600
18	Jati Uwung	82,000	2,000	58,842	90,421	122,000	1,605	3,494	6,100	1.2	1,926	4,193	7,320
19	Balaraja	67,000	0	47,368	73,684	100,000	1,292	2,847	5,000	1.1	1,421	3,132	5,500
20	Tigaraksa	57,000	0	74,842	116,421	158,000	2,041	4,498	7,900	1.1	2,245	4,948	8,690
21	Cisoka	67,000	0	7,579	11,789	16,000	207	456	800	1.0	207	456	800
-	(JIA Cengkareng)										2,500	3,000	3,500
	Total	1,687,000	453,000	1,514,053	2,103,526	2,693,000	41,292	81,273	134,650		61,241	116,202	188,795

Table 4.3 Demand Forecast and Population Estimates in Botabek Area
(Kabupaten Bekasi) (3/3)

No.	Kecamatan	Population 1985		Pop.1994	Pop.1999	Pop.2004	Residential Demand			Incr.	Total Demand		
		Total	(Urban)	(Urban)	(Urban)	(Urban)	1994	1999	2004	Rate	1994	1999	2004
1	Bekasi Barat	69,000	60,000	92,211	110,105	128,000	2,515	4,254	6,400	2.4	6,036	10,210	15,360
2	Bekasi Utara	31,000	27,000	41,211	49,105	57,000	1,124	1,897	2,850	2.2	2,473	4,173	6,270
3	Bekasi Timur	75,000	66,000	101,053	120,526	140,000	2,756	4,657	7,000	2.2	6,063	10,245	15,400
4	Bekasi Selatan	94,000	82,000	125,579	149,789	174,000	3,425	5,787	8,700	2.4	8,220	13,889	20,880
5	Pondok Gede	129,000	38,000	162,105	231,053	300,000	4,421	8,927	15,000	1.1	4,863	9,820	16,500
6	Jati Asih												
7	Tambun	97,000	38,000	67,368	83,684	100,000	1,837	3,233	5,000	1.1	2,021	3,556	5,500
8	Lemahabang	97,000	15,000	31,579	40,789	50,000	861	1,576	2,500	1.1	947	1,734	2,750
9	Cibitung	93,000	14,000	29,632	38,316	47,000	808	1,480	2,350	1.1	889	1,628	2,585
10	Cikarang	111,000	17,000	245,789	372,895	500,000	6,703	14,407	25,000	1.1	7,373	15,848	27,500
11	Kedung Waringin												
12	Setu	49,000	0	4,263	6,632	9,000	116	256	450	1.0	116	256	450
13	Cibarusa	48,000	0	4,263	6,632	9,000	116	256	450	1.0	116	256	450
14	Serang	53,000	0	4,737	7,368	10,000	129	285	500	1.0	129	285	500
15	Bantar Gebang	40,000	0	47,368	73,684	100,000	1,292	2,847	5,000	1.1	1,421	3,132	5,500
16	Tarumajaya	29,000	0	5,211	8,105	11,000	142	313	550	1.0	142	313	550
17	Babelan	49,000	0	9,000	14,000	19,000	245	541	950	1.1	270	595	1,045
18	Sukatani	66,000	0	12,316	19,158	26,000	336	740	1,300	1.0	336	740	1,300
19	Pebayuran	54,000	0	9,947	15,474	21,000	271	598	1,050	1.0	271	598	1,050
20	Cabangbungin	34,000	0	6,158	9,579	13,000	168	370	650	1.0	168	370	650
21	Tambelan	48,000	0	9,000	14,000	19,000	245	541	950	1.0	245	541	950
22	Muara Gebong	16,000	0	2,842	4,421	6,000	78	171	300	1.0	78	171	300
Total		1,282,000	357,000	1,011,632	1,375,315	1,739,000	27,588	53,136	86,950		42,177	78,360	125,490

(1) Basic Information for Demand Forecast

The following points are studied here as base data for telephone demand forecast in Botabek area:

- household affordability for telephone services;
- urban population estimates; and
- housing development plans.

a) Household Affordability for Telephone Services

The Study sets forth the following affordability level for telephone services in Botabek area, especially for its urban area:

Per capita monthly expenditure amount: around Rp. 60,000

The above estimate is derived from the following findings.

As far as expenditure pattern is concerned, Fig. 4.1 proves that rural inhabitants consume less portion of their income on miscellaneous goods and services, even though they earn the same amount of income as urban inhabitants. Hence, less affordability for having telephones is assumed for rural inhabitants than for urban inhabitants.

As shown in Table 4.2, urban inhabitants with the expenditure amount of Rp. 60,000 and more form 4.75% to the total, whereas corresponding rural inhabitants account for 0.52% only. This means that the affordable magnitude in rural area could nearly be one tenth of that in urban area. Additionally, when taking into account the actual expenditure on miscellaneous goods and services, the difference in both affordable magnitudes is to be considerably enlarged. It is therefore concluded that the residential telephone demands will mostly come from urban population and the demands in rural area are considered to be negligibly small.

In Fig. 4.1, Botabek urban inhabitants are classified as population in "urban area" together with those in DKI Jakarta. In reality, there seem to be some economic differentials between inhabitants in both areas. The economic level of Botabek inhabitants would be lower than that of DKI Jakarta. The Study, therefore, assumes the minimum expenditure amount of Rp. 60,000 as affordability level for telephone services in urban areas in Botabek area, instead of Rp. 42,000 in the case of DKI Jakarta.

b) Urban Population Estimates

Regarding the population and its growth in Botabek area, the relevant data are available in ARSDS[1/], in which estimation was made for urban population and rural population separately at each planning zone. The ARSDS's projection tried to distribute the total kabupaten population set by Jabotabek Structure Plan to each planning zone. The urban population of each zone estimated by ARSDS is roughly equivalent to the target population of each growth center set by Jabotabek Structure Plan, as shown in ANNEX 4-5.

The Study distributes the target population of the growth centers for 2005 into those of each kecamatan, referring to ARSDS estimates, in principle. The distributed urban population are presented in Table 4.3.

1/ ARSDS: "Arterial Road System Development Study" JICA, 1987

c) Housing Development Plans

As listed in ANNEX 3-3, a large number of housing development plans have been given permissions as of 1987. The actual implementation of these development plans could give a certain degree of influence on the future telephone demand, because such new dwellers are likely to be classified as urban population with relatively high income level.

The Study assumes that growth of urban population up to the estimated 2004 level will follow the linear growth pattern. Though, in reality, growth of urban population might proceed faster or slower than the assumed linear pattern as real estate and housing projects proceed, these conditions should be taken into account and the master plan be refined at the implementation stage. For the purpose of master planning, it would be reasonable to assume linear growth trend.

(2) Macroscopic Demand Forecast

Based on the aforementioned assumptions and conditions, telephone demands in Botabek area are obtained. However, some adjustments were made for exchange areas where telephone services have been provided by PERUMTEL, in due consideration of the existing expressed demands.

a) Residential Telephone Demand

Provided that per capita expenditure amount will increase with an constant and uniform growth rate of 3.9% per annum for Botabek urban population as estimated by ARSDS, the growth in expenditure amount level in Table 4.2 is to shift without any changes in percent distribution of population, as shown in Table 4.4.

Considering the per capita expenditure amount of Rp. 60,000 as minimum affordability level for telephone services, telephone services are estimated to be affordable for following proportions of Botabek urban population.

In 1994 : 12%
In 1999 : 17%
In 2004 : 22%

Thus, the above approximation is to give the residential telephone demands in each target year, on condition that 4.4 families share one telephone on average.

b) Non-Residential Telephone Demand

Taking into consideration the progress of industrial projects, some allowances are added to the estimated residential demands in each kecamatan in the manner mentioned below.

Fig. 3.5 and ANNEX 3-3 show areas given permission for industrial projects by kecamatan. It should be noted, however, that industrial area hardly affects telephone demand. The dominant factor for telephone demand forecast is the number of factories rather than the occupied land space. The following allowances are taken into consideration in the Study.

(Number of factories with permission) $\geq$ 10: 20% increment
(Number of factories with permission) $<$ 10: 10% increment

As for the administrative centers in Botabek area, no allowance is given in the Study. This is because administrative offices are mostly small to medium scale and their telephone demands remain constant in most cases.

In the case of DKI Jakarta, the figure in ANNEX 4-4 gives the ratio of the expressed demands to the residential demands for each exchange area. At almost all exchange areas, the incremental rates of the demands which are created by non-residential areas are limited within the maximum 50% of residential demands. In this case, however, 50% increment is assumed to come mainly from office buildings and/or trading activities. This assumption is proved by the fact that in the area where the residential area is dominant, such an increment is within the range of around 30%.

In addition to the above allowances, 20% increment is taken into account for Kecamatan Serpong, because of its specific features as academic and research institute area.

c) Further Adjustment for Demand

The preceding estimations are based on the average expenditure level of total Botabek urban population. Treating all Botabek urban areas in an uniform manner, however, might lead to underestimation of demands in relatively advanced kecamatans like Tangerang and Bekasi.

In order to check this point, a comparison is made between the obtained demands and actual expressed demands at the following exchange areas, all of which are the leading cities/towns in Botabek area. The following table shows the comparison results.

Expressed/Estimated Demand in 1988

Ex. Area	Expressed Demand	Estimated Demand	Adjacent Kecamatans Covered
TAN	10,111	4,500	Cipondoh, Batu Ceper, Jati Uwung
CPA	6,415	2,500	
BEK	9,256	7,000	(stopped marketing in 1986)
BOO	15,887	6,000	Semplak, Kedung Halang, Ciampea, Ciawi
DEP	4,223	5,000	
CIB	2,097	1,500	Bojong Gede, Citeureup

Above figures show that the expressed demands are almost two times larger than the estimated demands in most exchange areas. These discrepancies are most likely derived from the assumption that the major Botabek cities/towns above are not at the economic level equivalent to other Botabek urban areas.

In consideration of the actual economic level of these Botabek cities/towns, it would be more reasonable to assume the same portion of households being able to afford telephone services for above cities/towns as that for DKI Jakarta: 40% instead of 22% (2004). This point is reinforced by the actual discrepancies between the expressed and estimated demands in the table above. Thus adjustments

are made by doubling the above estimated demands except CIB exchange area. In the case of DEP, however, the doubling adjustment is made, referring to the microscopic demand forecasted by ITB.

Telephone demand of JIA exchange area in Kabupaten Tangerang, which covers a limited area of Jakarta International Airport (Soekarno Hatta), was estimated in a manner different from that for other Botabek area. The telephone subscribers in JIA seem to increase not so much up to 2004, due to the specific subscribers category, that is, business-use subscribers only related to the airport operation. In fact, the number of subscribers of JIA has been rather stably changed without any waiting applicants, in the past few years. The Study estimates the telephone demand for JIA as follows:

	1994	1999	2004
JIA telephone demand:	2,500	3,000	3,500

Table 4.4 Estimated Personal Income (at 1984 constant price)

Urban Botabek (Growth Rate : 3.9% per annum)

1984	1994	1999	2004	Percent Population
below 5,000	below 7,330	below 8,876	below 10,747	0.18
5,000 ~ 5,999	7,330 ~ 8,795	8,876 ~ 10,650	10,747 ~ 12,895	0.45
6,000 ~ 7,999	8,796 ~ 11,728	10,651 ~ 14,200	12,896 ~ 17,194	2.47
8,000 ~ 9,999	11,729 ~ 14,660	14,201 ~ 17,750	17,195 ~ 21,493	6.69
10,000 ~ 14,999	14,661 ~ 21,990	17,751 ~ 26,626	21,494 ~ 32,240	22.22
15,000 ~ 19,999	21,991 ~ 29,320	26,627 ~ 35,502	32,241 ~ 42,986	20.23
20,000 ~ 29,999	29,321 ~ 43,981	35,503 ~ 53,253	42,987 ~ 64,480	24.97
30,000 ~ 39,999	43,982 ~ 58,642	53,254 ~ 71,005	64,481 ~ 85,974	9.95
40,000 ~ 59,999	58,643 ~ 87,963	71,006 ~106,508	85,975 ~128,961	8.08
60,000 ~ 79,999	87,964 ~117,285	106,509 ~142,010	128,962 ~171,950	2.40
Over 80,000	Over 117,285	Over 142,010	Over 171,950	2.35

4.1.3 Non-Voice Services Demand

As for non-voice telecommunications services, the Study estimated the demand for data communications and telex services.

(1) Data Communications

At present, data communications services are rendered by PERUMTEL providing leased circuits or Packet Switched Public Data Network (called "SKDP"/Sambungan Komunikasi Data Packet). Based on the collected data shown in Fig. 7.3 and 7.4, it is featured that almost all data communications subscribers by leased circuits are concentrated in DKI Jakarta.

Although these two figures show rapid increase in the number of subscribers during the past few years, such a sharp uptrend is not applicable to the long-term demand estimation due to the short-term service period as in the introduction stage.

The estimation for these kinds of new services usually needs detailed market survey including direct interviews to collect fairly reliable base data. The market research for data/text communications was carried out by other study team and then integrated into "Strategic Development Plan for Data Communications/POSTEL, 1988". Shown below is the forecasted demand for data communications in Strategic Development Plan.

	1989	1993	2000	Growth Rate (1993-2000)
Leased circuits[1/] :	462	593	857	5.40%
SKDP subscribers[1/]:	261	596	1,265	11.35%

1/ Including international subscribers and showing optimistic cases.

Applying the above growth rates, following are obtained:

	1994	1999	2004
Leased circuits :	630	810	1,060
SKDP subscribers:	660	1,140	1,940

(2) Telex Terminals

The number of telex terminals in DKI Jakarta has increased at 13.2% of growth rate per annum on average from 1979 to 1987 as shown in Table 7.2.

In Table 7.2, the lowest one-year growth rate was observed in 1984 - 1985 period as 4.3%. At the end of 1985, the number of telex subscribers in DKI Jakarta reached 5,407, which occupied 98.3% of the capacity of telex switches (5,500 l.u.). The implication of this fact is that the lowest growth rate reflected the shortage of switch capacity against requirement for new lines connection. The growth rate in the years after 1985 recovered as shown below.

	1983	1984	1985	1986	1987
Telex switch capacity :	5,300	5,500	5,500	6,800	n.a.
No. of telex terminals:	4,835	5,186	5,407	6,075	6,549
Switch occupation (%) :	91.2	94.3	98.3	89.3	-
One-year growth (%) :	-	7.3	4.3	12.4	7.8

On the other hand, the Long Term Plan (JICA, 1988) estimated the nationwide telex demand up to the year 2004, as follows.

	1986	1994	1999	2004
No. of telex terminals :	11,738	38,281	59,412	83,245
Growth rate (%) per annum:	-	15.9	9.2	7.0

Per annum growth rate above implicates telex subscribers' willingness to introduce new services like facsimile and data communications services.

As for Jakarta, it could be said that the number of telex subscribers will increase steadily for the time being but the growth rate will slow down gradually.

Considering the above, the Study applies the following growth rate for the estimation of telex subscribers.

	1987	1994	1999	2004
Growth rate (%) per annum:	-	8%[1/]	7%	6%
No. of telex terminals :	6,549	11,200	15,700	21,000

1/ Based on the average growth rate of 7.9% from 1983 to 1987.

4.2 Traffic Forecast

In the Study, forecast is made for telephone traffic comprising local traffic, SLDD traffic and suburban traffic as well as data communications traffic. Moreover, interexchange local traffic is also estimated for Jakarta and Bogor multi-exchange areas.

4.2.1 Telephone Traffic

Telephone traffic is estimated separately for local traffic, SLDD traffic and suburban traffic, based on the analyses on the past traffic measured by each category.

As a result, following traffic intensities and traffic volumes are estimated in the expanded Jakarta multi-exchange area:

	1994	1999	2004
(Averaged traffic intensity)			
- local (mE)	49.1	48.1	47.7
- SLDD (mE)	4.02	3.79	3.66
- suburban (mE)	0.27	0.25	0.25
(Total traffic volume)			
- local (E)	46,600	68,900	95,200
- SLDD (E)1/	3,800(x2)	5,400(x2)	7,300(x2)
- suburban (E)1/	260(x2)	360(x2)	490(x2)

1/ Total traffic volume be doubled for outgoing and incoming directions.

Following sub-sections explain the actual analysis methods and estimation processes.

(1) General Traffic Characteristics

The Study analyzes the traffic data and produced pulses data collected during the field survey, to grasp general traffic characteristics in present Jakarta multi-exchange area.

a) Past Trend of Originating Traffic Intensity

The Study analyzes the traffic data as of 1987 provided by TRAFIKTEL. These base data are of four-time measured records in that year, hence, rather reliable.

After averaging these data by exchange area, a comparison is made with past few years data, which are quoted from the Study Report for OECF JKT PCM Phase 2 Project. The results are summarized in Table 4.5 and also illustrated in Fig. 4.2.

The figures indicate that the average traffic intensities have been changed stably at almost all exchange areas in DKI Jakarta, though some exchange records show a slightly decreasing trend. It may be said that there have not been drastic changes in the percent distribution of official, commercial, industrial and residential subscribers during the past 5 years, even though the number of total subscribers has nearly doubled from 155,000 to 282,000 during that period. This rather downward trend is found in the records of monthly produced pulses per subscriber by switching unit as shown in ANNEX 4-3.

b) Local Traffic and SLDD Traffic

The Study examines the past trend of monthly produced pulses per subscriber, in order to make sure the main reasons why some exchanges show a slightly declining trend in originating traffic intensity.

Fig. 4.3 details the past 4 years trend curves for per subscriber monthly produced pulses in total, SLDD call portion and local call portion separately. These trend curves are obtained by 12-month moving average method, for the purpose of excluding the influence of monthly and/or seasonal traffic fluctuations.

As shown in Fig. 4.3, the declining phenomenon is mainly caused by the decrease of SLDD call portion. This could be considerably influenced by several-time increases of calling charge rate per pulse.

On the contrary, local call portion shows rather increasing trend. This phenomenon, however, is not directly related to the increase of local traffic itself. The main part of increased pulses might have resulted from the change of charging system to local calls. In fact, the said charging system has been changed from one-call-metering to three-minute-metering in Jakarta multi-exchange area in the early 1980s (Dec. 20, 1982).

As a whole, it is concluded that SLDD traffic has rather decreasing trend, whereas local traffic is stable.

c) Cross-Section Analysis for Originating Traffic Intensity

Using the traffic intensities listed in Table 4.5 and the ratio of PABX lines and payphones to the total subscribers in 1987, regression analyses are examined. As a result, following model is obtained as the best fitting model and the regression curve is illustrated in Fig. 4.4.

$$ATI = 3.7349 \times (PP) + 35.102 \qquad (r = 0.872311)$$

where, ATI: Average traffic intensity
PP : Percentage of PABX lines plus payphones to total subscribers
r : Correlation coefficient

This regression model gives the findings stated below.

- The relative increase of PABX lines and/or payphones is to raise the average traffic intensity. In other words, the increase of residential telephones could be a negative factor to the average traffic increase.

- Minimum originating traffic intensity is assumed to be around 35 mE in present Jakarta multi-exchange area.

d) Present Network Performance

In the case of SPC type switch, the detailed information were obtained concerning call-mix and traffic-mix. The Study collected and analyzed the latest data of EWSD. Table 4.6 represents call-mix of the existing EWSD switches and Table 4.7 gives the percent distribution of lost calls as well as the major causes to be expected.

From the two tables, following findings are obtained:

- Intra-office call ratio;
  - To originating call attempts: 1.1 - 8.1% (1.1-7.1%)
  - To effective call attempts[1/]: 1.5 - 15.4% (1.5-8.9%)

- Successful call ratio;
  - To originating call attempts: 12 - 20% (12 - 20%)
  - To effective call attempts[1/]: 19 - 29% (19 - 25%)

- Lost call ratio;
  - By mainly subscriber behaviors: 30 - 57% (30 - 53%)
  - By mainly network congestions : 3 - 17% (3 - 16%)

  Note: Parenthesized figures show the case of Jakarta multi-exchange area.

From the standpoint of PERUMTEL, care should be taken, at first, on traffic congestion on local/SLDD junction circuits. When this kind of congestion is improved, poor successful call ratio at present could be remarkably improved. In this relation, present carried traffic is expected to be raised to some extent.

1/ Effective call attempts =
(Total originating call attempts) - (no/partial dialling calls)

(2) Local Junction Traffic Intensity

As a result of detailed analysis of originating and local outgoing traffic measured in 1987, Fig. 4.5 presents the relationship among the following three traffic intensities of EMD and PRX switches.

- Reference originating traffic intensity considering a deviation factor
- Averaged originating traffic intensity by four-time measurement
- Averaged local traffic intensity including 10% margin for intra-office calls

The following findings as a whole are derived from Fig. 4.5.

- For EMD switch, the deviation of measured originating traffic intensity is considerably large compared with PRX. This could be caused by line-finder-base measurement, i.e., every 100-subscriber base measurement. Thus, much deviation is expected to be diminished to the level of PRX, if EMD is replaced with other switches.

- For the purpose of circuit dimensioning for local junction, outgoing traffic with some margin rather than originating traffic itself would be better used in order to avoid over-providing telecommunications facilities.

The Study estimates local traffic intensities for each exchange covered by the expanded Jakarta multi-exchange area as summarized in Table 4.8, in due consideration of the above points as well as the rather stable trend in the past. The estimated local traffic intensity in 1994 includes the following margins in addition to the local traffic intensity (mean plus twofold of standard deviation) measured in 1987.

for intra-office calls : 10%
for over load condition: 20%

Moreover, minimum values of the intensity are set by the following criteria.

for DKI Jakarta	:	30 mE
for Botabek area	:	25 mE

On the other hand, the values in 1999 and 2004 are estimated by focusing on the change in exchange area features. In this relation, one base data (as of 1993) are referred to JTP '79 Report, and the other (as of 2005), land use maps prepared by the municipality. The studied results are attached as ANNEX 4-6.

(3) SLDD/Suburban Traffic Intensity

Table 4.9 shows the SLDD and suburban traffic intensities from both EMDs and PRXs in Jakarta multi-exchange area. Out of them, SLDD traffic intensity has been nearly constant for all exchanges. At this moment, there are no findings which support the description in SDP (page 8-10) mentioning yearly 2% increase in inter-area (i.e., SLDD) traffic intensity. In fact, Fig. 4.3 proves that per subscriber SLDD traffic is rather declined.

On the other hand, SLDD traffic intensity itself varies considerably each and all. This could reflect the specific area features and/or subscribers characteristics. The Study, therefore, applies the mean values with twofold of the standard deviation of 4-year data as SLDD traffic intensity, as shown in Table 4.9.

In the case of new exchange areas or the existing exchange areas without past records, 5% equivalent of local originating traffic intensity in Table 4.8 is estimated by the Study as SLDD traffic intensity. As shown in Table 4.9, this proportion is a lower limit except CPE exchange area. The dominant subscribers at newly established exchange areas are expected to be residential so that less SLDD traffic could be originated compared with the existing areas.

The Study assumes that the SLDD traffic intensity in 1994 will not change up to 2004 in consideration of safety margin, even though actual trend is rather decreasing year by year.

Regarding suburban traffic intensity, Table 4.9 presents past records and its percentage to the estimated local originating traffic intensity in Table 4.8. Table 4.9 shows that the percentage is distributed around 1% without not so large deviations.

The Study sets forth the 0.5% equivalent of estimated local traffic intensity as suburban traffic intensity. It should be noted that present 1% equivalent reflects a community of interest between DKI Jakarta and major cities/towns in Botabek area. After expansion of Jakarta multi-exchange area, the said cities/towns are to be incorporated into newly expanded Jakarta multi-exchange area. On the contrary, new suburban area is to be established according to the network expansion scenario, as shown in Fig. 1.2 through 1.5. At that time, the community of interest between expanded Jakarta multi-exchange area and new suburban area surely be weakened, compared with the present condition.

The Study assumes constant suburban traffic intensity through the planning period.

Table 4.5 Average Originating Traffic Intensity per Subscriber (mE)

Ex.	1983	1984	1985	1986	1987	1988
KT1	93.0	98.1	92.5		104.7	
KT2	48.2	54.0	55.1		48.4	
PLT	54.3	50.5	55.2		41.7	
CKG	N.A.	47.6	50.3		54.9	
ANC	36.0	40.2	41.5		33.5	
GB1	100.6	96.9	96.8		89.3	
GB2	83.6	93.4	92.9		77.7	
SLP	67.1	72.9	72.3		72.0	
SM1	99.1	106.9	94.1		95.6	
SM2	70.9	87.2	84.9		68.3	
PLM	45.9	54.1	53.8		53.8	
JIA						
CPP	56.6	64.7	63.9		53.9	
RMG	54.8	62.8	67.6		48.5	
KGP						
TPR	67.4	73.7	73.3			(71.2)
KB	55.5	60.6	56.2		57.6	
CPE	35.1	36.8	39.9		45.8	
KL1	N.A.	49.0	49.6		56.6	
CPA	29.5	32.6	38.1		37.3	
PSM	N.A.	54.5	51.2		74.0	(69.9)
JAG						
JT	50.7	51.8	53.7		48.2	
CW	62.3	61.3	51.4		47.3	
PSR						
KLD						
TB	43.9	48.0	49.4		40.8	
GAN						

Table 4.6 Present Network Performance (1988)

Ex.	Originating BHCA	Lost(1)	Effective C.A.	Intra-office			Outgoing		
				C.A.	Lost(2)	Successful	C.A.	Lost(3)	Successful
KT2E	27,494	(23%) 6,267	21,227	373	(1%) 173	200	20,854	(62%) 17,045	3,809
GB1E	85,561	(21%) 18,255	67,306	2,533	(2%) 1,469	1,064	64,773	(61%) 52,054	12,719
SLPB	31,851	(23%) 7,227	24,624	926	(2%) 489	437	23,698	(59%) 18,893	4,805
SM2B	21,226	(11%) 2,400	18,826	405	(1%) 263	142	18,421	(70%) 14,885	3,536
JIA	6,983	(20%) 1,426	5,557	497	(5%) 319	178	5,060	(55%) 3,872	1,188
CPPB	31,554	(27%) 8,432	23,122	936	(2%) 568	368	22,186	(54%) 17,032	5,154
KB2B	17,794	(25%) 4,368	13,426	203	(1%) 110	93	13,223	(57%) 10,152	3,071
CPEB	12,896	(46%) 5,887	7,009	156	(1%) 79	77	6,853	(42%) 5,353	1,500
JT2B	21,752	(29%) 6,209	15,543	600	(1%) 279	321	14,943	(53%) 11,557	3,386
PSRB	10,280	(33%) 3,436	6,844	346	(2%) 165	181	6,498	(51%) 5,232	1,266
DEPA	4,306	(48%) 2,048	2,258	347	(3%) 117	230	1,911	(34%) 1,485	426

Source : HASIL PENGUKURAN TRAFIK SENTRAL TELEPON EWSD JAKARTA (May/June, 1988)

Table 4.7 Percent Distribution of Lost Calls and Expected Causes

Lost Calls	Descriptions	Exchanges											Causes to be expected
		KT2E	GB1E	SLPB	SM2B	JIA	CPPB	KB2B	CPEB	JT2B	PSRB	DEPA	
(1)	No dial (tone)	19	19	20	10	17	22	21	44	24	31	41	Sub. behaviors/switch overload
	Partial dial	2	2	2	1	2	2	2	1	N.	2	3	Sub. behaviors
(2)	Calling P. release	0.2	0.3	0.3	0.2	1.0	0.3	0.1	0.2	0.4	0.4	0.7	Sub. behaviors
	No answer	N.	N.	N.	0	0	N.	N.	N.	0	N.	N.	Sub. behaviors
	Called P. busy	0.3	1.3	1.1	0.8	1.1	1.5	0.5	0.3	0.8	1.0	1.7	Sub. behaviors
(3)	Calling P. release	8	15	12	22	9	13	13	7	13	17	10	Sub. behaviors
	No answer	0.3	0.6	0.6	0.2	0.4	0.4	0.6	0.3	0.2	0.6	0.4	Sub. behaviors
	Incomplete dial	13	17	15	21	21	13	17	12	12	9	8	???
	Premature disconnection	20	0.5	1.0	0.5	0.5	0.2	0.3	0.1	0.9	0.4	0.4	Technical troubles
	Network congestion	8	14	15	16	3	12	12	12	11	12	17	Junction/Trunk CCT overload
	Called P. busy	0	0	0	14	9	0	0	0	0	0	0	Sub. behaviors

Table 4.8 Estimated Local Traffic Intensity (Expanded JKT M.A.)

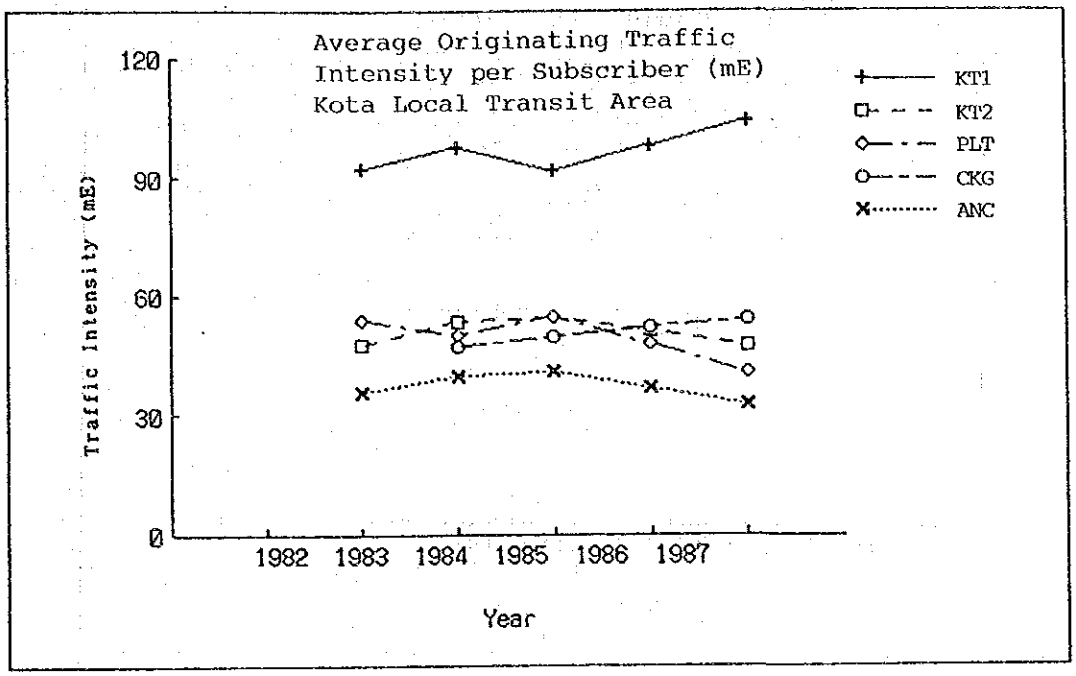
Ex. Area	Traffic Intensity (E) 1994	1999	2004	Remarks	Ref. Rate
KT1	0.065	0.0650	0.065		1.07
KT2	0.065	0.0650	0.065	Same as KT1	
KT3	0.050	0.0500	0.050	Same as present KT2	1.24
PLT	0.040	0.0375	0.035		0.86
CKG	0.045	0.0450	0.045		0.96
ANC	0.035	0.0325	0.030		0.76
GB1	0.075	0.0775	0.080		1.17
GB2	0.065	0.0650	0.065		1.04
SLP	0.060	0.0575	0.055		0.88
SM1	0.080	0.0825	0.085		1.13
SM2	0.065	0.0675	0.070		1.13
PLM	0.050	0.0525	0.055		1.22
KED	0.030	0.0350	0.040	Minimum value in 1994	7.56
MER	0.030	0.0325	0.035	Minimum value in 1994	1.30
TGA	0.030	0.0350	0.040	Minimum value in 1994	
JIA	0.050	0.0500	0.050	Dedicated use for business only	
CPP	0.050	0.0525	0.055		
RMG	0.045	0.0450	0.045		1.05
KGD	0.050	0.0475	0.045	Same as TPR	0.85
KGP	0.030	0.0300	0.030	Mainly residential use	
PGG	0.040	0.0375	0.035		0.86
TPR	0.050	0.0475	0.045		0.89
CIL	0.040	0.0350	0.030		0.47
KB	0.050	0.0500	0.050		1.03
KBB	0.030	0.0350	0.040	Minimum value in 1994	2.27
CPE	0.040	0.0450	0.050		3.71
CNE	0.030	0.0300	0.030	Minimum value	
KL1	0.045	0.0475	0.050		3.00
KL2	0.030	0.0300	0.030	Minimum value	
CPA	0.030	0.0300	0.030	Minimum value	
PSM	0.050	0.0500	0.050		0.96
JAG	0.050	0.0450	0.040		
SER	0.030	0.0300	0.030	Academic & research center	
SRU	0.025	0.0250	0.025	Minimum value	
SRB	0.000	0.0250	0.025	Minimum value	
CDG	0.025	0.0250	0.025	Minimum value	
SWG	0.000	0.0250	0.025	Minimum value	
JT	0.045	0.0475	0.050	Toll way planned to be constructed	
CW	0.045	0.0425	0.040		0.56
PSR	0.040	0.0425	0.045		1.22
KLD	0.045	0.0450	0.045		
PDK	0.000	0.0000	0.045	Same as KLD	
TB	0.045	0.0475	0.050		1.37
GAN	0.040	0.0400	0.040		
PDG	0.025	0.0250	0.025	Minimum value	
BEK	0.025	0.0250	0.025	Minimum value	
BKB	0.025	0.0275	0.030	Industrialized area	
BGG	0.000	0.0250	0.025	Minimum value	
CL	0.025	0.0250	0.025	Minimum value	
TAN	0.030	0.0300	0.030		
JUG	0.025	0.0250	0.025	Minimum value	
CPD	0.000	0.0250	0.025	Minimum value	
DEP	0.025	0.0250	0.025	Minimum value	
SKJ	0.025	0.0250	0.025	Minimum value	
CIB	0.035	0.0350	0.035		

Note: Ref. Rate is explained in ANNEX 4-6.

Table 4.9 SLDD/Suburban Traffic Intensity (1983 - 1987)

Ex.	SLJJ Traffic Intensity (mE)						Suburban Traffic Intensity (mE)					
Area	1983	1984	1985	1987	m+2d	% to Local	1983	1984	1985	1987	m+2d	% to Local
KT1	6.27	6.61	5.42	5.78	6.93	11	0.72	0.88	0.80	0.82	0.92	1.4
KT2	2.32	2.50	2.34	2.41	2.54	5	0.43	0.55	0.51	0.54	0.61	1.2
PLT	2.19	2.40	2.74	1.92	2.92	7	0.45	0.56	0.38	0.47	0.60	1.5
CKG		1.83	1.67	2.01	2.12	5		0.75	1.18	1.16	1.43	3.2
ANC	1.06	1.32	1.48	1.24	1.58	5	0.38	0.11	0.42	0.21	0.54	1.5
GB1	7.58	6.68	6.02	5.90	7.88	11	0.60	0.75	0.68	0.81	0.87	1.2
GB2	7.44	8.19	6.90	6.27	8.62	14	0.35	0.50	0.59	0.62	0.73	1.1
SLP	4.21	1.86	2.48	2.22	4.50	8	0.76	1.00	0.79	0.53	1.11	1.9
SM1	5.90	6.41	5.20	6.42	6.98	9	1.06	0.61	0.46	0.63	1.14	1.4
SM2	5.99	10.05	8.08	5.79	10.95	17	0.47	0.82	0.65	0.76	0.95	1.5
PLM	2.58	2.75	3.14	2.46	3.25	7	0.20	0.29	0.42	0.66	0.74	1.5
CPP	3.33	3.41	2.91	2.41	3.81	8	0.24	0.32	0.24	0.36	0.40	0.8
RMG	3.06	3.01	3.09	2.60	3.34	8	0.59	0.76	0.40	0.46	0.83	1.8
TPR	3.06	3.31	3.24	3.05	3.34	7	0.42	0.28	0.37	0.39	0.47	0.9
KB	3.47	3.82	3.38	3.49	3.88	8	0.19	0.27	0.24	0.54	0.59	1.2
CPE	1.06	1.14	1.05	1.02	1.16	3	0.24	0.08	0.16	0.64	0.71	1.8
KL1		2.99	2.80	3.01	3.13	7		0.23	0.32	0.38	0.44	1.0
CPA	0.58	1.79	0.70	0.68	1.93	7	0.30		0.15	0.52	0.63	2.1
PSM		3.14	2.40	2.84	3.41	7		0.23	0.11	0.35	0.43	0.9
JT	2.21	1.24	1.84	1.91	2.51	6	0.28	0.70	0.33	0.36	0.75	1.7
CW	2.98	2.91	2.82	2.04	3.45	8	0.41	0.35	0.44	0.46	0.50	1.1
TB	1.83	2.07	2.03	2.10	2.22	5	0.15	0.27	0.25	0.22	0.32	0.7
GAN				4.87	4.87	13				0.74	0.74	1.9
BEK			1.85		1.85	8						
TAN			1.67		1.67	6						
CIB			3.02		3.02	9						

(m+2d) means mean value plus twofold of standard deviation.



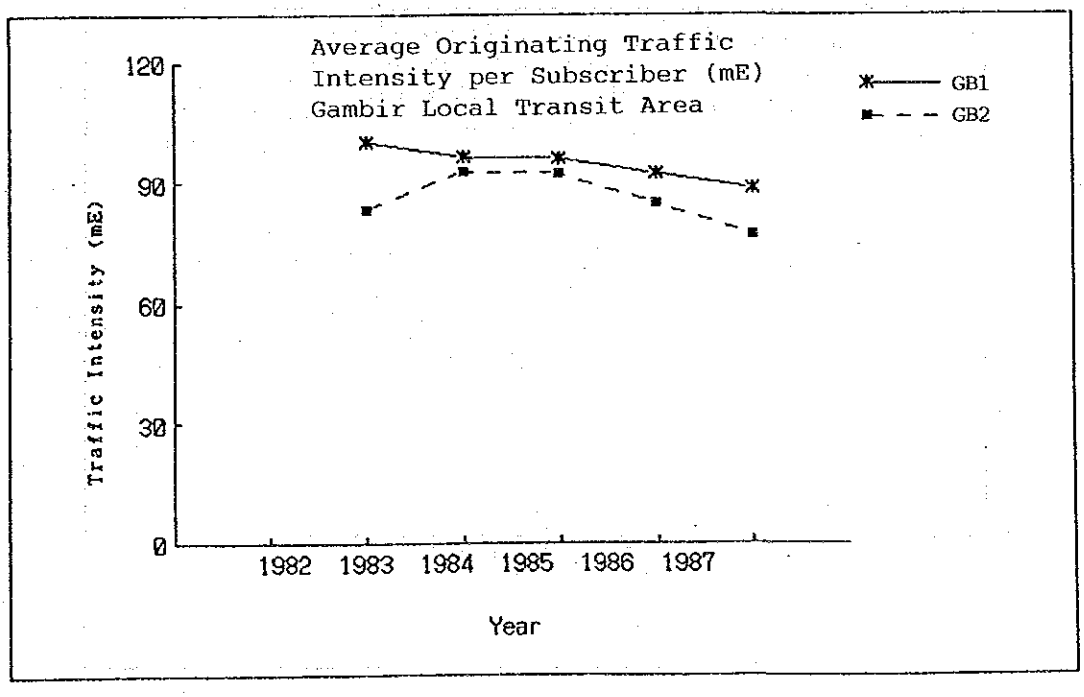
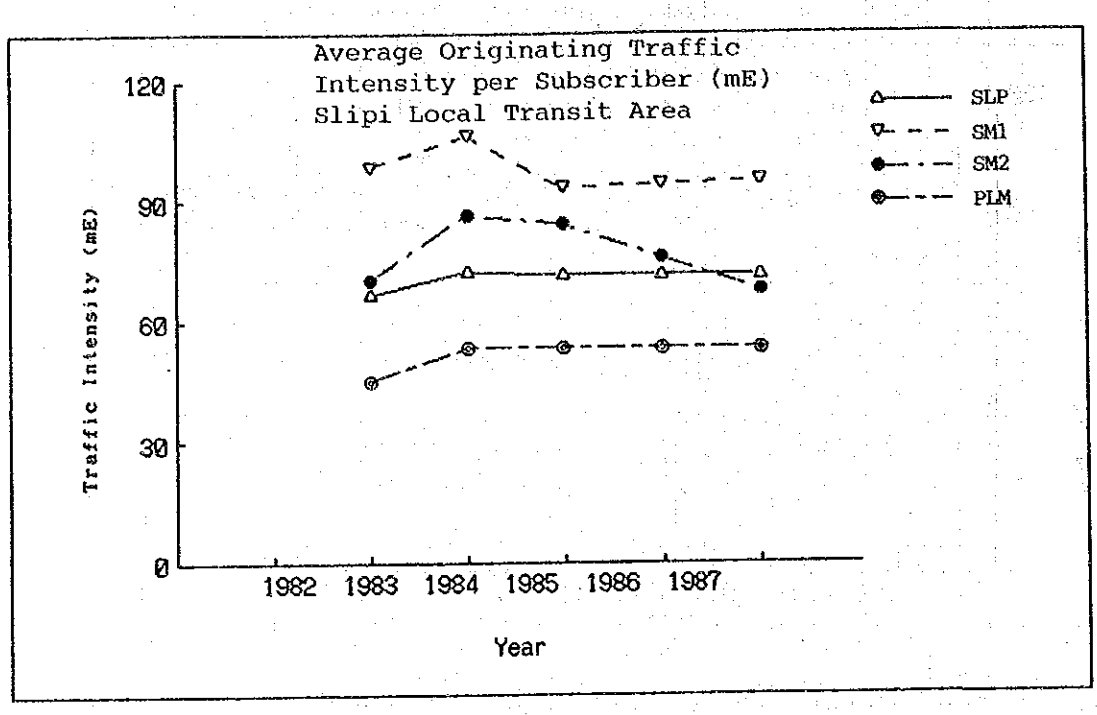


Fig. 4.2 Average Originating Traffic Intensity per Subscriber (1/3)



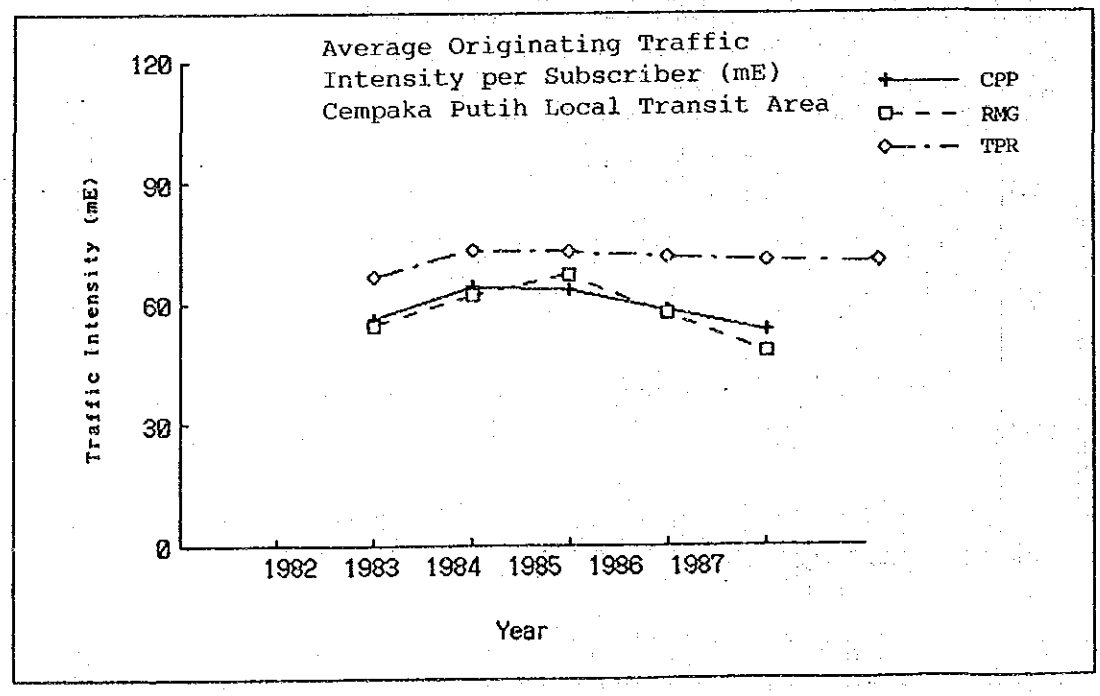
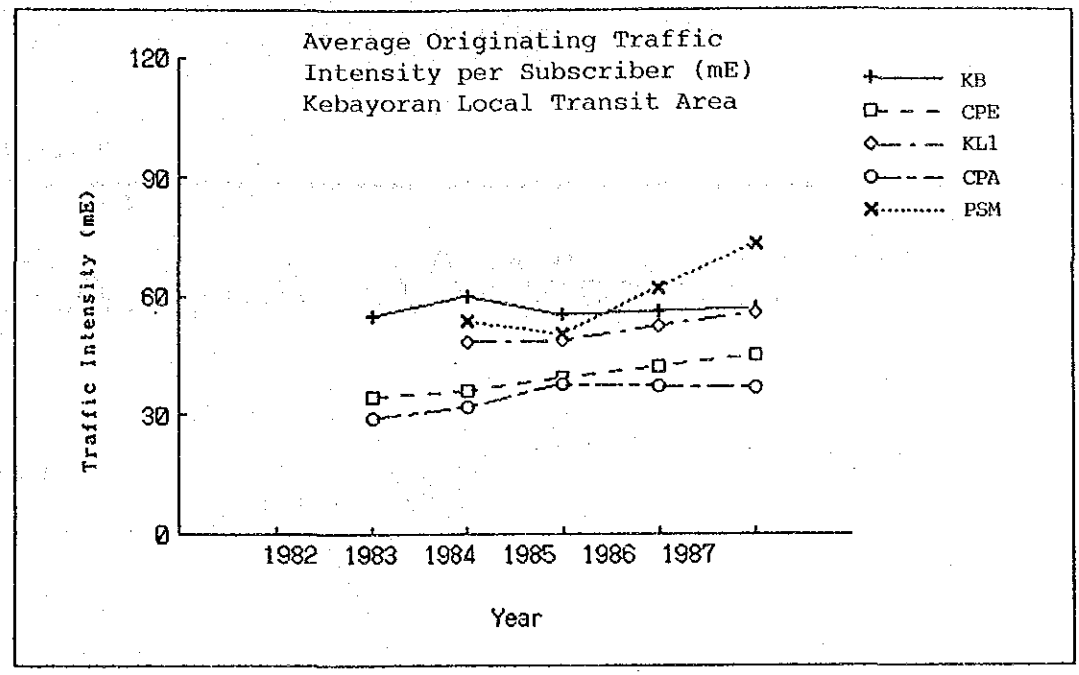


Fig. 4.2 Average Originating Traffic Intensity per Subscriber (2/3)



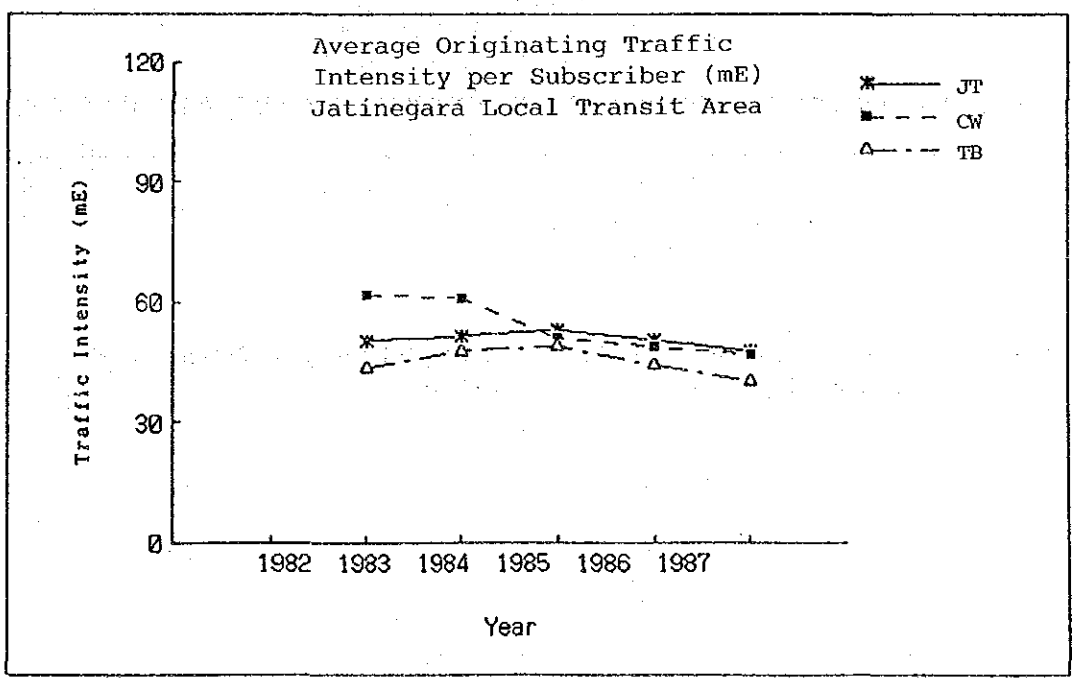


Fig. 4.2 Average Originating Traffic Intensity per Subscriber (3/3)

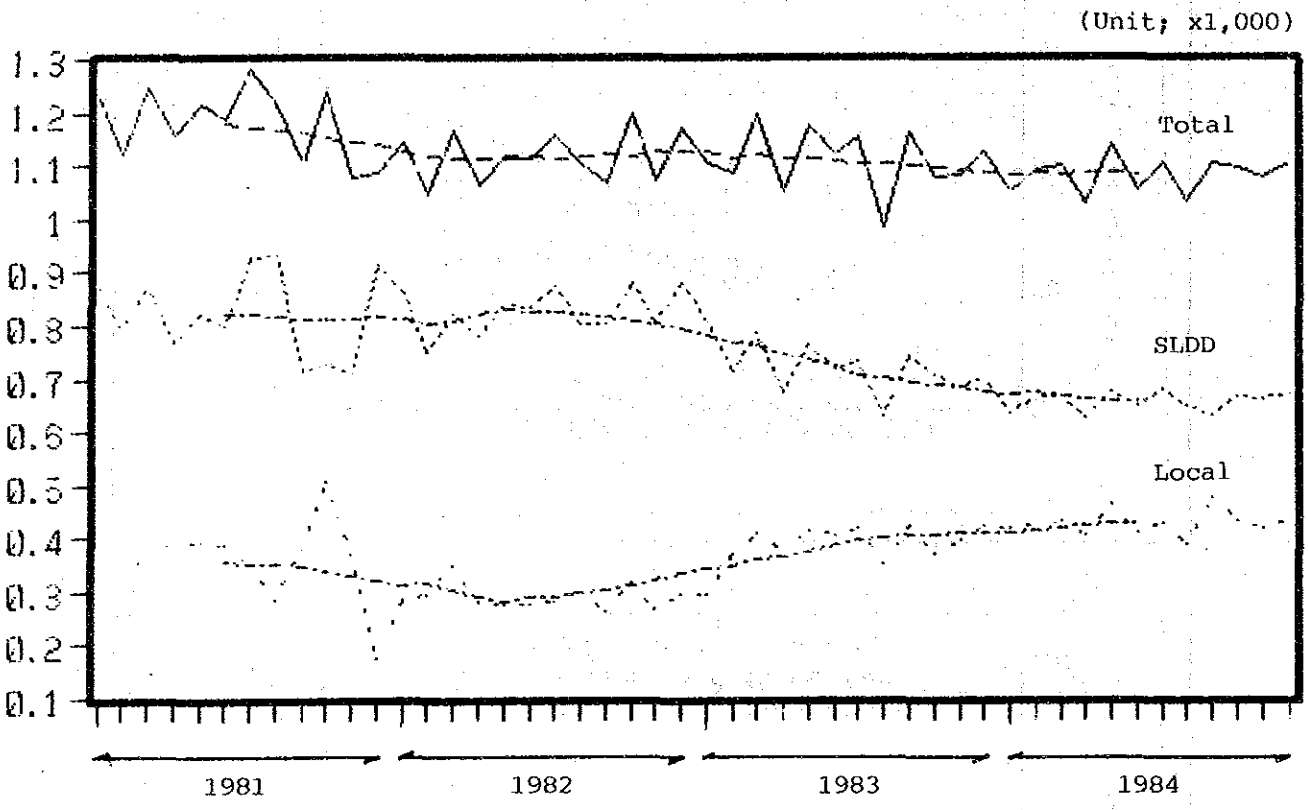


Fig. 4.3 Past Trend of Monthly Produced Pulses per Subscriber (12-month moving average method)

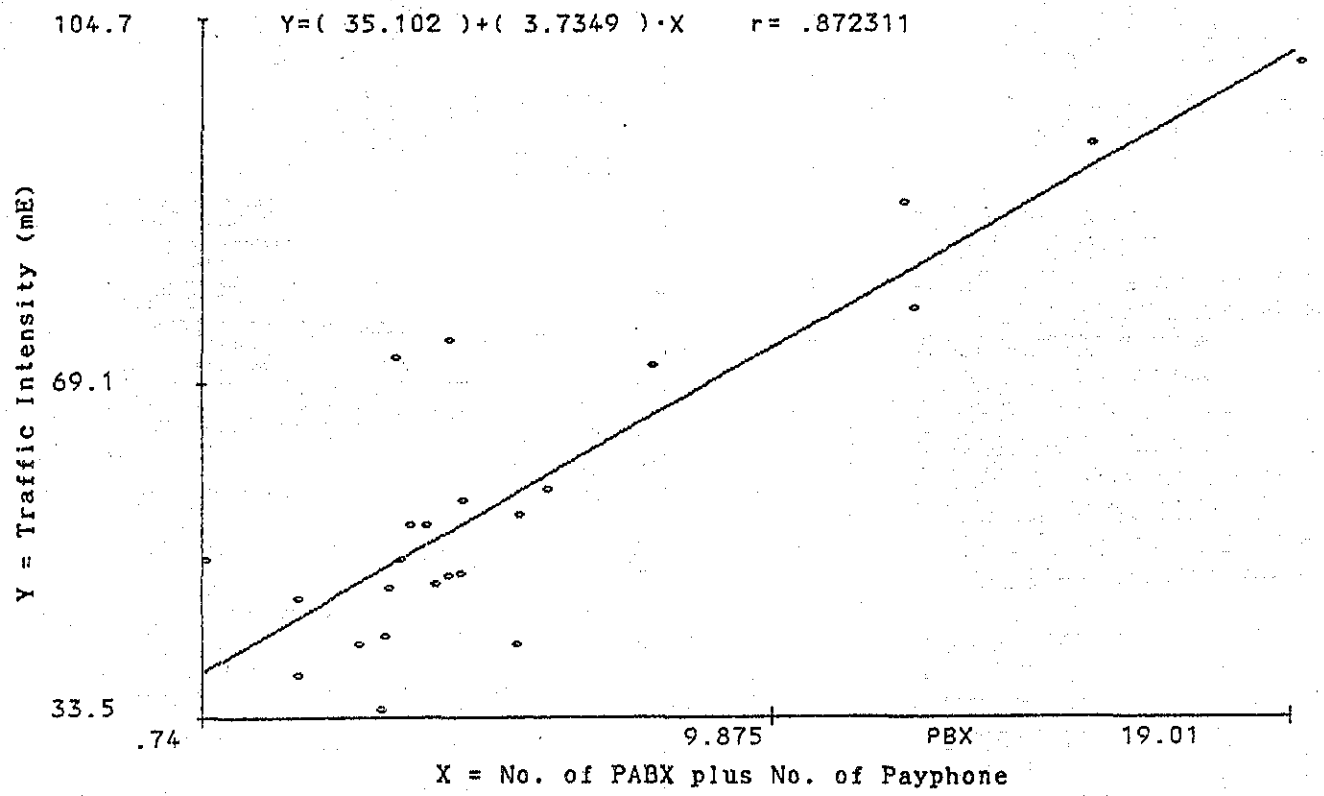
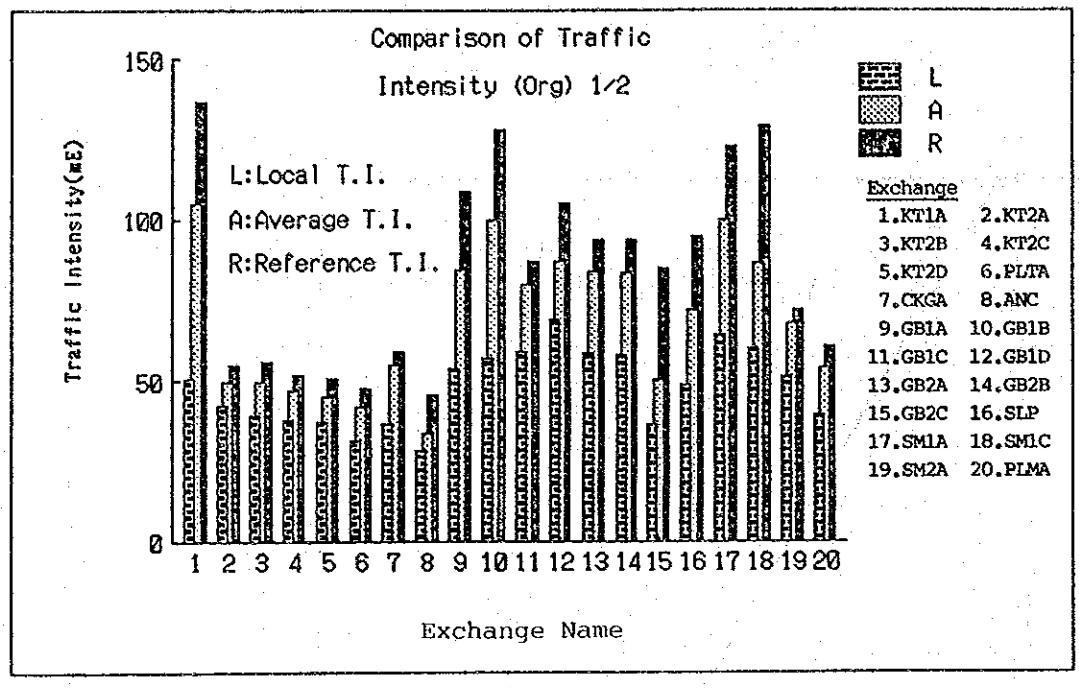


Fig. 4.4 Regression Analysis for Originating Traffic Intensity



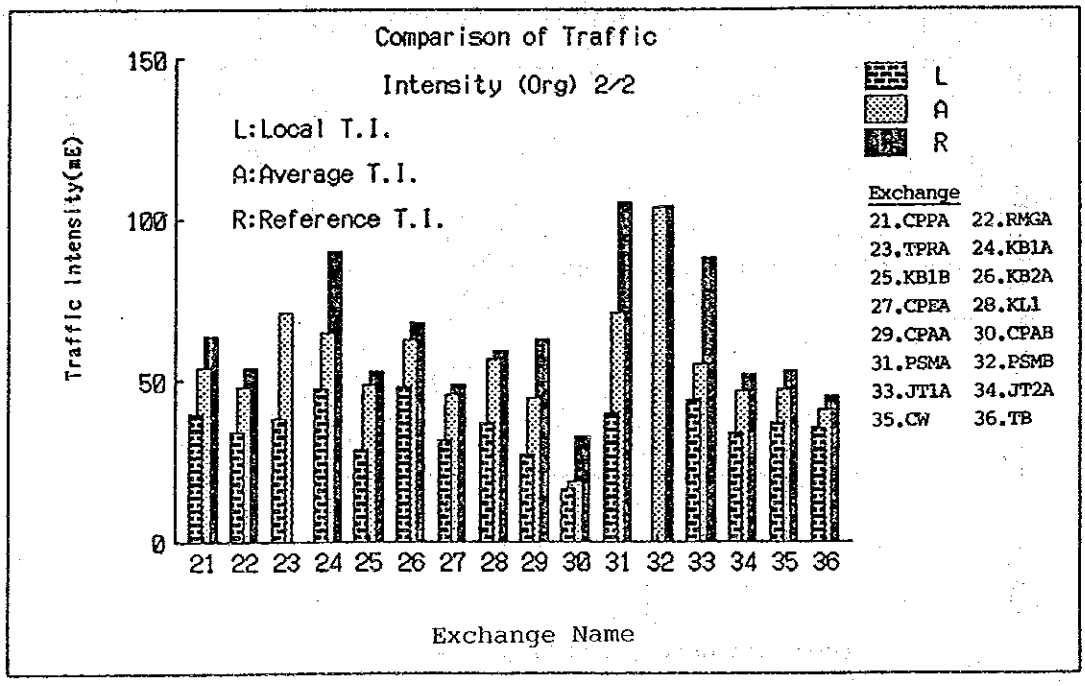


Fig. 4.5 Comparison of Originating and Local Traffic Intensities

(4) Interexchange Traffic Forecast

The Study forecasts interexchange traffic volumes in the expanded Jakarta multi-exchange area. Base data used are the estimated traffic intensities and the forecasted demands.

These interexchange traffic forecasts are to be separately carried out as follows:

- local junction traffic (interexchange base);
- SLDD traffic (outgoing/incoming base); and
- suburban traffic (outgoing/incoming base).

a) Present Interexchange Traffic Flow

Prior to local junction traffic estimate, the Study performs careful analysis on present interexchange traffic flow in Jakarta multi-exchange area.

The data used are as of 1987 provided by TRAFIKTEL. Out of the switching systems put into service in DKI Jakarta, PRX and EMD systems are selected for this purpose. The reason is that outgoing circuit groups of both systems are generally routed to destination exchanges directly and/or via a certain local transit switch installed in the local transit area to which the destination exchanges concerned belong. Consequently, the measured data are to show considerably reliable traffic distribution.

ANNEX 4-7 presents the obtained percent distribution of local traffic by destined local transit areas in 1987.

b) Junction Traffic Forecast

For junction traffic forecast in the expanded Jakarta multi-exchange area, the Study applies the following distribution formula, following JTP'79 Report:

$$A_{ij} = A_i \cdot \frac{A_j \cdot e^{-a \cdot L_{ij}}}{\sum_{x=1}^{n} A_x \cdot e^{-a \cdot L_{ix}}}$$

where, A_{ij} : Local junction traffic from exchange i to exchange j

$A_{i/j}$: Local traffic from exchange i/j

L_{ij} : Crow-flight distance in km between exchange i and exchange j

a : Factor to convert distance (L_{ij}) to socio-economic distance

For applying the above formula, the most significant point is selection of suitable values of "a". The Study actually selects "a" for each exchange area with PRX and/or EMD system(s), referring to measured outflow traffic to any local transit areas. As a result of cut-and-try process, a comparison list shown in ANNEX 4-7 was obtained that shows percent distribution of measured traffic and calculated ones.

Thus fixed values of "a" are to be applied to other exchange areas, that is, areas to be newly established as well as the existing exchange areas without PRX/EMD system. At that time, the Study takes into account the location and socio-economic features of the exchange areas.

After dimensioning conversion factors "a" for all exchange areas and crow-flight distances between any two exchanges, interexchange traffic volume is forecasted by using the estimated total local traffic as shown in Table 4.10.

The forecasted local junction traffic matrixes in 1994, 1999 and 2004 are attached as ANNEX 4-8.

c) SLDD/Suburban Traffic Forecast

Based on the estimated SLDD and suburban traffic intensities and the exchange demands, SLDD and suburban traffic volumes are estimated as shown in Table 4.11.

As for Table 4.11, it is noted that the estimated values are outgoing direction only. Assuming that incoming SLDD/ suburban traffic volume could be well-balanced to outgoing one, more precisely, the same amount, the estimated values should be doubled for SLDD/suburban circuit dimensioning.

(5) Traffic Forecast in Bogor Area

The Study estimates the traffic intensities for Bogor multi-exchange area as follows:

local outgoing traffic intensity	:	25 mE
SLDD traffic intensity	:	5 mE
suburban traffic intensity	:	1 mE

The above figures are estimated taking into account the following findings from the collected data as of 1987 and the conditions applied in the case of Jakarta multi-exchange area.

a) Originating traffic intensity : 26.47 (mE)
b) Terminating traffic intensity : 23.41 (mE)
c) More than 15% of originating/terminating traffic could be for intra-office calls. (in the case of DEP: 15%)
d) Around 18% of originating traffic is for SLDD calls.
e) Around 85% of SLDD traffic is routed to Jakarta trunk exchange; the rest, to Bandung.
f) In the case of Jakarta multi-exchange area, 20% margin is considered for over load conditions.

Table 4.12 presents the estimated results.

Table 4.10 Estimated Total Local Traffic (1994, 1999, 2004)

Ex.	Subscriber Estimate(1,000)			Traffic Intensity (mE)			Total Traffic (E)		
Area	1994	1999	2004	1994	1999	2004	1994	1999	2004
KT1	16.0	18.9	21.8	65.0	65.0	65.0	1,040	1,229	1,417
KT2	46.5	60.5	77.5	65.0	65.0	65.0	3,023	3,933	5,038
KT3	54.9	62.9	71.8	50.0	50.0	50.0	2,745	3,145	3,590
PLT	37.4	45.8	52.0	40.0	37.5	35.0	1,496	1,718	1,820
CKG	26.5	38.9	55.0	45.0	45.0	45.0	1,193	1,751	2,475
ANC	21.9	36.5	54.8	35.0	32.5	30.0	767	1,186	1,644
GB1	54.1	57.5	60.0	75.0	77.5	80.0	4,058	4,456	4,800
GB2	41.6	59.2	80.2	65.0	65.0	65.0	2,704	3,848	5,213
SLP	33.6	47.6	64.9	60.0	57.5	55.0	2,016	2,737	3,570
SM1	30.5	47.1	64.0	80.0	82.5	85.0	2,440	3,886	5,440
SM2	44.2	71.0	96.0	65.0	67.5	70.0	2,873	4,793	6,720
PLM	33.3	49.2	67.5	50.0	52.5	55.0	1,665	2,583	3,713
KED	13.8	25.0	39.0	30.0	35.0	40.0	414	875	1,560
MER	8.2	17.1	28.1	30.0	32.5	35.0	246	556	984
TGA	5.3	7.4	10.2	30.0	35.0	40.0	159	259	408
JIA	2.5	3.0	3.5	50.0	50.0	50.0	125	150	175
CPP	32.7	47.7	65.8	50.0	52.5	55.0	1,635	2,504	3,619
RMG	37.6	54.0	67.4	45.0	45.0	45.0	1,692	2,430	3,033
KGD	19.8	29.0	36.6	50.0	47.5	45.0	990	1,378	1,647
KGP	3.0	3.0	3.0	30.0	30.0	30.0	90	90	90
PGG	9.8	20.9	41.4	40.0	37.5	35.0	392	784	1,449
TPR	18.0	27.5	39.0	50.0	47.5	45.0	900	1,306	1,755
CIL	7.0	14.0	25.0	40.0	35.0	30.0	280	490	750
KB	41.6	52.1	65.2	50.0	50.0	50.0	2,080	2,605	3,260
KBB	14.2	26.0	42.0	30.0	35.0	40.0	426	910	1,680
CPE	28.6	40.2	54.0	40.0	45.0	50.0	1,144	1,809	2,700
CNE	11.4	17.0	18.3	30.0	30.0	30.0	342	510	549
KL1	24.9	39.4	56.4	45.0	47.5	50.0	1,121	1,872	2,820
KL2	8.8	13.5	19.8	30.0	30.0	30.0	264	405	594
CPA	9.0	16.0	25.0	30.0	30.0	30.0	270	480	750
PSM	12.0	18.4	26.2	50.0	50.0	50.0	600	920	1,310
JAG	2.7	5.6	10.0	50.0	45.0	40.0	135	252	400
SER	5.4	11.6	20.3	30.0	30.0	30.0	162	348	609
SRU	4.2	8.7	15.0	25.0	25.0	25.0	105	218	375
SRB	0.0	7.2	12.6	0.0	25.0	25.0	0	180	315
CDG	2.8	5.7	9.5	25.0	25.0	25.0	70	143	238
SWG	0.0	7.1	11.7	0.0	25.0	25.0	0	178	293
JT	37.0	51.8	70.0	45.0	47.5	50.0	1,665	2,461	3,500
CW	12.2	18.9	27.5	45.0	42.5	40.0	549	803	1,100
PSR	10.8	20.5	34.9	40.0	42.5	45.0	432	871	1,571
KLD	18.5	36.4	37.4	45.0	45.0	45.0	833	1,638	1,683
PDK	0.0	0.0	21.6	45.0	45.0	45.0	0	0	972
TB	27.6	41.0	58.5	45.0	47.5	50.0	1,242	1,948	2,925
GAN	6.2	11.5	18.9	40.0	40.0	40.0	248	460	756
PDG	6.8	13.0	21.1	25.0	25.0	25.0	170	325	528
BEK	4.4	7.6	11.6	25.0	25.0	25.0	110	190	290
BKB	12.6	21.6	32.7	25.0	27.5	30.0	315	594	981
BGG	0.0	9.4	14.9	0.0	25.0	25.0	0	235	373
CL	4.3	8.2	13.4	25.0	25.0	25.0	108	205	335
TAN	20.3	35.5	54.6	30.0	30.0	30.0	609	1,065	1,638
JUG	1.7	3.8	6.6	25.0	25.0	25.0	43	95	165
CPD	0.0	4.1	6.4	0.0	25.0	25.0	0	103	160
DEP	8.1	13.6	20.3	25.0	25.0	25.0	203	340	508
SKJ	10.5	17.4	25.7	25.0	25.0	25.0	263	435	643
CIB	3.3	5.1	7.2	35.0	35.0	35.0	116	179	252
Total	948.1	1,431.6	1,993.8	49.1	48.1	47.7	46,568	68,864	95,183

Table 4.11 Estimated SLDD/Suburban Traffic (1994, 1999, 2004)

Ex.	Subscriber Estimate(1,000)			SLJJ Traffic (E)				Suburban Traffic (E)			
Area	1994	1999	2004	T.I.(mE)	1994	1999	2004	T.I.(mE)	1994	1999	2004
KT1	16.0	18.9	21.8	6.93	111	131	151	0.33	6	7	8
KT2	46.5	60.5	77.5	6.93	323	420	537	0.33	16	20	26
KT3	54.9	62.9	71.8	2.50	138	158	180	0.25	14	16	18
PLT	37.4	45.8	52.0	2.92	110	114	152	0.20	8	10	11
CKG	26.5	38.9	55.0	2.12	57	83	117	0.23	6	9	13
ANC	21.9	36.5	54.8	1.58	35	58	87	0.18	4	7	10
GB1	54.1	57.5	60.0	7.88	427	454	473	0.38	21	22	23
GB2	41.6	59.2	80.2	8.62	359	511	692	0.33	14	20	27
SLP	33.6	47.6	64.9	4.50	152	215	292	0.30	11	15	20
SM1	30.5	47.1	64.0	6.98	213	329	447	0.40	13	19	26
SM2	44.2	71.0	96.0	10.95	484	778	1,052	0.33	15	24	32
PLM	33.3	49.2	67.5	3.25	109	160	220	0.25	9	13	17
KED	13.8	25.0	39.0	1.50	21	38	59	0.15	3	4	6
MER	8.2	17.1	28.1	1.50	13	26	43	0.15	2	3	5
TGA	5.3	7.4	10.2	1.50	8	12	16	0.15	1	2	2
JIA	2.5	3.0	3.5	2.50	7	8	9	0.25	1	1	1
CPP	32.7	47.7	65.8	3.81	125	182	251	0.25	9	12	17
RMG	37.6	54.0	67.4	3.34	126	181	226	0.23	9	13	16
KGD	19.8	29.0	36.6	2.50	50	73	92	0.25	5	8	10
KGP	3.0	3.0	3.0	1.50	5	5	5	0.15	1	1	1
PGG	9.8	20.9	41.4	2.00	20	42	83	0.20	2	5	9
TPR	18.0	27.5	39.0	3.39	61	94	133	0.25	5	7	10
CIL	7.0	14.0	25.0	2.00	14	28	50	0.20	2	3	5
KB	41.6	52.1	65.2	3.88	162	203	253	0.25	11	13	17
KBB	14.2	26.0	42.0	1.50	22	39	63	0.15	3	4	7
CPE	28.6	40.2	54.0	2.00	58	81	108	0.20	6	8	11
CNE	11.4	17.0	18.3	1.50	18	26	28	0.15	2	3	3
KL1	24.9	39.4	56.4	3.13	78	124	177	0.23	6	9	13
KL2	8.8	13.5	19.8	1.50	14	21	30	0.15	2	2	3
CPA	9.0	16.0	25.0	1.93	18	31	49	0.15	2	3	4
PSM	12.0	18.4	26.2	3.41	41	63	90	0.25	3	5	7
JAG	2.7	5.6	10.0	2.50	7	14	25	0.25	1	2	3
SER	5.4	11.6	20.3	1.50	9	18	31	0.15	1	2	3
SRU	4.2	8.7	15.0	1.25	6	11	19	0.13	1	2	2
SRB	0.0	7.2	12.6	1.25	0	9	16	0.13		1	2
CDG	2.8	5.7	9.5	1.25	4	8	12	0.13	1	1	2
SWG	0.0	7.1	11.7	1.25	0	9	15	0.13		1	2
JT	37.0	51.8	70.0	2.51	93	130	176	0.23	9	12	17
CW	12.2	18.9	27.5	3.45	43	66	95	0.23	3	5	7
PSR	10.8	20.5	34.9	2.00	22	41	70	0.20	3	5	7
KLD	18.5	36.4	37.4	2.25	42	82	85	0.23	5	9	9
PDK	0.0	0.0	21.6	2.25	0	0	49	0.23	0	0	5
TB	27.6	41.0	58.5	2.22	62	91	130	0.23	7	10	14
GAN	6.2	11.5	18.9	4.87	32	56	92	0.20	2	3	4
PDG	6.8	13.0	21.1	1.25	9	17	27	0.13	1	2	3
BEK	4.4	7.6	11.6	1.85	9	14	22	0.13	1	1	2
BKB	12.6	21.6	32.7	1.25	16	27	41	0.13	2	3	5
BGG	0.0	9.4	14.9	1.25	0	12	19	0.13		2	2
CL	4.3	8.2	13.4	1.25	6	11	17	0.13	1	1	2
TAN	20.3	35.5	54.6	1.67	34	60	92	0.15	3	6	9
JUG	1.7	3.8	6.6	1.25	3	5	9	0.13	1	1	1
CPD	0.0	4.1	6.4	1.25	0	6	8	0.13		1	1
DEP	8.1	13.6	20.3	1.25	11	17	26	0.13	1	2	3
SKJ	10.5	17.4	25.7	1.25	14	22	33	0.13	2	3	4
CIB	3.3	5.1	7.2	3.02	10	16	22	0.18	1	1	2
Total	948.1	1,431.6	1,993.8		3,811	5,430	7,296		258	364	489

Table 4.12 Estimated Traffic in Bogor Area (1994, 1999, 2004)

Ex. Area	Subscriber Estimates			Local Traffic				SLDD Traffic				Suburban Traffic			
	1994	1999	2004	TI (mE)	1994	1999	2004	TI (mE)	1994	1999	2004	TI (mE)	1994	1999	2004
B00	31.9	50.5	72.1	25.0	797.5	1,262.5	1,802.5	5.0	159.5	252.5	360.5	1.0	31.9	50.3	72.1
CWI	3.2	4.9	6.9	25.0	80.0	122.5	172.5	5.0	16.0	24.5	34.5	1.0	3.2	4.9	6.9
CAA	3.0	4.8	6.9	25.0	75.0	120.0	172.5	5.0	15.0	24.0	34.5	1.0	3.0	4.8	6.9
SPL	0	0	5.6	25.0	0	0	140.0	5.0	0	0	28.0	1.0	0	0	5.6
CSA	2.4	3.7	5.3	25.0	60.0	92.5	132.5	5.0	12.0	18.5	26.5	1.0	2.4	3.7	5.3
Total	40.5	63.9	96.8	25.0	1,012.5	1,597.5	2,420.0	5.0	202.5	319.5	484.0	1.0	40.5	63.9	96.8

4.2.2 Data Communications Traffic

According to the market survey by other study team, following results are reported concerning SKDP terminals in the whole Indonesia as of September, 1988.

a) Number of Subscribers

- Dial up : 177
- Leased channel: 15
(Total) : (192)

b) Transmission Rate Class

- 1,200 bps : 33.9%
- 2,400 bps : 44.1%
- 4,800 bps : 22.0%
- 9,600 bps : -
(Average) : (2,500 bps)

c) Traffic Features

	Domestic	International	Total
- No. of transactions :	2,019	13,496	15,515
- Volume (in segments) :	-	-	1,750,000[1/]
- Duration (in minutes):	7,248	58,339	65,587

1/ The number of yearly segments is presented in Fig. 7.4.

Based on the figures above, following are obtained on the average:

- No. of segments per transaction: 112.8
- Duration per transaction : 4.2 minutes
- Daily transactions per terminal: 3.2

Assuming the concentration ratio to busy-hour is 1/6 as given in the aforementioned survey report, it is concluded that less than 1 enquiry is to be originated from each terminal in busy-hour.

On the other hand, busy-hour traffic volume (in bits) for each subscriber is expected as under, assuming 50% extra traffic (packet headers; frame redundancy verification code; acknowledgements; charging tickets; routing information; transmission of lost or errored frames, etc.) as described in GAS 11 Handbook.

112.8(segments) x 64(octets) x 8(bits) x 1.5(overhead)
= 86,630.4(bits)

Therefore, total busy-hour traffic (in kbits) at most are expected to reach for SKDP subscribers:

1994: 57,176 kbits
1999: 98,759 kbits
2004: 168,063 kbits

4.3 International Telephone Traffic

As for international telephone traffic, the Study collected the following data in Jakarta from PT. INDOSAT.

Year	No. of Calls ($x10^3$)	Paid Minutes ($x10^3$)	Average Paid Minutes/Call
1982	2,107	15,592	7.4
1983	2,402	17,346	7.2
1984	2,784	19,024	6.8
1985	3,275	20,544	6.3
1986	4,564	24,117	5.3
1987	6,252	28,529	4.6
1988	9,339	35,999	3.9

The figures above implicate:

a) Number of international calls in Jakarta has been sharply increasing reflecting its lively socio-economic activities as the capital of Indonesia as well as a cosmopolitan city. (annual growth rate: 28%)

b) Growth rate of paid minutes is lower than that of number of calls. (annual growth rate: 15%)

c) Therefore, average paid minutes per an international call tend to be shortened. It could mean that the group of people to make international calls has been gradually extending from specific group comprising large-scale companies, etc. to the public.

Referring to the total number of subscribers in DKI Jakarta in 1986, 87 and 88, following are obtained.

Year	No. of Subscribers	Paid Minutes Per Subscriber	Traffic Intensity 1/
1986	227,000	106.2	0.66 mE
1987	295,400	96.6	0.60 mE
1988	305,900	117.7	0.73 mE

1/ Calculated by multiplying "Paid Minutes per Subscriber" and following factors:

- "Year to Working-day" converting term (1/300)
- "Day to Busy-hour" converting term (1/9)
- "Minute to Erlang" converting term (60/3600)