

2.3.5 Industrial Estate Project in the Objective Area

(1) Background and Objectives of Analysis

The importance of the telecommunications development has recently been drawing wide attention in terms of its role in economic growth. In an environment in which Indonesia's economic growth is expected to accelerate, deficiency of the telecommunications facilities is often cited as a major constraint of economic growth. It is pointed out that it is necessary to secure more reliable and refined telecommunications services to the public such that more efficient business and production operations become possible.

In recognition of these circumstances, particular attention is paid to industrialization trend in the objective area. Data were collected regarding the industrial estate projects planned in the objective area and the number of factories to locate in these industrial estates are estimated. The analysis in this sub-section aims to provide basic data for showing a model case of telecommunications supply planning focusing on industrial demand.

(2) Planned Industrial Estate Project

Data were collected at Badan Pertanahan Nasional East Jawa (BPN or National Land Body) and Bappeda East Jawa regarding the planned industrial estate projects in the objective area. BPN issues land permit to developers planning to develop land for a particular purpose such as industrial development and real estate development. Following the issuance of land permit, developers could proceed the project further toward implementation. The data collected at BPN include a list of industrial estate projects for which applications were submitted to BPN as of August 1990. To supplement these data, information from Bappeda East Jawa was considered.

Interview surveys were also carried out for two large-scale industrial estate projects: one in Kabupaten Gresik and the other in Kabupaten Bangkalan in Madura Island.

The data show that seventeen industrial estate projects have been proposed to BPN as of August 1990, out of which two projects have recently been approved. Information from Bappeda indicates that there is a development plan of an industrial estate in north of Kecamatan Gresik in an area of 500 ha. The following table summarizes the number of proposed industrial estate projects and the total area by Kotamadya and Kabupaten in the objective area.

Area	Number	Total Area (ha)
Kodya Surabaya	8	2,373
Kab Gresik	6	2,400
Kab Mojokerto	1	200
Kab Bangkalan	3	1,350
Total	18	6,323

Table 2.3.6 presents the names of developers, proposed area for development, location and an estimate of the number of factories to locate in the industrial estates. Figure 2.3.4 shows the locations of each industrial estate project. For reference Figure 2.3.4 shows the locations of real estate projects proposed to BPN as well. Table 2.3.7 presents a list of real estate projects proposed to BPN.

(3) Estimate of the Number of Factories

The number of factories to locate in the industrial estates are estimated until the target year 2004 by each Repelita period. The following are the assumptions underlying the estimate.

- It is assumed that all industrial estates proposed to BPN be implemented.
- The estimate is made assuming that the development areas remain unchanged as proposed to BPN.

In reality it is possible that some of the proposed projects might not be implemented or areas for development change over time. In the study, however, an estimate based on the assumptions above is applied considering an analysis at this level of detail would still be effective for the purpose of showing a model case of telecommunications planning for industrial demand. It is recommended that Perumtel keeps an eye on the industrial estate development trends and updates the telecommunications development plans from time to time.

The following table summarizes the result of estimating the number of factories to locate in the industrial estates in the objective area by the end of each Repelita period until the year 2004.

No. of Factories by Repelita			
Area	V	VI	VII
Kodya Surabaya	570	1,090	1,090
Kab Gresik	146	1,110	1,110
Kab Mojokerto	45	90	90
Kab Bangkalan	0	55	630
Total	761	2,345	2,920

The following method is employed in estimating the number of factories.

- 1) Land area of each industrial estate was used as the basis for estimating the number of factories. The following are the assumptions.

- gross area per factory : 1.5 ha
- proportion of land area in an industrial estate to be filled with factories: 70%

- 2) The following conditions are assumed for the pace of development.

- Industrial estates in Surabaya will grow faster than those in the other areas.
- Development in Kabupaten Bangkalan in Madura Island is closely related with the progress of the Surabaya - Madura bridge project. As explained in the section 2, it is likely that the bridge be completed in later years during Repelita VI.

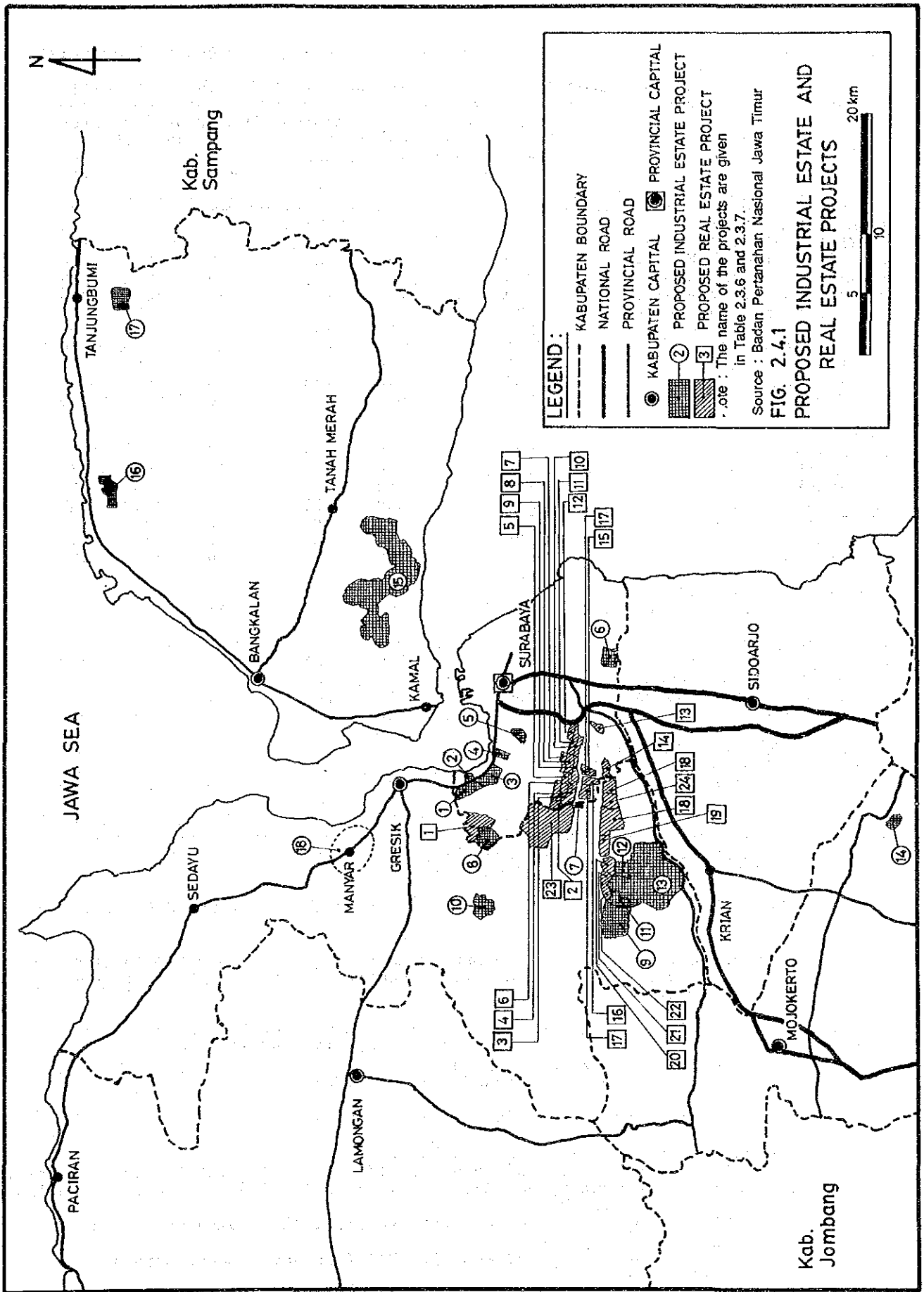


Table 2.3.6 Estimate of the Number of Factories to Locate in Proposed Industrial Estates
(Based on Data from BPN and Interview Survey at BAPPEDA East Jawa)

No.	Name of Developer	Total Area (ha)	Number of factories at full development (4)	Assump- tions in Phasing (5)	Number of factories by Repelita		
					V	VI	VII
** DATA FROM BPN **							
(KODYA SURABAYA)							
1.	Altap Prima I.E	500	230	(a)	120	230	230
2.	Sarana Wisma Permai	200	90	(a)	50	90	90
3.	Almindo Lightmetal I.	600	280	(a)	140	280	280
4.	Surya Jaya Bumi Prima E.	200	90	(a)	50	90	90
5.	Hasta Manunggal Citra Tama	200	90	(a)	50	90	90
6.	Sier (1)	320	150	(a)	80	150	150
7.	Darmo Santosa Raya	53	20	(a)	10	20	20
8.	Maspion	300	140	(a)	70	140	140
	Sub-total	2,373	1,090	-	570	1,090	1,090
(KABUPATEN GRESIK)							
9.	Kasih Jatim	200	90	(b)	15	90	90
	Kasih Jatimanda	200	90	(b)	15	90	90
10.	Injoko	100	50	(b)	8	50	50
11.	Alas Watu Utama	500	230	(b)	38	230	230
12.	Prima Anom Permai	200	90	(b)	15	90	90
13.	Sinar Satelit I.E (2)	700	330	(b)	55	330	330
	Sub-total	1,900	880	-	146	880	880
(KABUPATEN MOJOKERTO)							
14.	Darma Sejahtera Sakti (1)	200	90	(a)	45	90	90
(KABUPATEN BANGKALAN)							
15.	Dhipa Madura Pradana (2)	700	330	(c)	0	55	330
16.	Dhipa Madura Pradana	300	140	(d)	0	0	140
17.	Dhipa Madura Pradana	350	160	(d)	0	0	160
	Sub-total	1,350	630	-	0	55	630
** INFORMATION FROM BAPPEDA EJ **							
(KABUPATEN GRESIK)							
18.	Pt. Liku Telaga (3)	500	230	(e)	0	230	230
GRAND TOTAL		6,323	2,920	-	761	2,345	2,920

Note: (1) Location permit has been given by governor and the right of land has been acquired. Others are in process.

(2) The number of factories in these two projects are estimated based on the interview surveys.

(3) This project is still at the preliminary stage and has not been proposed to BPN for approval yet. The exact location, therefore, has not been clarified yet.

(4) In estimating the number of factories from the total land area, the following assumptions are applied: (except 13. and 15.)

- Portion of total area in which factories will be established : 70 % ha

- Average size of lot per factory : 1.5 ha

(5) The assumptions in phasing are as follows.

(a) full development by end Repelita VI/50 % development by end Repelita V

(b) full development by end Repelita VI/17 % (1/6) development in the last year of Repelita V

(c) full development by end Repelita VII/17 % (1/6) development in the last year of Repelita VI

(d) full development by end Repelita VII / no development before Repelita VII

Table 2.3.7 List of Real Estate Development Projects Proposed to BPN

No.	Name of Developer	Location (Name of Kecamatan)	Area (ha)	No.	Name of Developer	Location (Name of Kecamatan)	Area (ha)
I. KOTAMADYA SURABAYA				II. KABUPATEN GRESIK			
1.	Pt.Altap Prima Real Estate	Benowo	600	18.	Perum Perumnas	Driyorejo	800
2.	Pt.Subur Hijau Jaya Makmur	Lakarsantri	192	19.	Kodam V Brawijaya	n.a.	n.a.
3.	Taman Citra Surya Hijau	Lakarsantri	178	20.	Pt.Prima Ngepung Permai	Kedamaian	150
4.	Pt.Bumi Citra Surya	Lakarsantri	199	21.	Pt.Prima Damai Permai	Kedamaian	150
5.	Pt.Apta Citra Universal	Lakarsantri	70	22.	Pt.Prima Anom Permai	Driyorejo	200
6.	Pt.Bumi Indah Permai Terang	Lakarsantri	76	23.	Pt.Ciputra Group	Menganti	1,000
7.	Pt.Pakuwon Dharma	Karangpilang	195	24.	Perum Perumnas	Driyorejo	200
8.	Pt.Artisan Surya Kressi	Karangpilang	190				
9.	Perum Perumnas	Lakarsantri	140				
10.	Pt.Sanggar Sptoargo	Karangpilang	65				
11.	Pt.Darmo Grande	Karangpilang	100				
12.	Perumahan KODAM V Brawijaya	Karangpilang	150				
13.	Pt.Agra Paripurna	Karangpilang	35				
14.	Pt.Sinar Galaxy	Lakarsantri	166				
15.	Pt.Persada Kencana Mukti	Karangpilang	60				
16.	Pt.Cahaya Baru Raya	Lakarsantri	50				
17.	Pt.Kusuma Kartika Internusa	Lakarsantri	110				

Note: (1) Locations of each project are shown in Figure 2.3.4 with corresponding numbers.

(2) The list is valid as of August 1990.

Source: Badan Pertanahan Nasional (BPN) Jawa Timur

SECTION 3 PRESENT TELECOMMUNICATIONS NETWORK

SECTION 3

PRESENT TELECOMMUNICATIONS NETWORK

3.1 Present Conditions of Telecommunications Network

3.1.1 Telecommunications Services

The principle services provided over existing telecommunications network in the objective area are as follows:

- Telephone service (including Mobile Telephone Service)
- Telex/Telegraph service
- Facsimile service
- Data communication service
- Radio paging service

Telephone service is provided by ordinary telephone network (PSTN: Public Switched Telephone Network), while telex/telegraph services are by telex network and leased circuits. Facsimile service is available through telephone network. Data communication services in Indonesia are provided through telephone network, leased circuits and packet switched public data network (PSPDN). PSPDN in Indonesia is called SKDP (Sambungan Komunikasi Data Paket). Circuit switched public data network (CSPDN) has not been established in Indonesia and no development plan is available. Radio paging service is available in Surabaya city. Two private companies are authorized to operate the service.

Table 3.1.1 shows the present conditions of each telecommunication service provided in the objective area as of 1989.

Table 3.1.1 Conditions of Existing Telecommunications Services

Service category	Surabaya (A)	Jakarta (B)	Indonesia (C)	(A)/(B)	(A)/(C)
Telephone	60,510	337,254	861,888	18 %	7 %
Telex	1,774	7,341	15,943	24 %	11 %
Leased circuit:					
Data	12	604	657	2 %	2 %
Telegraph/Telex	3	389	455	less than 1 %	
SKDP:					
Dial-up	24	242	334	10 %	7 %
Dedicated	2	33	37	6 %	5 %
Radio paging	4,809 subs	-	-		

Source: PERUMTEL's statistics as of 1989 (OPTEKTEL)
 Figures show number of subscribers.

3.1.2 Existing Development Plan

PERUMTEL drew up the telecommunications network development program to meet demand and improve the quality of service on the basis of Government's Fifth Five Year Development Plan (Repelita V). Table 3.1.2 shows summary of telecommunications network development plan during Repelita V.

Table 3.1.2 Summary of Fifth Five-Year Plan (Repelita V)

Area	Number of Locations (A)	Switching Capacity(LU) (B)	(B)/(A)	Subscribers Network(Pairs) (C)	(C)/(A)
Indonesia (1)	534	1,478,678	2,769	2,198,560	4,117
WITEL VII (2)	63	183,246	2,909	264,490	4,198
(2)/(1) %		12.3 %		12.0 %	
Objective Area (3)	24	115,496	4,812	169,200	7,050
(3)/(2)		63.0 %		64.0 %	
WITEL IV (4)	52	628,560	12,088	814,600	15,665
(4)/(1)		42.5 %		37.1 %	

Source : PERUMTEL DIREKTORAT PEMBANGUNAN
PEMBANGUNAN TELEKOMUNIKASI STO & JARKAB PELITA V (18 Jan 1990)

In order to assist the PERUMTEL's development program, the World Bank (IBRD: International Bank for Reconstruction and Development) decided to extend the loan for Third Telecommunications Project (TELECOM III). The Project covered by the World Bank Loan is to modernize and expand the subscribers network throughout Indonesia. Proposed scope of the Project, which is called "TELECOM III OSP Project", is summarized in Table 3.1.3.

Table 3.1.3 Scope of TELECOM III OSP Project

ITEM	UNIT	Indonesia (1)	WITEL VII (2)	(2)/(1)%	Objective Area (3)	(3)/(2)%	WITEL IV (4)	(4)/(1)%
Subscribers network								
Number of exchanges	Location	116	31		15		16	
Termination cable on MDF	Pairs	594,290	134,440	22.6%	91,900	68.4%	204,400	34.4%
140 Mbit/s optical fiber cable transmission systems								
Route	Number	21	7		7		5	
Optical fiber cable	Route-km	109.1	35.1	32.2%	35.1	100.0%	21.7	19.9%
140 Mbit/s systems								
New installation	Number	1,384	533	38.5%	533	100.0%	253	18.3%
System expansion	Number	418	271	64.8%	271	100.0%	0	0.0%
2 Mbit/s cable PCM transmission systems								
Route	Number	17	4		4		1	
PCM cable	Route-km	107.7	29.0	26.9%	29.0	100.0%	6.5	6.0%
2 Mbit/s systems	Number	136	0	0.0%	0	0.0%	12	8.8%
Microwave transmission systems								
Route	Number	2	0		0		0	
Microwave system	Route-km	33.0	0	0.0%	0	0.0%	0	0.0%
2 Mbit/s systems	Number	10	0	0.0%	0	0.0%	0	0.0%
Construction of new buildings	Number	51	14	27.5%	8	57.1%	8	15.7%
Modification of existing buildings	Number	20	5	25.0%	2	40.0%	3	15.0%
Subscriber service lines to be connected	Number	166,876	57,223	34.3%	39,608	69.2%	36,900	22.1%

Source : Bidding documents of TELECOM III (OSP)

3.2 Telephone Switching Network

3.2.1 Present Condition of Telephone Service

Surabaya and its surrounding areas are not only the center of East Jawa Province but also the core of East Indonesia. Also in the telecommunications sector, Surabaya is not only one of tertiary centers but also a most important strategic position in east half of Indonesian telecommunications network.

The telephone service penetration ratio in this area is the second highest in Indonesia following Jakarta area: more precisely, the penetration ratio of Surabaya area is 70 % of that of Jakarta areas, as of 1989. These comparisons of penetration ratio among Surabaya and other areas are shown in the following Table 3.2.1:

Table 3.2.1 Telephone Service Indexes in Indonesia as of 1989

Areas	Sub.s/ 100 Pop	No.of Sub.s	Sub.s Share(%)	Pop (x1000)	Pop Share(%)	Waiting Applicants
SURABAYA	2.89	60,510	7.0	2,097	1.3	63,422
JAKARTA	4.26	337,254	39.1	7,914	4.8	194,364
INDONESIA	0.52	861,888	100.0	164,629	100.0	498,079
WITEL-I	0.52	65,076	7.6	12,438	7.6	42,759
WITEL-II	0.35	27,851	3.2	8,019	4.9	13,205
WITEL-III	0.34	41,771	4.8	12,262	7.4	13,114
WITEL-IV	2.69	346,300	40.2	12,864	7.8	199,578
WITEL-V	0.33	85,829	10.0	25,989	15.8	62,645
WITEL-VI	0.23	70,062	8.1	29,981	18.2	44,321
WITEL-VII	0.36	113,447	13.2	31,373	19.1	64,136
WITEL-VIII	0.35	32,860	3.8	9,369	5.7	21,507
WITEL-IX	0.34	26,284	3.0	7,749	4.7	10,577
WITEL-X	0.33	38,087	4.4	11,594	7.0	22,409
WITEL-XI	0.38	6,191	0.7	1,614	1.0	1,497
WITEL-XII	0.59	8,130	0.9	1,376	0.8	2,331

Sources:

Population : BPS data as of 1985 (Yearbook 1988).

Telecom data: PERUMTEL's telecom statistics as of 1989 (OPTEKTEL).

Waiting applicants are those for automatic service.

In the objective area, the penetration ratio in Surabaya multi-exchange area is 2.89 per 100 inhabitants, following 4.26 in Jakarta multi-exchange area; however, the ratio in surrounding areas of Surabaya is still only 0.13 per 100 inhabitants. Even in Kecamatan capitals, most of the telephone connections are still being made by manual exchange and open wire facility for both trunk and subscriber lines.

The number of waiting applicants for automatic telephone service in Indonesia is considerably large, approximately corresponding to 60 % of the total number of existing subscribers. In Surabaya multi-exchange area, the number of waiting applicants is almost equal to the number of the existing subscribers. The numbers of subscribers and waiting applicants in Surabaya area for past five years (1985 - 1989) are shown in Table 3.2.2. Judging from the past worldwide trends, it is anticipated that the gap between supply and demand will become larger.

Table 3.2.2 The Number of Subscribers and Waiting Applicants (1/2)

No. Exchange Name	No. of Sub. /Waiting	Year				
		1985	1986	1987	1988	1989.11
[Surabaya Multi-Exchange Area]						
1 Kapsan	No. of Sub.	8,652	9,173	9,649	9,770	9,579
	Waiting	3,882	5,549	7,733	8,728	8,855
	Total	12,534	14,722	17,382	18,498	18,434
2 Kebalen	No. of Sub.	9,891	9,946	10,275	11,534	12,732
	Waiting	2,764	3,342	4,931	5,569	5,601
	Total	12,655	13,288	15,206	17,103	18,333
3 Tj. Perak	No. of Sub.	1,972	2,166	2,182	2,278	2,339
	Waiting	489	506	620	634	595
	Total	2,461	2,672	2,802	2,912	2,934
4 Darmo	No. of Sub.	5,341	5,396	5,302	5,618	5,800
	Waiting	9,486	11,283	14,485	16,473	17,808
	Total	14,827	16,679	19,787	22,091	23,608
5 Mergoyoso	No. of Sub.	10,110	10,182	11,242	16,115	16,364
	Waiting	8,756	11,609	16,070	14,052	12,395
	Total	18,866	21,791	27,312	30,167	28,759
6 Manyar	No. of Sub.			1,395	1,980	2,543
	Waiting					4,767
	Total					7,310
7 Sepanjang	No. of Sub.	383	450	499	532	540
	Waiting	417	461	514	297	313
	Total	800	911	1,013	829	853
8 Rungkut	No. of Sub.	8,209	8,812	9,200	9,561	9,880
	Waiting	5,762	7,532	9,663	11,028	12,275
	Total	13,971	16,344	18,863	20,589	22,155
Sub Total (*1)	No. of Sub.	44,558	46,125	49,744	57,388	59,777
[Surabaya Area]	Waiting	31,556	40,282	54,016	56,781	62,609
	Total	76,114	86,407	102,365	112,189	122,386

Table 3.2.2 The Number of Subscribers and Waiting Applicants (2/2)

No.	Exchange Name	No. of Sub. /Waiting	Year				
			1985	1986	1987	1988	1989.11
[Surrounding Area]							
1	Gresik	No. of Sub.	1,144	1,181	1,162	1,159	1,186
		Waiting	912	1,094	1,506	2,060	2,248
		Total	2,056	2,275	2,668	3,219	3,434
2	Cerme	No. of Sub.	18	21	32	41	46
		Waiting	27	32	25	19	41
		Total	45	53	57	60	87
1	Sidoarjo	No. of Sub.	1,795	1,894	1,920	1,924	1,986
		Waiting	169	308	499	837	1,060
		Total	1,964	2,202	2,419	2,761	3,046
2	Krian	No. of Sub.	163	185	182	181	189
		Waiting	13	8	13	17	35
		Total	176	193	195	198	224
1	Mojokerto	No. of Sub.	1,643	1,755	1,832	1,921	1,987
		Waiting	98	134	287	435	568
		Total	1,741	1,889	2,119	2,356	2,555
2	Mojosari	No. of Sub.	189	193	242	251	250
		Waiting	11	28	21	54	62
		Total	200	221	263	305	312
1	Lamongan	No. of Sub.	242	272	288	324	534
		Waiting	61	61	54	80	133
		Total	303	333	342	404	667
2	Babat	No. of Sub.	168	189	195	213	232
		Waiting	21	23	22	29	21
		Total	189	212	217	242	253
1	Bangkalan	No. of Sub.	331	363	362	428	474
		Waiting	180	300	397	463	450
		Total	511	663	759	891	924
2	Kamal	No. of Sub.	31	33	64	139	159
		Waiting	95	104	101	100	160
		Total	126	137	165	239	319
1	Jombang	No. of Sub.	983	988	964	963	993
		Waiting	22	31	217	372	430
		Total	1,005	1,019	1,181	1,335	1,423
2	Mojoagung	No. of Sub.	133	142	149	178	185
		Waiting	1	6	9	11	16
		Total	134	148	158	189	201
3	Ploso	No. of Sub.	67	72	74	78	85
		Waiting	3	2	1	1	5
		Total	70	74	75	79	90
Sub Total (*2)		No. of Sub.	6,907	7,288	7,466	7,800	8,306
[Surrounding Area]		Waiting	1,613	2,131	3,152	4,478	5,229
		Total	8,520	9,419	10,618	12,278	13,535
Grand Total		No. of Sub.	51,465	53,413	57,210	65,188	68,083
(*1+*2)		Waiting	33,169	42,413	57,168	61,259	67,838
		Total	84,634	95,826	112,983	124,467	135,921

3.2.2 Existing Telephone Network

The existing telephone network in GERBANGKERTOSUSILA and Jombang areas consists of Surabaya multi-exchange area network and its surrounding area network. It forms Surabaya Secondary Area (SA) network consisting of five (5) message areas. The relation between message areas and relevant administrative areas is shown in the following:

Message areas and administrative areas

Message areas	Area Codes	Administrative areas
Surabaya	<031>	Kotamadya Surabaya Kabupaten Gresik Kabupaten Sidoarjo
Mojokerto	<0321>	Kotamadya Mojokerto Kabupaten Mojokerto
Lamongan	<0322>	Kabupaten Lamongan Kabupaten Sampang(*1)
Bangkalan	<0323>	Kabupaten Bangkalan
Sangkapura	<0325>	P. Bawean(*2)

Note:

*1: Kabupaten Sampang is not included in the study area.

*2: P. Bawean consists of two Kecamatan in Kabupaten Gresik.

In Surabaya message area, two local automatic exchanges, i.e., Gresik and Sidoarjo, are not included in Surabaya multi-exchange area. The number of digits for local connections within the multi-exchange area is 5 or 6 digits depending on the type of switch. For connections between a local exchange in the multi-exchange area and that in the message area (i.e., Gresik and Sidoarjo), prefix "9" is used.

The overall telephone switching network in the study area and the Surabaya multi-exchange area network are shown in Figures 3.2.1 and 3.2.2, respectively. The network configuration in Surabaya multi-exchange area as of the end of 1989 is shown in Figure 3.2.3.

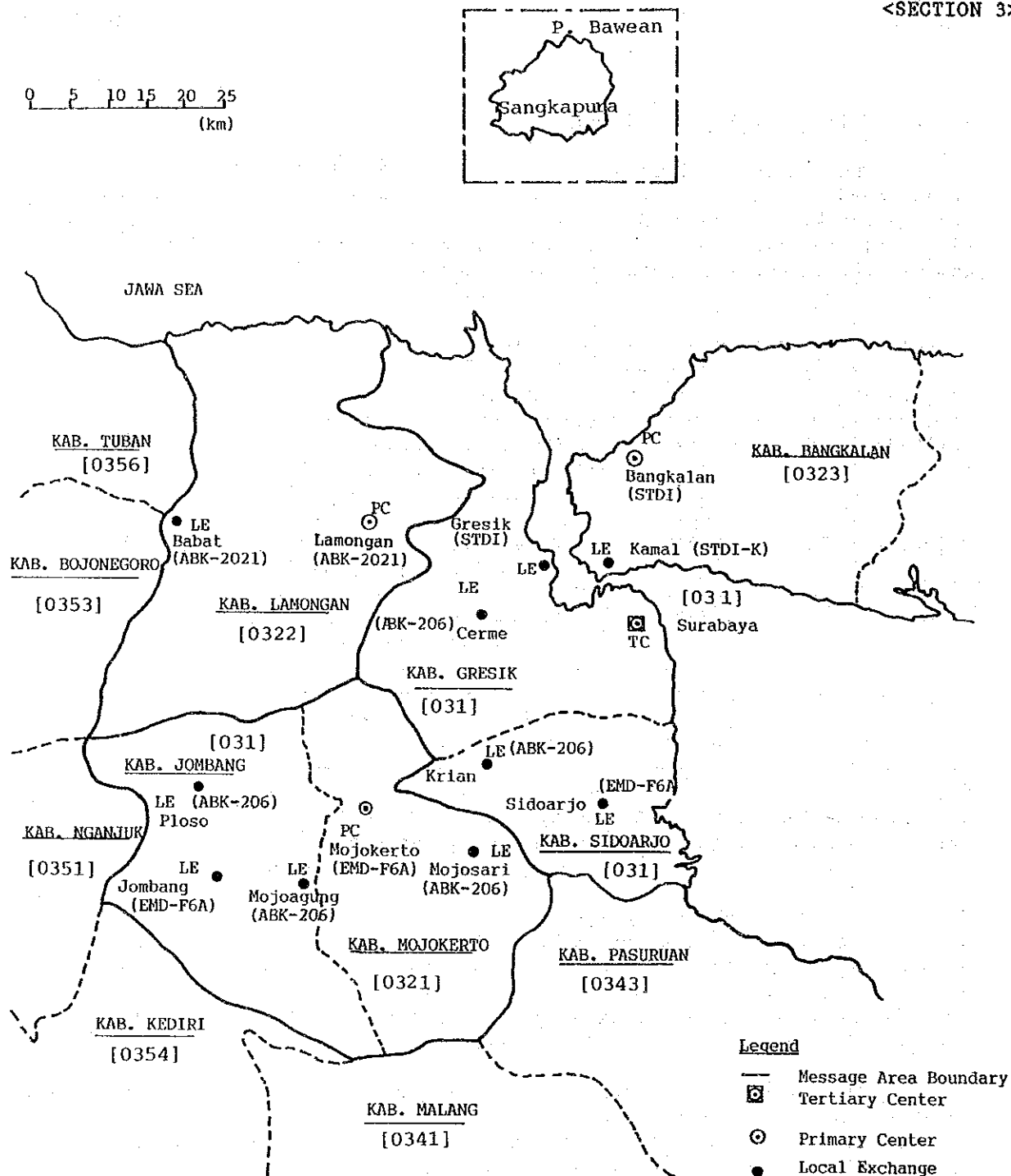


Figure 3.2.1 Existing Telephone Switching Network and Message Areas

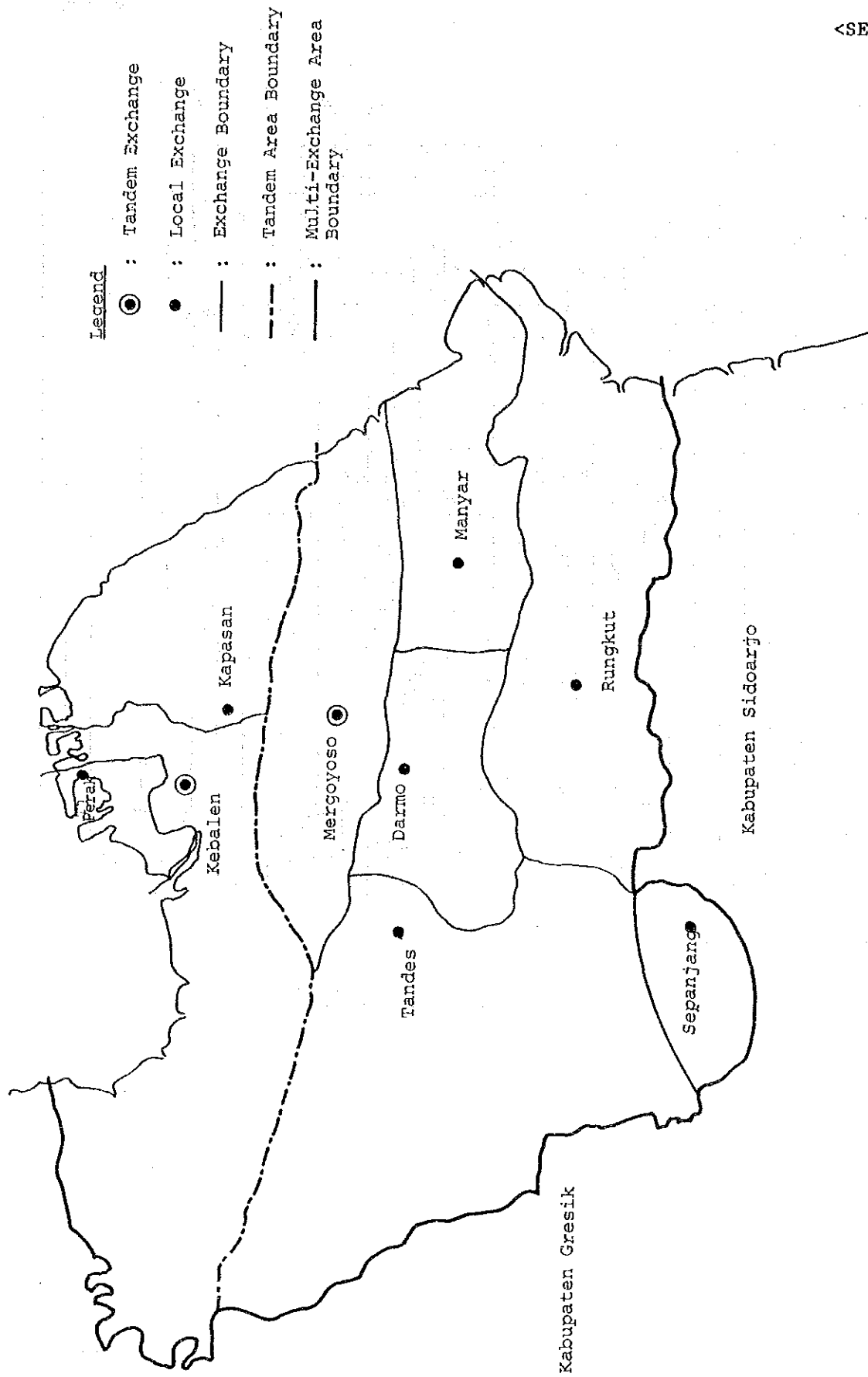
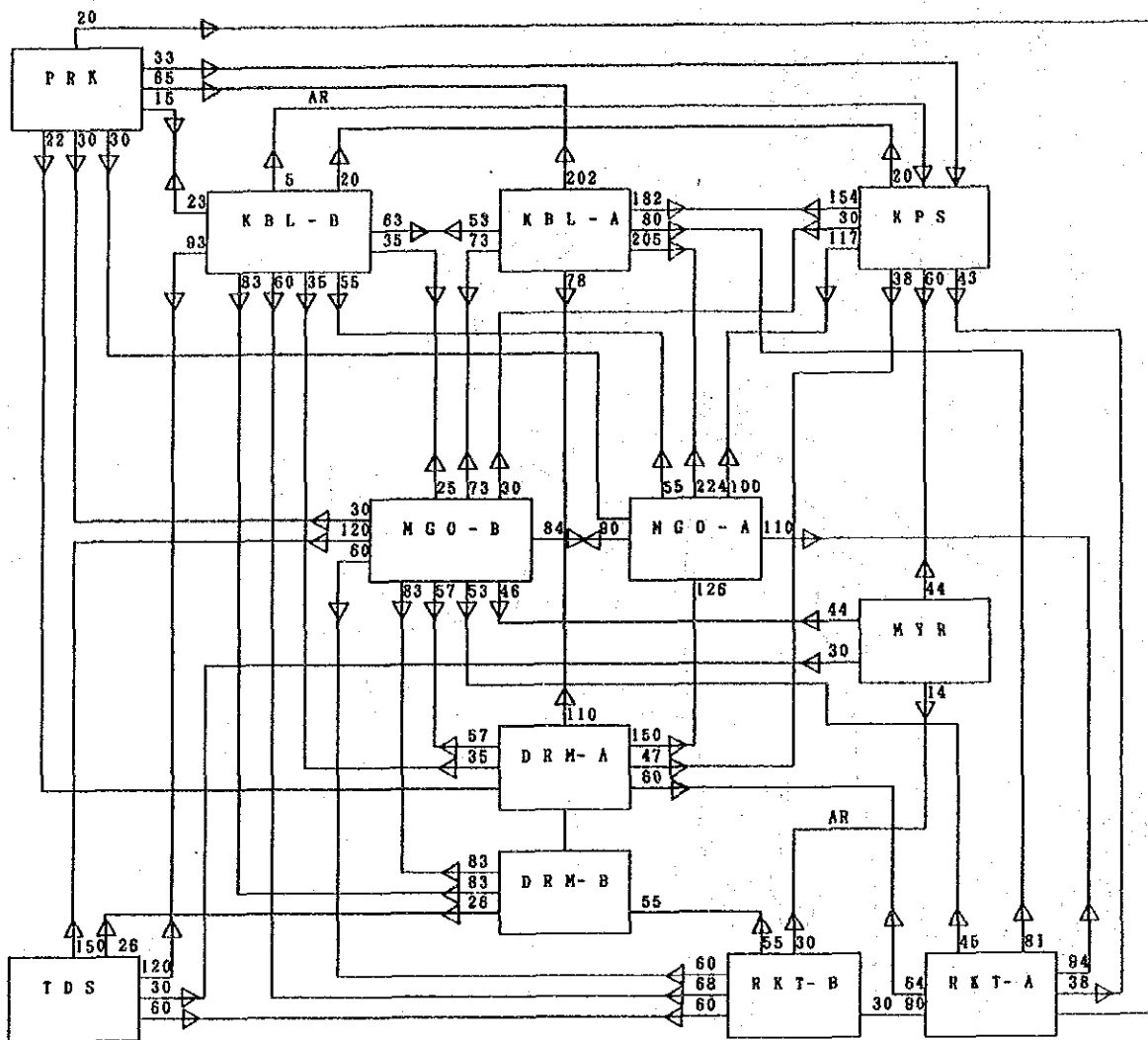


Figure 3.2.2 Existing Surabaya Multi-Exchange Area



Note: AR:Alternative Route

Figure 3.2.3 Existing Network Configuration in Surabaya Multi-Exchange Area

3.2.3 Existing Telephone Exchanges

Existing telephone exchanges in the objective area consist of thirteen (13) automatic exchanges and nine (9) manual exchanges. As of February 1990, five (5) digital exchanges among them have already been in operation. During Repelita V, seventeen (17) more digital exchanges in the number of units will be installed. Consequently, three (3) manual exchanges will be automatized and the digital trunk exchange covering not only GERBANGKERTOSUSILA area but also east half of Indonesia in addition to the existing analog trunk exchange will be newly introduced in Kebalen Exchange. In Kamal Exchange, a small capacity digital exchange (STDI-K) has been operated combining with a field test.

Present conditions of existing telephone exchanges and expansion plans by the end of Repelita V are shown in Table 3.2.3. The existing routing and junction circuit matrix and traffic matrix in Surabaya multi-exchange area are shown in Tables 3.2.4 and 3.2.5, respectively.

Table 3.2.3 Existing Telephone Exchange Facilities as of September 1990 (1/2)

No.	Exchange Name	Ex. Rank	Tk Code	Office Code	Switch Type	OT (M)	Capacity (10)	No. of Sub.s	Waiting Lists	Repelita V Ongoing Planned	Completion Ongoing Planned			
<Surabaya Multi-Exchange Area>														
1	Kapasari-A	LE	31	31XXXX	MG-10C (STDI)	OT	10,000	9,613	8,792	3,000	3/90			
2	KAPASARI-B	LE	31	81XXX	MG-10C	OT	10,000	9,876	12,161	3,000	3/90			
3	Rungkut-A	LE	31	83XXX	STDI	OT	5,000	-	-	5,000	-			
4	Rungkut-B	LE	31	60XXX	EMD-F6A	OT	5,800	5,666	12,938	-	(Remove)			
5	Darmo-A	LE	31	66XXX-69XXX	(STDI)	OT	-	-	-	4,000	1/90			
		LE	31	651XX-658XX	(STDI)	OT	-	-	-	5,000	91			
6	Darmo-B	LE	31	-	EMD-F6A	OT	10,200	9,668	12,453	-	91			
7	Mergoyoso-A	LE	31	40XXX-46XXX	STDI	OT	7,000	6,520	-	-	End 90			
		LE	31	470XX-472XX	EMD-F6A	OT	10,000	9,568	5,673	-	92			
8	Mergoyoso-B	LE	31	51XXXX	STDI	OT	-	-	-	-	-			
9	Kebalen-A	LE	31	2XXXX-270XXX	EMD-F6A	OT	10,000	9,568	5,673	-	-			
		LE	31	278XX-279XX	STDI	OT	5,000	3,011	-	6,000	92			
10	Kebalen-B	LE	31	33XXXX	MG-10C	OT	4288cct	-	-	-	-			
11	Toll-A	TC	31	-	STDI	OT	5000cct	-	-	-	-			
12	Toll-B	TC	31	-	EMD-F6A	OT	2,400	2,331	259	-	(Remove)			
13	Tj.Perak-A	LE	31	291XXX-293XXX	(STDI)	OT	-	-	-	4,000	91			
		LE	31	2951XX-2954XX	STDI	OT	7,000	14	6,000	-	(Remove)			
14	Tj.Perak-B	LE	31	71XXXX	ADK-513	CB	640	537	316	-	92			
15	Tandes	LE	31	-	(STDI)	OT	-	-	-	5,000	92			
16	Sepanjang	LE	31	-	PRX205	OT	3,000	2,670	4,830	-	-			
17	Kenjeran	LE	31	595XXX-597XXX	DLU	OT	-	-	-	2,000	93			
18	Manyar-A	LE	31	-	(STDI)	OT	-	-	-	8,500	92			
19	Manyar-B	LE	31	-	(STDI)	OT	-	-	-	4,000	92			
20	Injoko	LE	31	-	(STDI)	OT	-	-	-	3,000	92			
21	Karang Pilang-A	-	31	-	-	OT	-	-	-	1,000	91			
22	Karang Pilang-B	-	31	-	-	OT	-	-	-	2,500	92			
23	Karang Pilang-C	-	31	-	-	OT	-	-	-	4,000	92			
24	Kandangan	LE	31	-	-	OT	-	-	-	1,000	91			
25	Kalianak	LE	31	-	-	OT	-	-	-	2,500	92			
26	Karu-A	LE	31	-	-	OT	-	-	-	4,000	92			
27	Karu-B	LE	31	-	-	OT	-	-	-	5,000	92			
28	Bambe	LE	31	-	-	OT	-	-	-	1,000	91			
Sub Total										76,040	59,494	63,422	7,000	78,660

FILE:EXISTING.MP2

Table 3.2.3 Existing Telephone Exchange Facilities as of September 1990 (2/2)

Exchange No.	Ex. Rank	Tk Office Code	Switch Type	Capacity (LN)	No. of Sub.s	Waiting Lists	Repetita V. Ongoing	Completion-- Planned
<Gresik>								
1	LE	31	81XX,83XX	EMD-F6A	OT	-	-	(Remove)
2	LE	31	STDI	OT	3,000	1,186	2,248	-
3	LE	-	ABR-206	LB	50	46	41	-
Sub Total					3,050	1,232	2,289	0
<Sidoarjo>								
1	LE	31	21XX,41XX	EMD-F6A	OT	2,000	1,986	1,145
2	LE	31	(STDI)	OT	-	-	-	2,500
3	LE	-	ABR-206	LB	190	189	40	-
Sub Total					2,190	2,175	1,185	0
<Mojokerto>								
1	PC	321	21XX,22XX	EMD-F6A	OT	2,000	1,987	576
2	LE	-	(STDI)	OT	-	-	-	4,000
3	LE	-	ABR-206	LB	350	258	62	-
Sub Total					2,350	2,245	638	0
<Lamongan>								
1	PC	-	-	ABR-2021	LB	400	381	127
2	LE	322	-	(STDI)	OT	-	-	1,000
	LE	-	-	ABR-2021	LB	250	240	14
Sub Total					650	621	141	0
<Bangkalan>								
1	LE	323	-	DLU	OT	1,000	167	170
2	LE	31	91XX	STDI-K	OT	184	170	388
Sub Total					1,184	167	170	0
<Mojokerto>								
1	LE	321	81XX	EMD-F6A	OT	1,000	985	434
2	LE	-	-	(STDI)	OT	-	-	2,500
3	LE	-	-	ABR-206	LB	200	184	12
4	LE	-	-	ABR-206	LB	100	83	5
SUB TOTAL					1,300	1,252	451	0
Total					86,764	67,186	68,296	7,000

Source: Perumtel H/Q, Wiral VI

Table 3.2.4 Existing Routing and Junction Circuit Matrix in Surabaya Multi-Exchange Area

(as of December 1989)

NO.	TO FROM	PRK	KBL-A	KBL-B	KPS	MGO-A	MGO-B	DRM-A	DRM-B	MYR	RKT-A	RKT-B	IDS	TOTAL
1	PRK	XXXXX	65 D	15 D	33 D	30 D	30 D	22 D	-----	TA(MGO-B)	20 D	TR(RKT-A)	TA(KBL-B)	215
2	KBL-A	202 D	XXXXX	53 D	182 D	205 D	73 D	78 D	-----	TA(MGO-B)	80 D	TR(RKT-A)	TA(KBL-B)	873
3	KBL-B	23 D	63 D	XXXXX	20 D	55 D	35 D	35 D	-----	TA(MGO-B)	60 D	TA(MGO-B)	90 D	381
4	KPS	TR(KBL-A)	154 D	20 D	XXXXX	117 D	30 D	38 D	-----	60 D	43 D	TA(MGO-B)	TA(KBL-B)	462
5	MGO-A	TR(KBL-A)	224 D	55 D	100 D	XXXXX	80 D	126 D	-----	TA(MGO-B)	118 D	TR(RKT-A)	TA(MGO-B)	713
6	MGO-B	30 D	73 D	25 D	30 D	84 D	XXXXX	57 D	-----	46 D	53 D	60 D	120 D	578
7	DRM-A	TR(KBL-A)	110 D	35 D	47 D	150 D	57 D	XXXXX	-----	TA(MGO-B)	60 D	TR(RKT-A)	TA(MGO-B)	459
8	DRM-B	-----	-----	-----	-----	-----	-----	XXXXX	-----	-----	-----	-----	-----	0
9	MYR	TR(KPS)	TR(KPS)	TA(MGO-B) AR(IDS)	44 D	IA(MGO-B)	44 D	TA(MGO-B)	-----	XXXXX	TR(KPS) AR(RKT-B)	TA(MGO-B)	30 D	118
10	RKT-A	TR(KBL-A)	81 D	TA(MGO-B)	38 D	94 D	45 D	64 D	-----	TR(KPS)	XXXXX	90 D	TR(RKT-B)	412
11	RKT-B	TA(KBL-B)	TA(KBL-B)	60 D	TA(MGO-B)	TA(MGO-B)	60 D	TA(MGO-B)	-----	14 D	30 D	XXXXX	60 D	224
12	IDS	TA(KBL-B)	TA(KBL-B)	120 D	TA(KBL-B)	TA(MGO-B)	150 D	TA(MGO-B)	-----	30 D	TR(RKT-B)	60 D	XXXXX	350
	TOTAL	255	770	383	494	735	614	420	0	150	404	270	300	

Note: D: Direct Route, TA: Tandem Route, AR: Alternative Route

Table 3.2.5 Existing Traffic Matrix in Surabaya Multi-Exchange Area

No.	From	To													Total	Local Total	
		MGO-A	MGO-B	DEM-A	DEM-B	RKT-A	RKT-B	MNR	KBL-A	KBL-B	KPS	PRK	TDS	Toll			9
1	MGO-A	94.02	27.63	80.05	55.21	51.91	25.96	11.84	88.01	17.65	61.97	21.12	27.62	62.01	7.04	632.04	582.98
2	MGO-B	73.37	66.79	44.62	30.77	40.00	4.20	37.95	44.12	15.37	28.70	3.67	10.40	39.80	4.83	444.58	399.96
3	DRM-A	83.30	18.38	61.43	28.33	33.22	16.61	7.87	52.74	6.26	28.35	12.66	18.37	42.96	5.14	415.62	387.52
4	DRM-B	57.45	12.68	42.32	19.51	22.91	11.45	5.43	36.37	4.32	19.55	8.73	12.67	29.63	3.54	286.57	253.40
5	RKT-A	78.14	19.15	45.47	36.38	56.48	1.96	7.13	42.98	13.67	23.76	10.32	2.74	66.13		404.31	338.18
6	RKT-B	1.30	0.89	0.74	0.51	2.70	2.43	0.65	1.47	1.49	1.27	0.71	0.38	1.30		15.84	14.54
7	MNR	10.05	6.90	5.71	3.93	13.29	4.29	15.32	13.29	4.92	13.29	3.18	2.54	9.28		106.99	97.71
8	KBL-A	105.30	29.14	60.30	41.59	39.20	18.60	12.49	98.40	6.17	84.30	76.90	12.83	69.80	4.90	663.92	589.22
9	KBL-B	21.70	6.97	10.45	7.21	8.95	4.72	2.98	24.60	21.34	10.45	4.10	3.32	22.12	2.45	152.36	127.79
10	KPS	87.98	15.18	24.84	17.13	38.32	10.85	27.81	88.53	69.16	5.44	21.25	7.61	34.76		448.87	414.11
11	PRK	12.30	5.67	6.70	4.62	8.07	4.03	2.43	28.27	1.21	16.10	5.30	1.69	17.50		113.89	96.39
12	TDS	27.62	10.40	18.37	12.67	2.74	0.38	2.54	12.83	3.22	7.61	1.69	20.08	15.63		135.78	120.15
13	Total	652.53	219.79	401.00	257.86	318.79	106.49	135.44	531.61	167.78	300.79	169.63	120.25	410.92	27.90	3820.78	3381.96

Note: IR: Transit, TA: Tandem, AR: Alternative Route

3.3 Transmission Network

Transmission network in the study area is categorized as follows:

- Junction Network:
Junction cable network in Surabaya multi-exchange area
- Regional Transmission Network:
Transmission network in Surabaya, Bangkalan, Mojokerto, Lamongan and Sangkapura message areas
- Mobile Communication Network:
Mobile telephone network and paging network in Surabaya city

3.3.1 Junction Network in Surabaya Multi-Exchange Area

(1) Present Condition

9 (nine) exchanges in Surabaya multi-exchange area mentioned below are inter-connected by junction network:

Kebalen, Mergoyoso, Darmo, Rungkut, Kapasan, Manyar, Tj.Perak Sepanjang and Tandes.

Configuration of existing transmission systems and junction cables in Surabaya multi-exchange area is shown in Figure 3.3.1 and ANNEX 3.3.1 (1/4 - 4/4).

Transmission systems adopted are digital transmission system using metallic pair cables (2 Mbit/s) and fiber optic cables (140 Mbit/s).

(2) Recent Development

In order to improve the junction network in Surabaya multi-exchange area, "Junction Cable Phase-IV Project" is being implemented in coordination with digital switching expansion program and following new exchanges are scheduled to be connected with the existing exchanges by this Project.

<u>Name of Exchanges</u>	<u>Site Condition</u>
Sepanjang	Building was constructed
Karangpilang	Building is under construction
Kandangan	Building is under construction
Kalianak	Construction is not started yet
Injoko	Construction is not started yet

For further development of the junction network during Repelita V, expansion program is planned and scheduled to be executed under the scheme of TELECOM III OSP Project, with the World Bank loan assistance.

After completion of the above projects, major exchanges are to be inter-connected by digital transmission system on fiber optic cables with a bit rate of 140 Mbit/s.

3.3.2 Regional Transmission Network

(1) Present Condition

1) Regional Transmission Network

Transmission media and routes of the existing regional transmission network in the objective area are shown in Figure 3.3.2.

In the northern area, open wire carrier (o.w.c) system is still a sole transmission media linking existing manual exchanges. Following is the summary of transmission routes to/from Surabaya:

	o.w.c		M/W	
Lamongan	-----	Bojonegoro(out of objective area)	-----	Madiun(out of objective area)
		M/W		
			-----	Surabaya

In the southern area, analog carrier transmission system using mono-coaxial cable having a capacity of 360 telephony channels (SMC-360 coaxial cable system) is used for linking existing automatic analog exchanges. This system forms major transmission network not only in the objective area but also in East Jawa Province. Route configuration is available in Figure 3.3.3 (1/2 - 2/2).

However, reliability of SMC-360 Coaxial Cable System is not sufficient, because system failures and troubles sometimes happen in transmission equipment and coaxial cables. Details are given in Paragraph (3) "Problems on Transmission Network".

Only HF radio link is available for Sangkapura in Bawean island at present, while small type satellite earth station at Sangkapura is under construction.

An outline of existing transmission systems is summarized in ANNEX 3.3.2.

2) Trunk Circuits

Surabaya is categorized as Tertiary Center in exchange hierarchy in Indonesia and regarded as transmission center in the eastern part of Indonesia.

The number of trunk circuits between Surabaya Tertiary Center (Kebalen) and major cities in Indonesia are more than 2,000 at present. For improvement of trunk circuits in Jawa island, two major projects are planned and being implemented. One is "Jawa - Bali 2nd Digital Microwave Project" and the other, "Jakarta - Surabaya Fiber Optic Transmission Project (SKSO)". After completion of these projects, the number of trunk circuits will reach 6,700. Configuration of trunk circuits to/from Surabaya is shown in Figure 3.3.4 and ANNEXs 3.3.3 (1/5 - 5/5) and 3.3.4.

(2) Recent Development

For the regional transmission network development in the objective area, following projects are under implementation.

- a) Jawa - Bali 2nd Microwave Route Project (Digital)
- b) Jakarta - Surabaya Optical Fiber Route (SKSO) (Digital)
- c) Remote Area Project (PH-I, II) (Digital)
- d) Rural Area Project (PH-I, II) (Digital)
- e) Microwave Tail Link for Surabaya - Banjarmasin Submarine Cable Project (Digital)

Route maps and system configurations of the above projects are shown in Figures 3.3.5 and 3.3.6, respectively. Summary of the system is available in Table 3.3.1. After completion of Jawa - Bali 2nd Route and SKSO Projects, trunk circuits between Surabaya and major cities in Jawa will be linked by a high speed digital transmission system.

Summary of Remote Area and Rural Area Projects is listed in Table 3.3.2. The implementation of Remote Area Project is delayed considerably due to the difficulty in land acquisition and delay of building construction work, while the erection of antenna towers was almost completed at the end of 1987. However, the installation work for following sections has been completed at the end of 1990.

- a) Surabaya - Gresik (2 GHz, 34 Mbit/s, 1+1)
- b) Surabaya - Kamal (1.5 GHz, 8 Mbit/s)
- c) Surabaya - Sepanjang (1.5 GHz, 8 Mbit/s)
- d) Gresik - Bangkalan (1.5 GHz, 8 Mbit/s)

The implementation of Rural Area Project is also delayed due to the delay of subscriber cable installation work, while acceptance test for radio sections was completed in December 1989. Integrated project management is required to avoid further delay of the project implementation.

(3) Problems on Transmission Network

1) Delay of Construction of Transmission Network

According to Repelita V, following exchanges in the objective area are to be digitalized during Repelita V:

- Sepanjang (Manual exchange)
- Lamongan (")
- Sidoarjo (Analog automatic exchange)
- Mojokerto (")
- Jombang (")

Above exchanges is planned to be connected with trunk switching system installed in Kebalen Exchange Office in Surabaya by digital transmission link to be provided by Remote Area Project or new transmission network. However, no digitalization plan is prepared for transmission links to/from Sidoarjo and Jombang exchanges at present.

2) Delay of Rural Area Project

Despite the completion of acceptance tests for radio sections, subscribers cable installation has not started yet.

3) Reliability of SMC-360 Coaxial Cable System

SMC-360 Coaxial Cable Carrier System is a sole transmission system linking automatic exchanges not only in the study area but also in the East Java Province. However, this system has been in operation for more than 10 (ten) years and total hours of the system failure reached 750 hours during past 2 (two) years from November 1987 to November 1989. Detailed information for the system failure is shown in Table 3.3.3 (1/2 - 2/2).

3.3.3 Mobile Communication Network

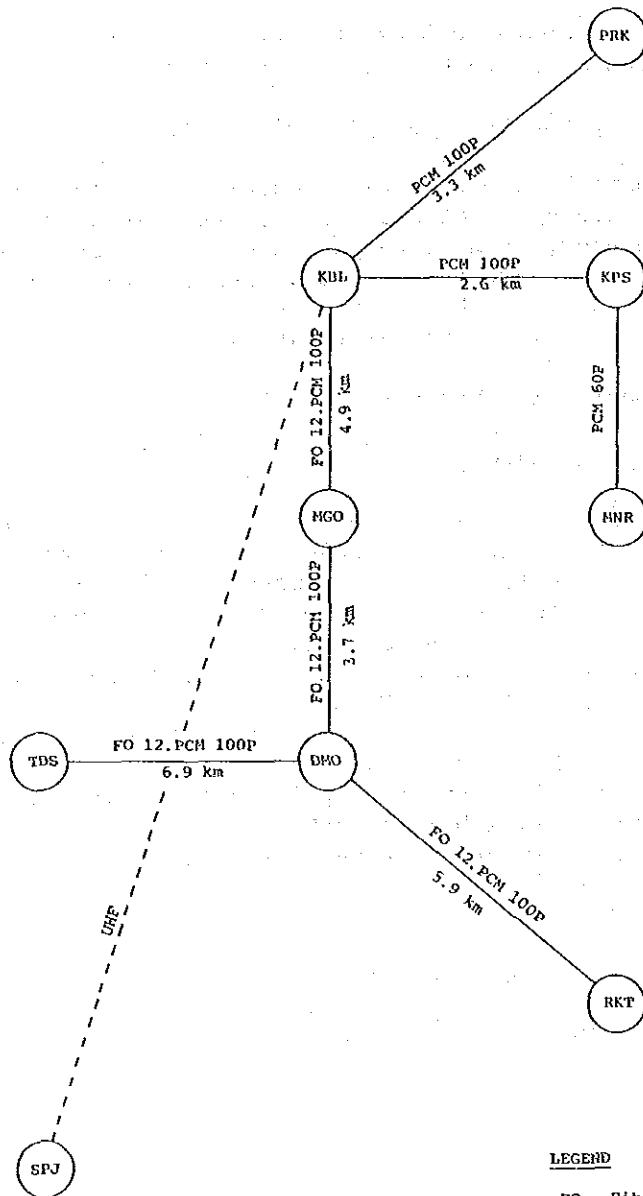
(1) Mobile Telephone Network

Mobile telephone network in Surabaya, now under operation and management by PERUMTEL, is of single zone type with a capacity of 300 subscribers and its coverage is approximately 20 km in radius. The system has already accommodated the subscriber to its capacity, while waiting applicants amount to 1,054 in January 1990. Subscription fee, monthly charge and call charge are available in the tariff book issued by PERUMTEL. (Tarip Jasa Telekomunikasi 1988 PERUMTEL)

According to the recent development program, new mobile telephone system will be installed in Surabaya, applying cellular system configuration in 800 - 900 MHz band. New mobile telephone system is scheduled to be built and operated by private sectors on revenue sharing basis.

(2) Paging Network

Paging network is also available in Surabaya, which is operated and managed by 2 (two) private companies. Names of companies, configuration and tariff are shown in ANNEX 3.3.5 (1/2 - 2/2).



LEGEND

- FO: Fiber Optic Cable
- 12: No. of Cores
- UHF: UHF Radio Route (400 MHz)

FIG. 3.3.1	JUNCTION NETWORK CONFIGURATION FOR SURABAYA MULTI-EXCHANGE AREA (1990)
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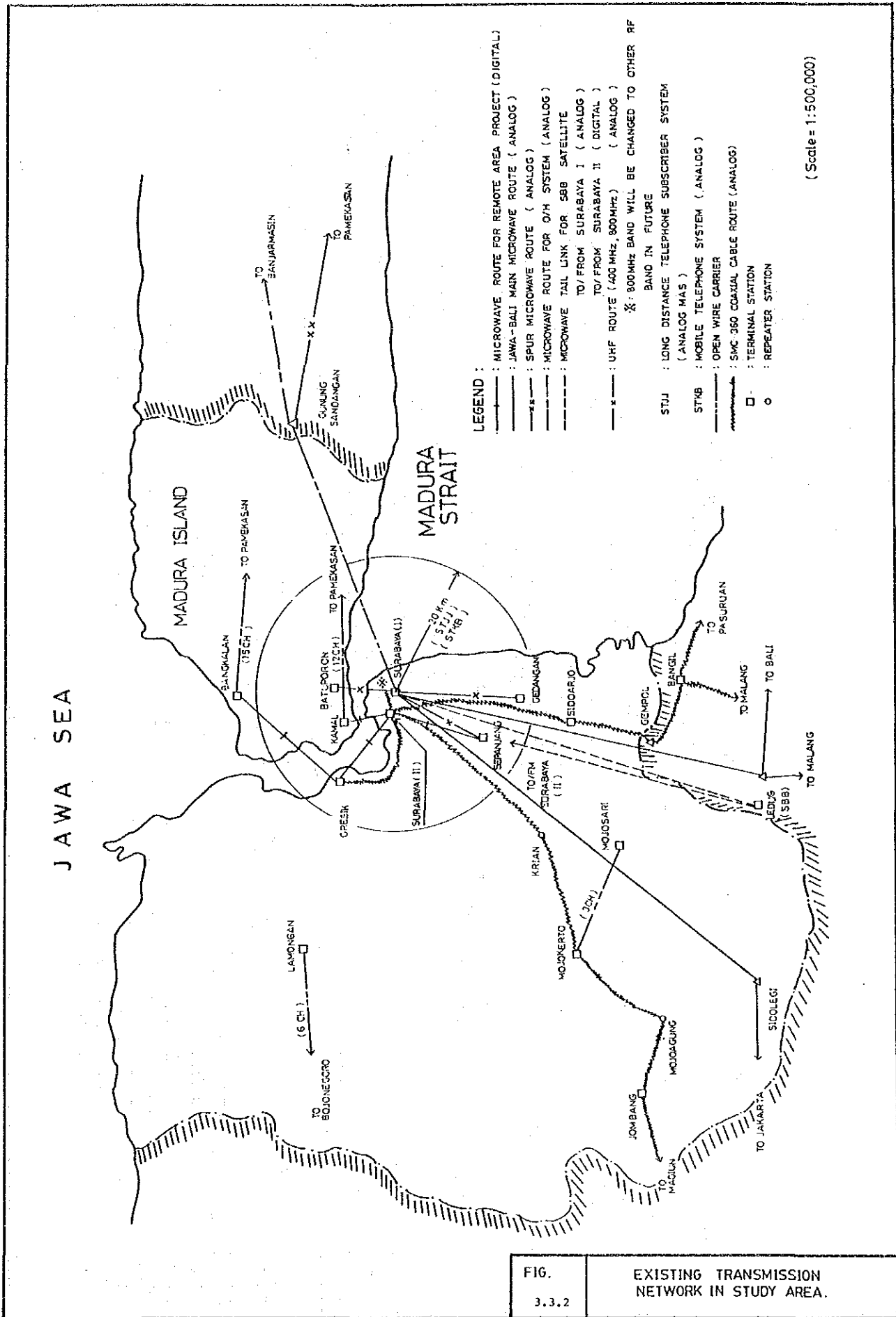


FIG. 3.3.2 EXISTING TRANSMISSION NETWORK IN STUDY AREA.

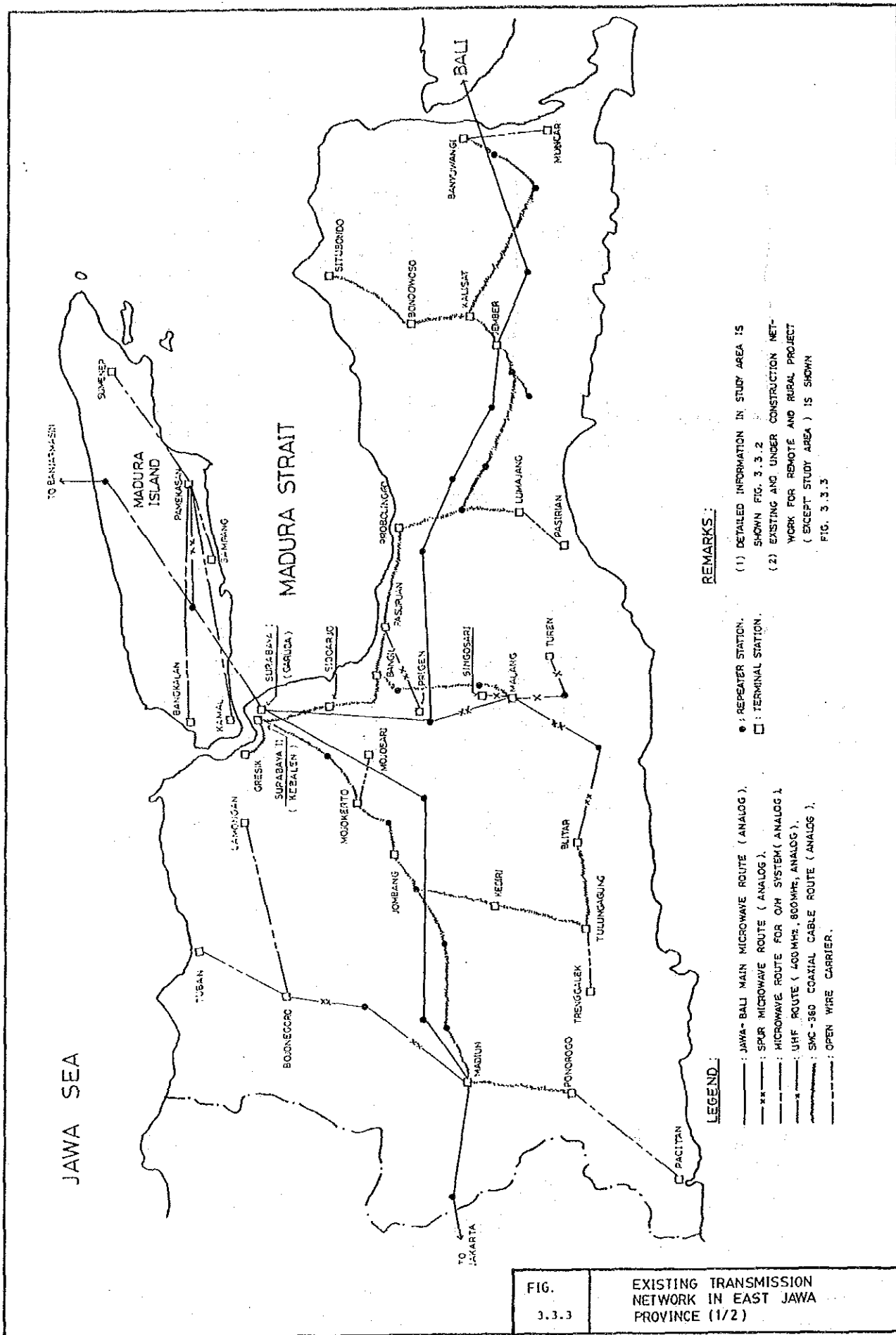


FIG. 3.3.3 EXISTING TRANSMISSION NETWORK IN EAST JAVA PROVINCE (1/2)

LEGEND:

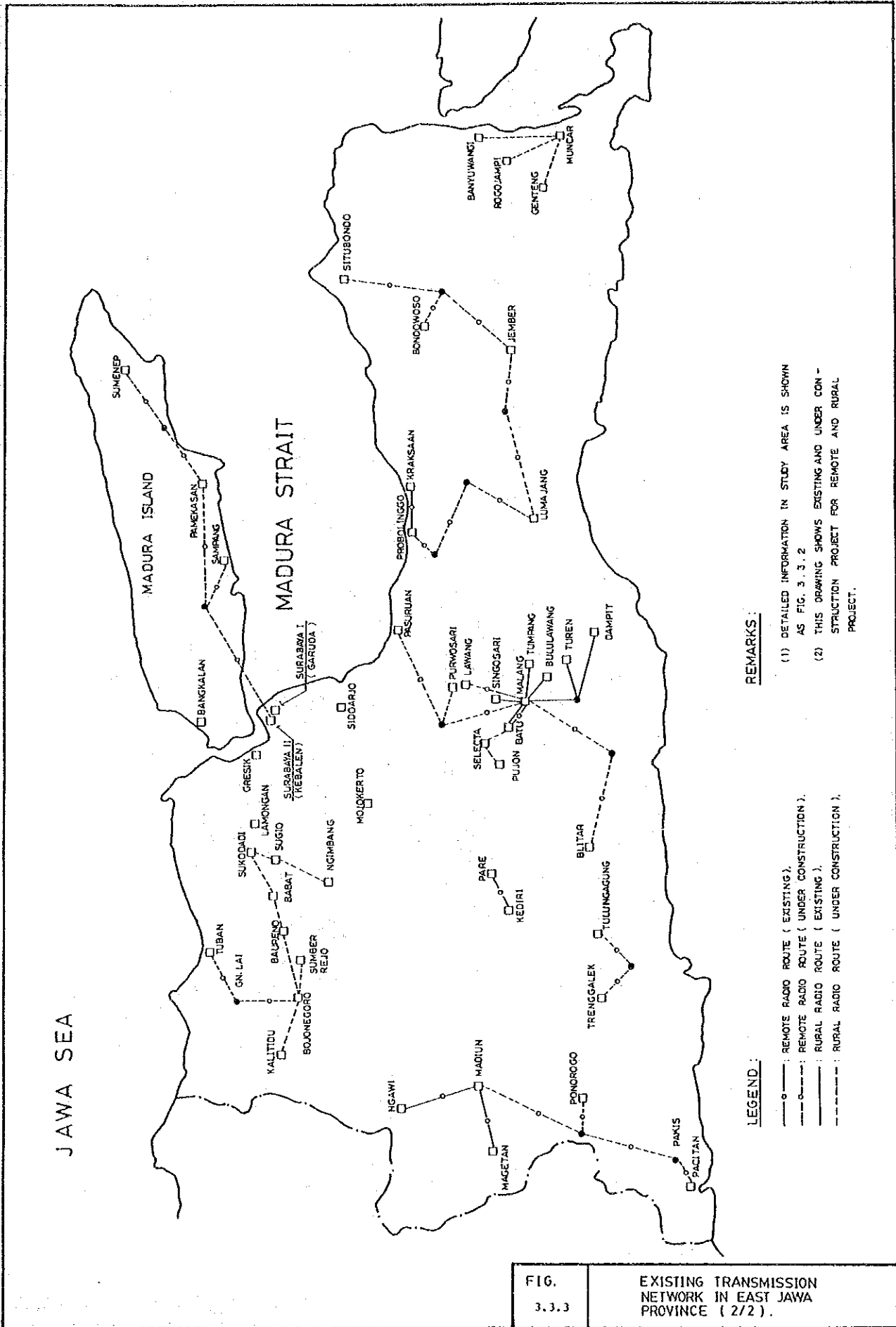
- : JAWA-BALI MAIN MICROWAVE ROUTE (ANALOG).
- - - : SPUR MICROWAVE ROUTE (ANALOG).
- : MICROWAVE ROUTE FOR OM SYSTEM (ANALOG).
- : UHF ROUTE (400MHZ, 800MHZ, ANALOG).
- : SMC-360 COAXIAL CABLE ROUTE (ANALOG).
- : OPEN WIRE CARRIER.

REMARKS:

- : REPEATER STATION.
- : TERMINAL STATION.

(1) DETAILED INFORMATION IN STUDY AREA IS SHOWN FIG. 3.3.2

(2) EXISTING AND UNDER CONSTRUCTION NETWORK FOR REMOTE AND RURAL PROJECT (EXCEPT STUDY AREA) IS SHOWN FIG. 3.3.3



REMARKS:

- (1) DETAILED INFORMATION IN STUDY AREA IS SHOWN AS FIG. 3.3.2
- (2) THIS DRAWING SHOWS EXISTING AND UNDER CONSTRUCTION PROJECT FOR REMOTE AND RURAL PROJECT.

LEGEND:

- : REMOTE RADIO ROUTE (EXISTING)
- - -○- - - : REMOTE RADIO ROUTE (UNDER CONSTRUCTION)
- : RURAL RADIO ROUTE (EXISTING)
- - -○- - - : RURAL RADIO ROUTE (UNDER CONSTRUCTION)

FIG. 3.3.3
EXISTING TRANSMISSION NETWORK IN EAST JAWA PROVINCE (2/2).

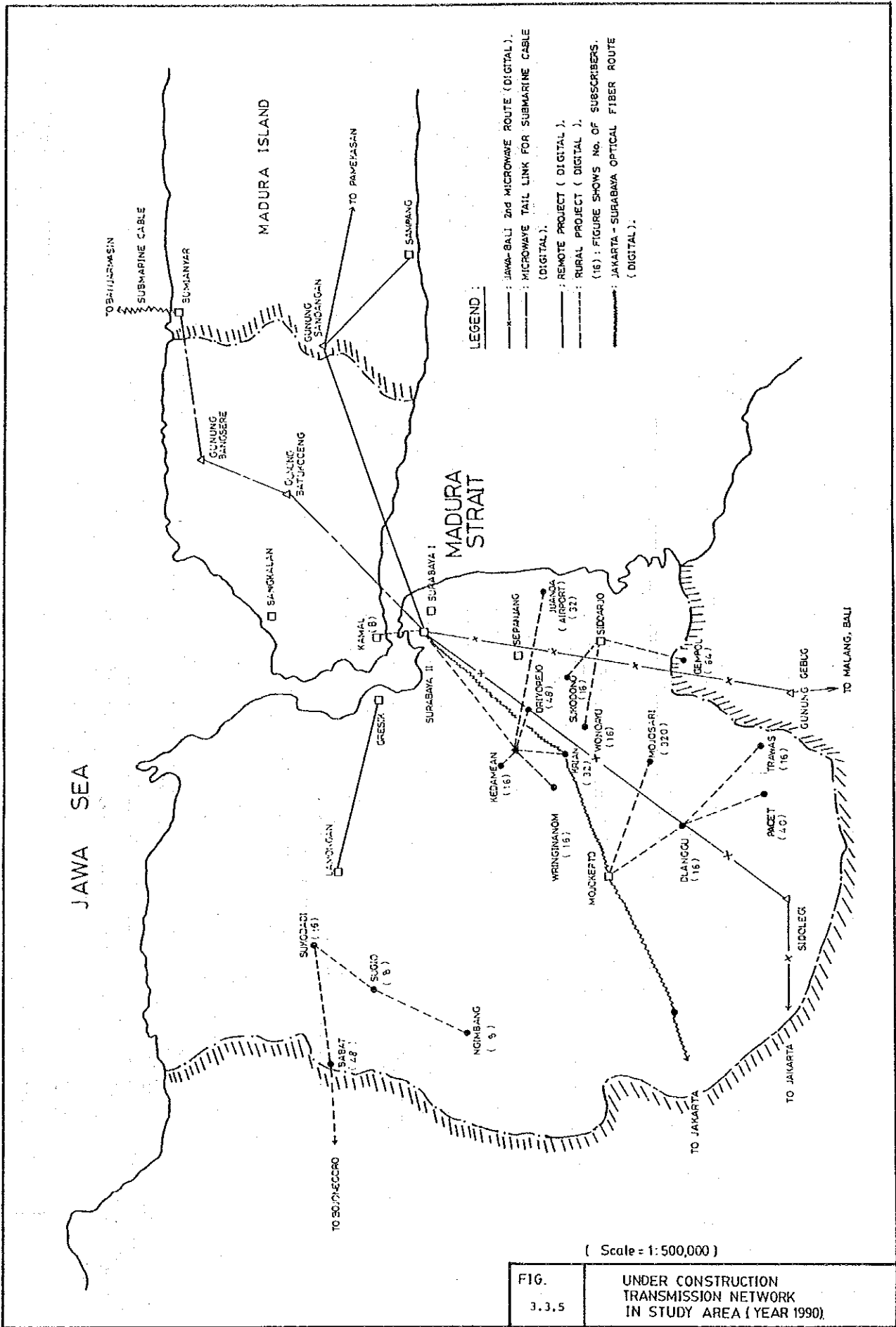


TABLE 3.3.1 OUTLINE OF TRANSMISSION PROJECTS UNDER CONSTRUCTION

-
1. Jakarta - Surabaya Optical Fiber (SKSO)
 - Optical Fiber Mode : Single mode fiber, 1300 nm (CCITT Rec. G.956)
 - Number of Core : 12
 - Capacity : 140 Mbit/s
(Equivalent to 1920 telephone channels)
 - NO.of Tube : 3 Working and 1 Standby ; Jakarta - Madiun
2 Working and 1 Standby ; Madiun - Surabaya
 - Modulation Type : -
 - Manufacturer : APT (AT&T and Phillips)
 - Target : June 1991
 - Jakarta - Surabaya : 1007.788 km (Cable Length)

 2. Jawa - Bali 2nd Route Digital Microwave
 - Radio Frequency (RF) Band : Upper 6 GHz Band (CCIR Rec.384-3)
 - Capacity : 140 Mbit/s
(Equivalent to 1920 telephone channels)
 - NO.of RF CH : 3 Working and 1 Standby ; Jakarta - Solo (CIT)
2 Working and 1 Standby ; Solo - Surabaya (TRT)
1 Working and 1 Standby ; Surabaya - Denpasar (TRT)
 - Modulation Type : 16 QAM
 - Manufacturer : CIT/TRT
 - Target : Dec 1991

 3. Microwave Tail Link for Surabaya - Banjarmasin Optical Fiber Submarine Cable
 - Surabaya II - Gn.Batukoceng - Gn.Bangsere - Bumianyar
 - Radio Frequency (RF) Band : 8 GHz Band (CCIR Rep.934-1 Annex III)
 - Capacity : 140 Mbit/s
(Equivalent to 1920 telephone channels)
 - NO.of RF CH : 2 Working and 1 Standby
 - Modulation Type : 16 QAM
 - Manufacturer : NEC
 - Target : 1992

 4. Remote Area Project
 - Radio Frequency (RF) Band : 2 GHz (Surabaya - Gresik, Surabaya - Gn.Sandangan
- Pamekasan)
1.5 GHz (other sectors)
 - Capacity : 34 Mbit/s and 17 Mbit/s for 2 GHz Sys.
8 Mbit/s for 1.5 GHz Sys.
 - NO.of RF CH : 1 + 1 (2 GHz)
1, Hot Standby (1.5 GHz)
 - Modulation Type : QPSK
 - Manufacturer : NEC (2 GHz)
JRC (1.5 GHz)
NEC (Mux.)
 - Target : September 1991

 5. Rural Area Project
 - Radio Frequency (RF) Band : 1.5 GHz
 - Capacity (max.) : 128 Subs.
 - NO.of RF CH : 1 (hot standby)
 - Modulation Type : 4 PSK
 - Manufacturer : TRT
 - Target :

TABLE 3.3.2 LIST OF REMOTE / RURAL PROJECTS AND RELATED TELEPHONE EXCHANGES

(IN THE STUDY AREA)

RADIO SECTORS		RELATED TELEPHONE EXCHANGES					REMARKS		
No	NAME OF STATIONS	RADIO LINK	REMOTE / RURAL	CAPA.	STATUS	CAPA OF TELEPHONE		SUPPLEMENT PLAN	
						EXIST.	RE-MAIN UNIT		
1.	Surabaya II (SB)		Remote (I), (II)	Under constr.	5,000				Kebalen (B), Digital Auto Ex.
	Cresik (GS)	SB - GS	Remote (I)	34	Operating	3,000			Analog Auto Ex. was changed to Digital in Year 1990
	Lamongan (LMG)	SB - GS - LMG	Remote (I)	8	Under constr.	400	381	19	Manual Ex. will be changed to Digital in Year 1991
	Bangkalan (BKL)	SB - GS - BKL	Remote (I)	8	Operating	1,000			Manual Ex. was changed to Digital in Year 1990
	Kamal (KML)	SB - KML	Remote (II)	8	Operating	184	167	17	Digital Auto Ex.
	Sepanjang (SPJ)	SB - SPJ	Remote (I)	8	Operating	640	537	103	Digital Auto Ex. will be changed to Digital in Year 1992
	Pamekasan (PM)	SB - PM	Remote (I)	17	Under constr.	1,000	947	53	Out of Study Area
2.	Surabaya II (SB)		Rural (I)	80	Radio Section completed in end of 1989	5,000			Kebalen (B), Digital Auto Ex.
	Rep. Kedamean (RKDM)		Rural (I)						
	Kedamean (KDM)	SB - RKDM - KDM	Rural (I)	16					
	Driyorejo (DY)	SB - RKDM - DY	Rural (I)	48					
	Wringinanom (WG)	SB - RKDM - WG	Rural (I)	16					
3.	Sidoarjo (SDA)		Rural (I)	96	Radio Section completed in end of 1989	2,000	1,986	14	Analog Auto Ex. will be changed to Digital in Year 1994
	Gempol (GPL)	SDA - GPL	Rural (I)	64					
	Sukodono (SKD)	SDA - SKD	Rural (I)	16					
	Wonoayu (WNY)	SDA - WNY	Rural (I)	16					
4.	Mojokerto (MR)		Rural (I)	416	Radio Section completed in end of 1989	2,000	1,987	13	Analog Auto Ex. Digital Auto Ex.
	Dianggu (DLG)	MR - DLG	Rural (I)	24					
	Pacet (PCT)	MR - PCT	Rural (I)	48					
	Trawas (TW)	MR - TW	Rural (I)	24					
	Mojosari (MJS)	MR - MJS	Rural (I)	320		350	258	92	Manual Ex.
5.	Surabaya II (SB)		Rural (II)	72	Radio Section completed in end of 1989	5,000	167	17	Kebalen (B), Digital Auto Ex. Digital Auto Ex. Airport
	Kamal (KML)	SB - KML	Rural (II)	8		184			
	Juanda (JD)	SB - RKDM - JD	Rural (II)	32					
	Krian (KR)	SB - RKDM - KR	Rural (II)	32					
	Rep. Kedamean (RKDM)		Rural (II)						

TABLE 3.3.3 RECORD OF SYSTEM FAILURE (MORE THAN 1 HOUR) ON SMC-360 SYSTEM
(NOV.1987 - NOV.1989, WITHIN WITEL VII)

(1/2)

DATE	FAILURE	FAILURE		CAUSE
	HOURS	SECTION		
Nov.1987	01h 15m	Surabaya	- Gresik	Amp at Repeater
	10h 20m	Surabaya	- Gresik	Power Separater at Repeater
Dec.1987	14h 40m	Kediri	- Blitar	SG at Kediri
	05h 50m	Pasuruan	- Probolinggo	Pilot Fade
	10h 20m	Surabaya	- Gresik	Power Separater at Repeater
	03h 15m	Surabaya	- Gresik	Amp at Repeater
Jan.1988	26h 12m	Madiun	- Ponorogo	Coaxial Cable damaged
	01h 14m	Surabaya	- Madiun	L.B.O. Unit at Repeater
	17h 10m	Kediri	- Madiun	Coaxial Cable damaged
	2 days	Repeater Kertosono		Battery and Grounding Cable
Feb.1988	04h 30m	Situbondo	- Jember	Equalizer at Repeater
Apr.1988	16h 10m	Jember	- Probolinggo	Coaxial Cable damaged
May 1988	01h 55m	Jember	- Banyuwangi	Pilot Fade
	01h 30m	Jember	- Banyuwangi	Pilot Fade
	02h 45m	Jember	- Banyuwangi	Pilot Fade
	06h 30m	Jember	- Banyuwangi	Pilot Fade
	01h 08m	Jember	- Banyuwangi	Pilot Fade
	02h 50m	Jember	- Banyuwangi	Pilot Fade
	08h 10m	Situbondo	- Jember	Equalizer at Repeater
Jun.1988	2 days	Repeater Kertosono		Batt
	2 days	Ponorogo		SG Pilot Unit
	11h 30m	Malang	- Bangil	Coaxial Cable damaged
	26h 30m	Jember		Line Repeater
	05h 32m	Jember	- Situbondo	Separating Filter at Repeater
Jul.1988	1 day	Jember	- Probolinggo	Repeater
Aug.1988	01h 45m	Jember	- Banyuwangi	Power Supply
	13h	Surabaya	- Mojokerto	Coaxial Cable damaged
Sep.1988	42h 15m	Pasuruan	- Probolinggo	Coaxial Cable damaged
Oct.1988	25h 30m	Repeater Rogojampi		DC Power Unit and Batt.
	20h 45m	Jombang	- Mojokerto	Coaxial Cable damaged
Nov.1988	01h 15m	Bondowoso		Pilot Fade

TABLE 3.3.3 RECORD OF SYSTEM FAILURE (MORE THAN 1 HOUR) ON SMC-360 SYSTEM
(NOV.1987 - NOV.1989, WITHIN WITEL VII)

(2/2)

DATE	FAILURE	FAILURE		CAUSE
	HOURS	SECTION		
Jan.1989	20h 40m	Surabaya	- Mojokerto	Coaxial Cable damaged
	06h 30m	Malang	- Bangil	Coaxial Cable damaged
	04h 35m	Malang	- Bangil	Pilot Fade
Mar.1989	03h	Repeater Nganjuk		Repeater
	05h 25m	Jember		Power Separating Filter
	06h	Surabaya	- Gresik	Pilot Fade
	04h	Surabaya	- Gresik	Pilot Fade
May 1989	04h	Repeater Nganjuk		Power Supply
	30h 35m	Malang	- Jember	Coaxial Cable damaged
	14h 50m	Surabaya	- Mojokerto	Coaxial Cable damaged
Oct.1989	18h	Bondowoso	- Jember	Coaxial Cable damaged
	25h	Tulungagung	- Kediri	Coaxial Cable damaged
	01h	Probolinggo	- Jember	Power Supply
Nov.1989	08h 45m	Jember	- Banyuwangi	Transformer at Repeater
	93h 30m	Surabaya	- Mojokerto	Transparator Unit at Repeater
	30h 30m	Surabaya	- Mojokerto	Pilot Fade
	20h	Surabaya	- Mojokerto	Pilot Fade

Remarks

-
- 1) Total No. of Failures : 48
 - 2) Total Failure Hours :
 - Equipment : 485h 29m
 - Coaxial Cable : 262h 37m
 - Total : 748h 06m
 - 3) Average Failure Hours per Month : 15h 17m
 - 4) Total Length of the Rout : Refer to next page

3.4 Subscribers Network

For subscribers network, no large scale expansion or improvement has been made during the past several years. As the result, Surabaya multi-exchange area is presently covered by only 9 (nine) exchanges, namely, Kapasan, Rungkut, Darmo, Mergoyoso, Kebalen, Tj.Perak, Manyar, Speanjang and Tandes. Each exchange service area, therefore, inevitably becomes large and sometimes subscribers in the adjacent service area are accommodated beyond the boundary as a tentative remedy to meet an urgent need, when occasion demands. In many districts, tentative and patchy installations of aerial and rubber cables are seen, partly because conduit capacity is insufficient.

Table 3.4.1 presents the present condition of primary cables. It can be summarized as follows:

- (1) Surplus primary cables are found in Kapasan, Mergoyoso, Sidoarjo, etc. This is because the line unit capacity of these exchanges is too small to accommodate them.
- (2) High fault ratio is observed at Darmo and Tj.Perak.
- (3) In the surrounding areas, aerial and direct buried cables are mainly used.

To some Kecamatan capitals in the surrounding area, 1 (one) telephone line is provided by open wire from the nearby exchange which is often several tens km distant. Presently, Rural Area Telecommunication Project (Phase I and II) is being implemented, aiming at the addition of 656 subscribers by the end of 1990, as outlined in Table 3.4.2. Expansion of subscriber cable for this project is now being carried out by WITEL VII. Even after completion of this project, there will remain a lot of no telephone Desas.

To cope with the present status mentioned above, the TELECOM-III OSP Project is now being materialized with the World Bank financial assistance. As of June 1990, tender proposal evaluation work is underway. With the completion of this project which covers the whole nation, telephone service in Surabaya multi-exchange area and its surrounding areas will be improved considerably. Details of this project will be discussed in SECTION 4.4

Table 3.4.1 The Present Condition of Primary Cables

(As of November 1989)

No.	Exchange Name	Type of Cable	Primary Cable Condition (pairs)				Ratio (2)/(1)%	Remarks
			Capacities	Contents (1)	Empty	Fault (2)		
Surabaya Multi-Exchange Area								
1	KAPASAN	KK	22,500	9,971	12,293	236	2.37%	
2	KEBALEN	KK	18,310	16,016	1,229	1,065	6.65%	
3	TJ. PERAK	KT	3,372	2,455	455	462	18.82%	
4	DARMO	KK	10,460	6,284	2,395	1,781	28.34%	
5	SEPANJANG	KT	880	539	339	2	0.37%	OLD EX.
6	MERGOYOSO	KK	26,958	15,680	10,231	1,047	6.68%	
7	TANDES	KJ	21,300	--	--	--	--	16 Dec.89
8	MANYAR	KT	4,300	3067	1233	--	--	
9	RUNGKUT	KK	14,700	10,282	3,557	861	8.37%	
TOTAL (1)			122,780	64,294	31,732	5,454	8.48%	
Surrounding Area								
[GRESIK]								
1	GRESIK	KT	2,000	1,233	703	64	5.19%	
2	GERME	KT	100	48	51	1	2.08%	
[SIDOARJO]								
3	SIDOARJO	KT	4,750	1,939	2,801	10	0.52%	
4	KRIAN	KT	200	182	18	--	--	
[BANGKALAN]								
5	BANGKALAN	KT	1,400	450	950	--	--	OLD CABLE
6	KAMAL	KT	350	93	257	--	--	
[MOJOKERTO]								
7	MOJOKERTO	KT	3,350	1,970	1,184	196	9.95%	
8	MOJOSARI	KT	400	258	142	--	--	
9	JOMBANG	KT	1,700	1,042	611	47	4.51%	
		KU	50	46	3	1	2.17%	
10	MOJOAGUNG	KT/KU	210	182	28	--	--	
11	PLOSO	KU	140	81	59	--	--	
[LAMONGAN]								
12	LAMONGAN	KT	630	382	178	70	18.32%	
13	BABAT	KT	386	232	152	2	0.86%	
TOTAL (2)			15,666	8,138	7,137	391	4.80%	
TOTAL (1)+(2)			138,446	72,432	38,869	5,845	8.07%	

Note : KK --- Dry cable
 KJ --- Jelly filled cable
 KT --- Direct buried cable
 KU --- Aerial cable

Source : WITEL VII

Table 3.4.2 Rural Area Project in the Surrounding Area

A) Rural Area Telecommunication Project - Phase I

Section Name		No of Sub.	Expansion	Target	
		Ex.---- Remote	(pairs)		
11-SURABAYA (KEBALEN)	111-SURABAYA	80		1990	
	112-REP.KEDAMEAN		0		
	113-KEDAMEAN		16		
	115-DRIYOREJO		48		
	116-WRINGINANOM		16		
13-SIDOARJO	131-SIDOARJO	32		1990	
	132-SUKODONO		16		
	133-WONOAYU		16		
	134-GEMPOL*		(64)		40
14-MOJOKERTO	141-MOJOKERTO	392		1990	
	142-DLANGGU		16		
	143-PACET		40		50
	144-TRAWAS		16		
	145-MOJOSARI		320		400
17-BOJONEGORO	171-BOJOEGORO*	80		1990	
	172-KALITIDU*		(16)		
	173-SUMBEREJO*		(32)		
	174-SUKODADI		16		
	175-SUGIO		8		
	176-NGIMBANG		8		
	177-BABAT		48		40
	178-BAURENO*		(16)		
TOTAL (1)			(128)		
			584		

B) Rural Area Telecommunication Project - Phase II

Section Name		No of Sub.	Expansion	Target
		Ex.---- Remote	(pairs)	
21-SURABAYA (KEBALEN)	SURABAYA II	72		1990
	KAMAL		8	
	REP.KEDAMEAN		0	
	AIRPORT		32	
	KRIAN		32	100
TOTAL (2)			72	
TOTAL (1)+(2)			(128)	
			656	

Note : * / (128) --- Out of the objective area
Source : TRT system and installation handbook

3.5 Telex Network

3.5.1 Present Condition of Telex Service

The total number of telex subscribers in Indonesia is approx. 16,000 as of 1989 and penetration ratio per 1,000 inhabitants is 0.1. It is equal to approx. 2.0% of the total number of telephone subscribers in Indonesia.

A penetration ratio of telex service in the area is the second highest in Indonesia, following that of Jakarta area. There is only little difference between Surabaya and Jakarta areas, though. These comparisons of penetration ratio among Surabaya, Jakarta and other areas are shown in the following table:

Telex service indexes in Indonesia as of 1989

Areas	Sub.s/ 1000Pop	No.of Sub.s	Sub.s Share(%)	Pop (x1000)	Pop Share(%)	Waiting Applicants
Surabaya	0.85	1,774	11.0	2,097	1.3	188
Jakarta	0.93	7,341	46.0	7,914	4.8	0
Indonesia	0.10	15,943	100.0	164,629	100.0	1,472
WITEL-I	0.09	1,149	7.0	12,438	7.6	160
WITEL-II	0.08	680	4.0	8,019	4.9	38
WITEL-III	0.06	687	4.0	12,262	7.4	195
WITEL-IV	0.57	7,341	46.0	12,864	7.8	0
WITEL-V	0.03	689	4.0	25,989	15.8	467
WITEL-VI	0.03	862	5.0	29,981	18.2	164
WITEL-VII	0.06	1,750	11.0	31,373	19.1	188
WITEL-VIII	0.05	494	3.0	9,369	5.7	147
WITEL-IX	0.15	1,148	7.0	7,749	4.7	57
WITEL-X	0.07	782	5.0	11,594	7.0	49
WITEL-XI	0.10	156	1.0	1,614	1.0	5
WITEL-XII	0.15	205	1.0	1,376	0.8	2

Sources:

Population : BPS data as of 1985 (Yearbook 1988)

Telecom data: PERUMTEL's telecom statistics as of 1989 (OPTEKTEL)

In the objective area, the total number of telex subscribers including 272 long distance subscribers (LDS) is 1,774 as of 1989. The penetration ratio in Surabaya area is 0.85 per 1000 inhabitants.

The total number of waiting applicants for the telex service in the whole country is 1,472 as of 1989. It accounts for less than 10% of the total number of existing telex subscribers. It may imply that telex demand in Indonesia tends to decline. In developed countries, a decrease of the number of telex subscribers is remarkable, as the telex service tends to be rapidly replaced with other advanced services, i.e., facsimile and data communications services. Also in Indonesia, some private sectors, such as travel agents, are introducing packet switched data communications service

(SKDP) instead of telex service in both domestic and international communications. Such a trend will continue and will become more prominent not only in developed countries but also in developing countries.

3.5.2 Existing Telex Network

The existing telex network in Indonesia consists of two (2) international gateways, five (5) national tandem exchanges and forty-five (45) terminal exchanges as shown below.

The existing telex exchanges in Indonesia

Telex Exchange Hierarchy	No. of Exchanges	Exchange Name
International Gateways	2	Jakarta, Medan
National Tandem Exchanges	5	Jakarta (2), Medan, Surabaya, Ujung Pandang
Terminal Exchanges	45	Jakarta, Surabaya Major Provincial capitals

Surabaya telex tandem exchange (in Kapasan) which is one of national tandem exchanges has nine (9) terminal exchanges covering not only East Jawa area but also Balikpapan, Samarinda, Banjarmasin and Denpasar areas. The telex service in the objective area is covered by five (5) terminal exchanges under Surabaya tandem exchange. Details of the existing telex network are shown in Figure 3.5.1.

3.5.3 Existing Telex Exchanges

The existing telex exchanges in the objective area consist of five (5) terminal exchanges, i.e., Kapasan I & II, Rungkut, Mergoyoso and Kebalen. These exchanges cover not only telex subscribers in Surabaya area but also the whole East Jawa area through long distance subscriber lines.

The present conditions of the existing telex exchanges in the objective area are shown in the following table:

Present conditions of telex exchanges

Exchange	Rank	SW type	Capacity	Subs/cct	Waiting Applicants
Kapasan	ME	TWKD2A	792	680	-
Kapasan	TE	TWK-9	1,000	969	191
Kebalen	TE	TWK-9	350	322	-
Mergoyoso	TE	TWK-9	300	295	-
Rungkut	TE	TWK-9	200	188	-

Note: ME: National Tandem Exchange
TE: Terminal Exchanges

In addition to the above, 1,500 line units and 2,160 circuits will be added in Kebalen Exchange during Repelita V.

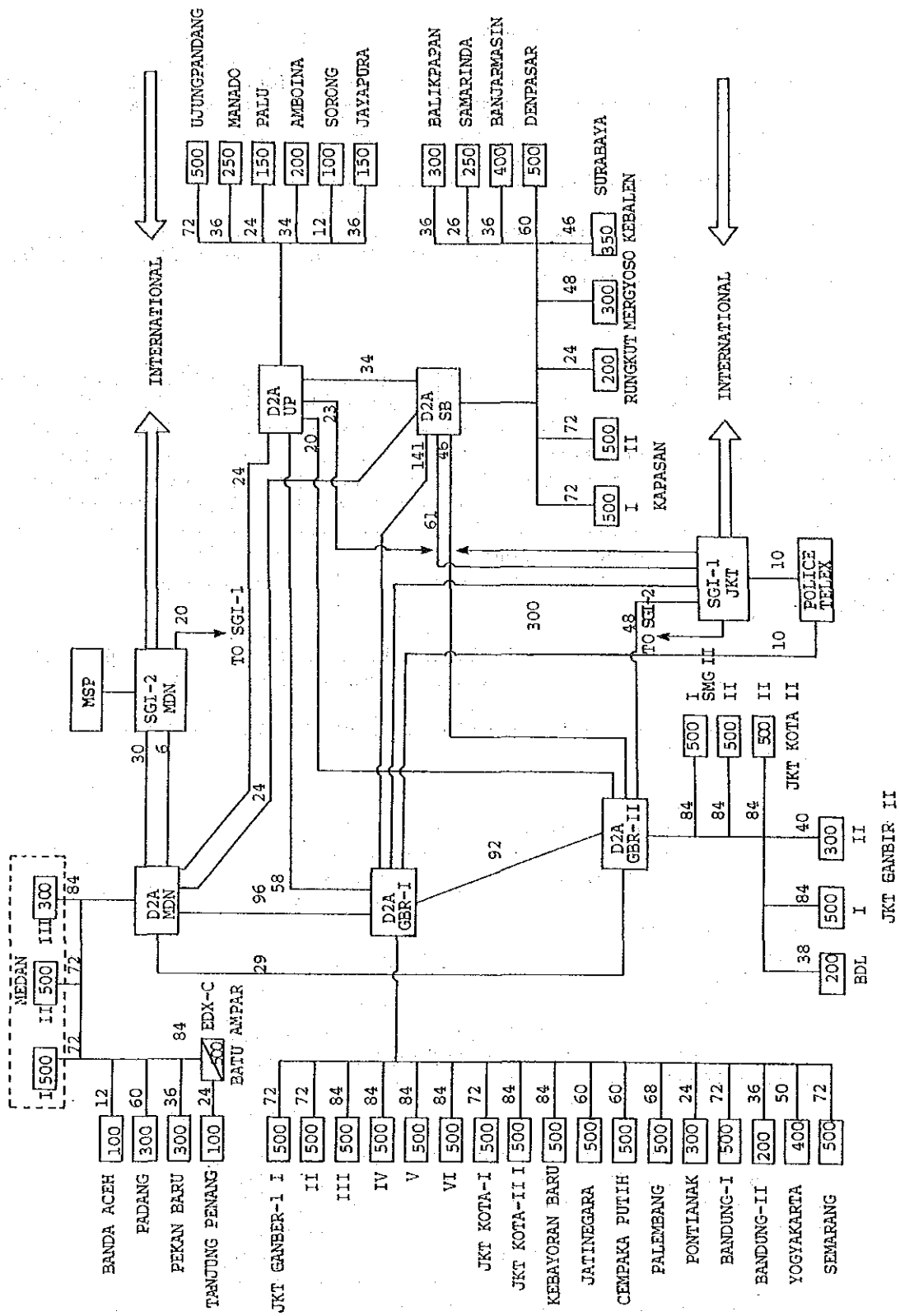


Figure 3.5.1 Existing Telex Network

3.6 Data Communications Network

The data communications network in Indonesia consists of packet switched public data network (PSPDN), leased circuits and VSAT (Very Small Aperture Terminals).

3.6.1 Packet Switched Public Data Network (PSPDN)

The packet switched public data network (PSPDN) for domestic data communications services consists of SKDP (Sambungan Komunikasi Data Paket) and PACKSATNET by satellite (PALAPA).

(1) Existing Condition of SKDP

Data communications service through SKDP is provided by the network shown in Figure 3.6.1. The network covers whole Indonesia. Through the international gateway of SKDP in Jakarta, the network is connected with 65 PSPDNs in 30 foreign countries as shown in Figure 3.6.2. During the recent development of SKDP, the second NNFE (Network Node Front End) will be installed in Surabaya in 1991. In addition, four ANPs (Advanced Network Processor) will be newly installed in Semarang, Yogyakarta, Denpasar and Palembang. Data communications service through LDS (Long Distance Subscribers) will be newly available in Balikpapan, Manado, Pekanbaru, Lhokseumawe.

In 1990, PERUMTEL started electronic mailbox service. The number of mailboxes amounted to 1,600 boxes and the number of users reached 150.

The number of SKDP subscribers as of May 1990 and the capacity of SKDP equipment are shown below:

The number of subscribers as of May 1990

Area	Dedicated (SKDP-L)	Dial up (SKDP-D)
Indonesia	54	392
Witel-VII	2	27
Total	446	29

Source: POSTEL

The capacity of SKDP

Type of Equipment	No. of Ports	Location
NNFE	704 ports	Jakarta
ANP	128 ports	Surabaya

Note: ANP in Surabaya consists of:

- SKDP-L : 80 ports (80 subs)
- SKDP-D(Dial-in) : 40 ports (400 subs)
- SKDP-D(Dial-out): 8 ports

As a result of a user survey for new services, the share of SKDP user category is as follows:

The share by user category

User categories	Share (%)
Tourism	12.5
Trade	9.4
University	6.3
Computer	9.4
Finance	15.6
Government	3.1
Manufacturing	21.9
Publication	3.1
Individual	6.3
Others	12.5

(2) Traffic of SKDP

The existing traffic of SKDP service for both domestic and international connections as of 1989 is summarized as follows:

Existing SKDP traffic as of 1989	(month/sub)	
	Domestic	International
Volume (segments)	165.0	9,168.5
Duration (minutes)	6.5	265.5

Source: PERUMTEL

During 1989, the total traffic amounted to 205,000 in the number of transactions, about 22.5 million in the number of segments and 652,800 minutes in the total duration. 98% of total traffic were of international calls. After the commencement of electronic mailbox service provided by PERUMTEL in 1990, its service traffic in domestic connection is gradually increasing and account for 4% of total SKDP traffic. The main sources of SKDP traffic are as follows:

- International data bases access
- Electronic mailbox service
- Intra-company data transfer
- Electronic fund transfer
- Reservations for tourism

(3) Numbering of SKDP

The numbering for SKDP service for domestic and international connections are as follows:

a) National Numbering

SKDP-D

"N-XXXXXX-YYYYYYYYYY"

where,

N: NUI Indication,

X: Network User Identifier(NUI)

Y: Network Terminal Number(NTN)

Note: NUI is a password that is used as a security check when establishing a connection to the network. The password is confidential, known only to a user.

SKDP-L

"YYYYYYYYYYYYYY"

where,

Y: Network Terminal Number(NTN)

International Data Number

An international data number consists of data network identification code (DNIC) and TNT. Access to PSPDN subscribers in other countries from the SKDP subscribers in Indonesia can be made by adding an international prefix to the international data number.

(4) User facilities (user services)

The user facilities (user services) for SKDP consists of basic packet switching services including virtual call service and permanent virtual circuit service and optional user facilities (optional user services). Optional user facilities for SKDP service are as follows:

Optional user facilities

Optional user facilities	X.25	X.28	Dial-up	Remark
1. Closed User Group	x	x	x	
2. Collective Number Group	x	x	-	
3. Fast Select	x	x	x	
4. Auto Call	-	x	-	
5. Abbreviated Call	-	x	x	
6. Call Redirection	x	x	-	
7. Direct Call	-	x	x	
8. Reverse Charging	x	x	x	no charge
9. Reverse Charging Acceptance	x	x	-	
10. Fast Select Acceptance	x	x	-	no charge
11. International Call Barred	x	x	x	
12. One Way Logical Channel	x	-	-	
13. Through Put Class Negotiation	x	-	-	
14. Window Size Negotiation	x	-	-	

Note: X: Provided, -: Non-Provided

(5) PACKSATNET

PACKSATNET supported by the PALAPA satellite system was introduced as the first data communications network in Indonesia. However, in 1990 there is no subscriber. This service will be covered by SKDP network.

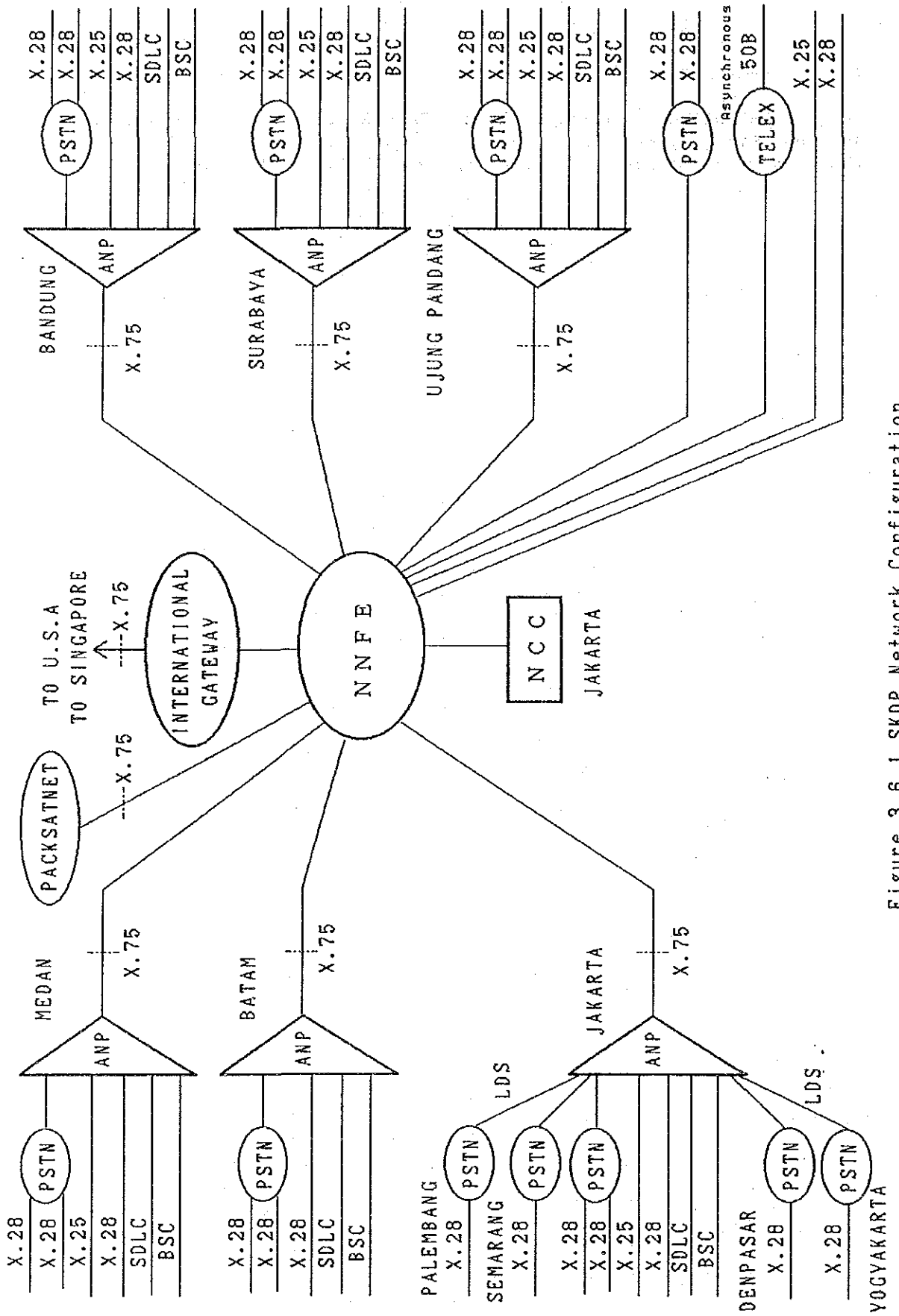


Figure 3.6.1 SKDP Network Configuration

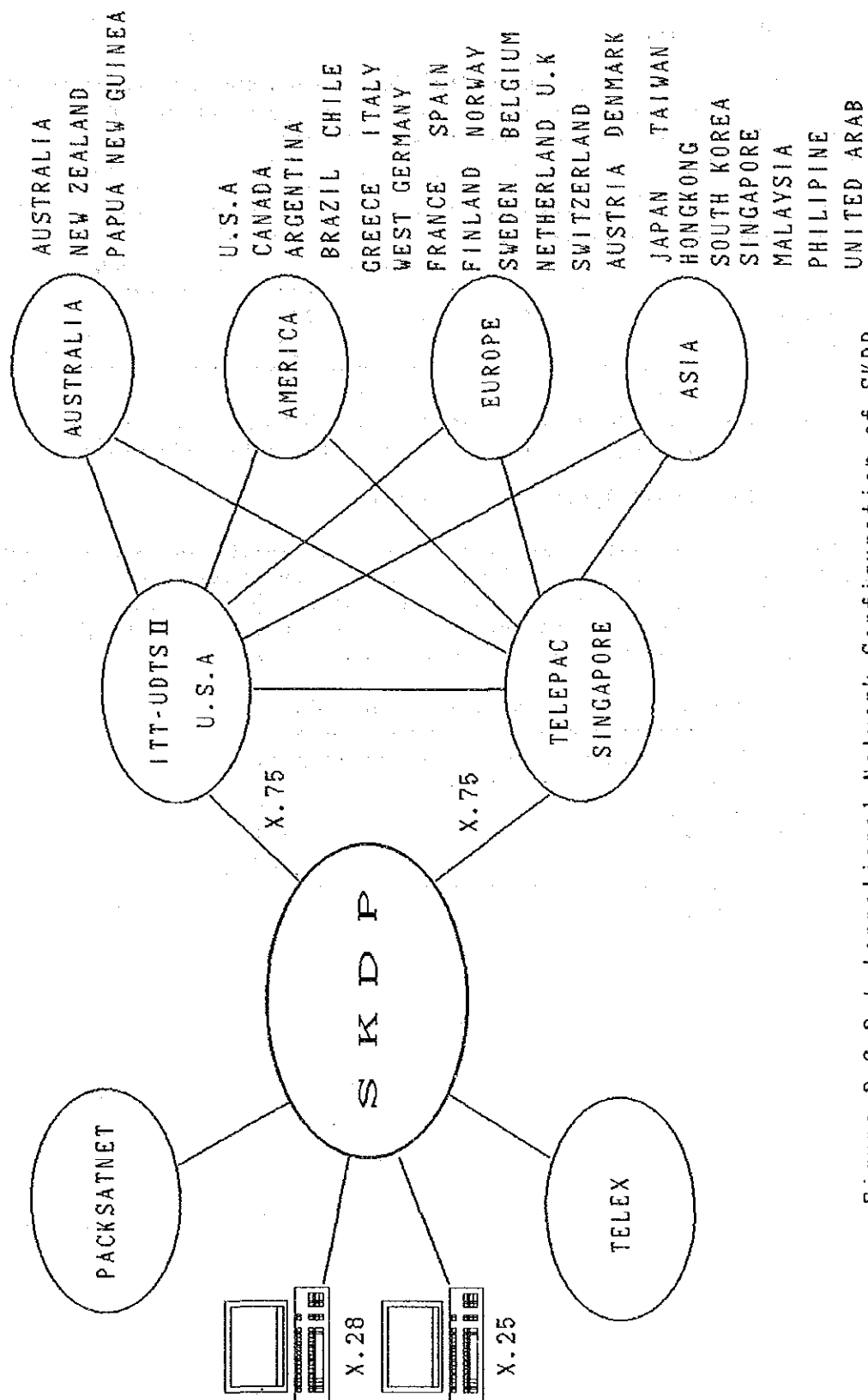


Figure 3.6.2 International Network Configuration of SKDP

3.6.2 Leased Circuits

Leased circuits are provided for both domestic (local/SLDD) and international (countries/carriers) connections. The number of subscribers for leased circuits service in 1990 are as follows:

The number of subscribers in 1990

Area	Local	Inter-city	International
Indonesia	713	282	117
Witel VII	12	3	0

Source: PERUMTEL

Note : service categories: Voice grade Data, Data, Telegraph/Telex signaling bit rate: 1200/2400/4800/7200/9600 bit/s

3.6.3 VSAT (Very Small Aperture Terminals)

VSAT is a satellite communication system, which can save the several isolated areas from communications means. The number of terminals in Indonesia has reached 220 terminals as shown below. This service has started in 1990 and the VSAT system will be connected to the packet data network (SKDP) by a SPINTEL gateway in the near future.

The number of VSAT terminals as of June 1990

Subscriber categories	No. of subscribers
Operation trial	78
Non-connected	142
Total	220

Source: POSTEL

3.7 Existing Exchange Site and Floor Layout

Existing exchange sites in the objective area and the respective floor layouts are shown in VOLUME II.

Capacities of floor space and MDF (Main Distribution Frame) in the existing exchange buildings in Surabaya multi-exchange area have been studied by PMC Option Services which were carried out by the World Bank loan assistance. The study result proves all exchange buildings in Surabaya multi-exchange area have enough capacities for additional installations during Repelita V except for Manyar Exchange.

**SECTION 4 MEDIUM AND LONG TERM TELECOMMUNICATIONS
DEVELOPMENT PLAN**

SECTION 4

MEDIUM AND LONG TERM TELECOMMUNICATIONS DEVELOPMENT PLAN

4.1 Development Target and Strategy

4.1.1 Telecommunications Services

Following telecommunications services will be provided in the objective area by the end of Repelita VII:

- Telephone service (including Mobile Telephone Service)
- Data communication service
- Facsimile service
- Teletex service
- Videotex service
- Message Handling Systems (MHS)

Telephone service will be enhanced to provide some supplementary services such as:

- Call transfer service
- Call waiting service
- Number identification services
- Charging services
- Multiparties call

Full implementation of ISDN service will make it possible to provide all the enhanced services mentioned above on an integrated network. However, transition from an existing network to comprehensive ISDN in the objective area may require a period of time extending over one or more decades. Until then, various services necessary for socio-economic activities will be provided over respective dedicated networks, such as telephone network, data communication network, etc.

4.1.2 Development Target

Surabaya is the second largest city in Indonesia following Jakarta, and the objective area, i.e., Surabaya and surrounding areas, functions as an important regional center in the East Java Province and the eastern part of Indonesia as well. Despite the remarkable increase of demands for telecommunications services along with the growth of socio-economic activities in the area, provision of telecommunications services is still insufficient.

On the other hand, nationwide telecommunications network development program is being implemented by PERUMTEL giving priority to Jakarta area. Consequently, difference in telecommunication service between Jakarta and other areas tends to magnify.

In order to improve the above situations, following basic concept are established as the target of long-term and medium-term development plan for telecommunications network in the objective area:

- to prevent the magnification of service difference between Jakarta and Surabaya;
- to support the socio-economic activities and regional development program; and
- to improve the service in quantity and quality (reduction of waiting applicants and introduction of new services).

Based on the above concepts and in consideration of nationwide telecommunications development policies, target to be realized by the end of Repelita VII (2004) has been determined as mentioned below:

- (1) Surabaya multi-exchange area will be expanded along with the growth of socio-economic activities in urban area;
- (2) The present difference between Jakarta and Surabaya urban areas in penetration ratio will be kept up to the end of Repelita VII.
- (3) Telephone service will be expanded up to all Desas to support the administrative activities and realize a civil minimum. This target realizes the rural development target in ITU Kuala Lumpur Declaration, i.e., "Telephone service shall be available within any 3 km radius for all people".

4.1.3 Strategy

To reach the target described in the previous paragraph, following items are studied as network development strategy:

- (1) Network configuration
- (2) Development scenario of Telecommunications network up to 2004
- (3) Introduction of new services

Summary of Telecommunications network development strategy and implementation is illustrated in Figure 4.1.1

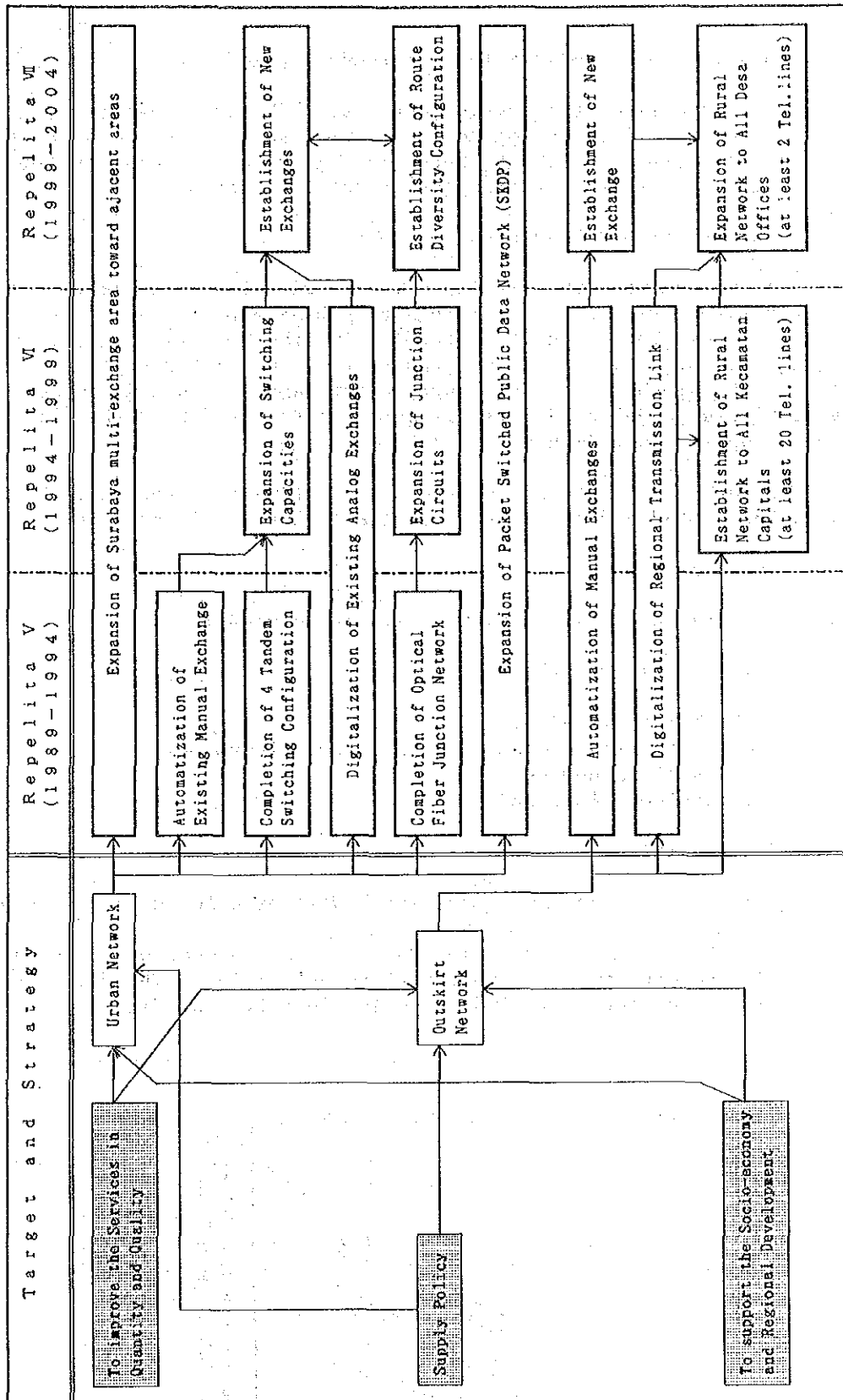


Figure 4.1.1: Summary of Network Development Strategy

4.2 Development Framework for Telephone Service

To establish the development framework for telephone service up to the year 2004 to be incorporated in medium-term (by the end of Repelita VI) and long-term (by the end of Repelita VII) plans, studies are made demand estimate and supply and network development strategies.

4.2.1 Subscription Demand Study

A telephone subscription demand study aims to estimate a demand in the objective area and to verify a telephone supply volume established in this study as shown in a work flow in Figure 4.2.1. The study is done dividing the objective area into two parts. One is Surabaya multi-exchange area and the other is its surrounding areas. This is because an area characteristic in demand density is quite different due to the difference in the past supply achievements.

Before the details of the demand study is described, the relation between the demand and the supply is clearly defined as follows:

The demand:

The demand consists of the following demands:

$$TD = SD + WD + PD$$

where,

TD: Total demand

SD: Satisfied demand (existing subscribers)

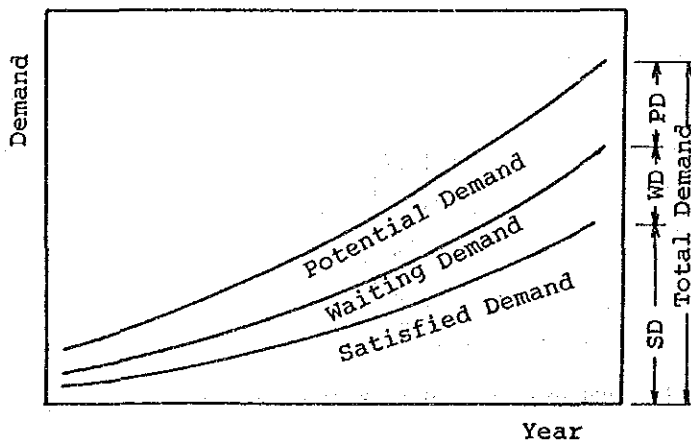
WD: Waiting demand

PD: Potential demand

The supply:

The supply means the demand which will be able to be satisfied.

All the descriptions in relation to the demand and the supply in this study report are based on the above definition. The relation between the demand and the supply is indicated in the following figure:



(1) Subscription Demand in Surabaya Multi-Exchange Area

The demand study by exchange area in Surabaya multi-exchange area was already made in both macroscopic and microscopic approaches by the Program Management Consulting Option Service (PMC-Option) Project financed by the World Bank during the period from 1987 to 1988. The Project is now on-going aiming at the implementation during Repelita V. The results of the demand study done by the World Bank Project underlie this JICA study. The results are summarized in the following table together with the supply targets established, considering a balance with telephone density in Jakarta. During PMC-Option Service Project, the microscopic demand survey does not cover all the objective area. Accordingly, a comparison between both macroscopic and microscopic demands is not possible on the total but possible on exchange area basis. It is found that the difference between the results is very little. It is described in detail in the following paragraph 4.2.2. In addition, the detail of the results on exchange area basis are shown in Table 4.2.1.

Estimated Demand by PMC-OPTION Project

Category / Year	1994	1999	2004
Macroscopic demand	180,000	304,000	458,000
Microscopic demand	131,000	204,000	300,000
Supply target 1	150,000	210,000	322,000
Supply target 2	150,000	244,000	403,000

Note: The above figures are rounded off.

Microscopic demand does not cover all the areas.

A development plan in this study is drawn up in accordance with the supply target 1 which was evaluated to be the most reasonable supply scenario through the discussion with PERUMTEL. However, the above figures are adjusted in accordance with the expansion of the multi-exchange area boundary up to Repelita VII. The expansion of the boundary is explained in detail in the later paragraph 4.2.3.

(2) Subscription Demand in Surrounding Areas

A demand study for the surrounding areas was done by both using Kabupaten Model which had been developed in JICA study on Rural Telecommunications Network Development in Indonesia and the findings of the field survey executed in a limited period at the time of the first field survey in October 1989 through February 1990. The Kabupaten model is to estimate demands on Kabupaten basis in consideration of a correlation between demands and various socio-economic indexes. The model is composed of the following formulas:

The calculation results by demand category are shown in Table 4.2.2. These results are obtained based on statistical data on administrative boundary basis. Since the telecommunications boundary is slightly different from that of administration, the calculation results based on the administrative boundary may involve some deviation which, however, is quite negligible. According to the JICA study on "Rural Telecommunications Network Development", the average demand by Kabupaten in Jawa island is approximately 10,000 and the demand share in a Kabupaten is as follows:

Demand share in a Kabupaten

Area	Share (%)
Kabupaten Capital	45.7
Kecamatan Capitals	47.5
Desas	6.8
Total	100.0

Source: JICA Rural Telecom. Study

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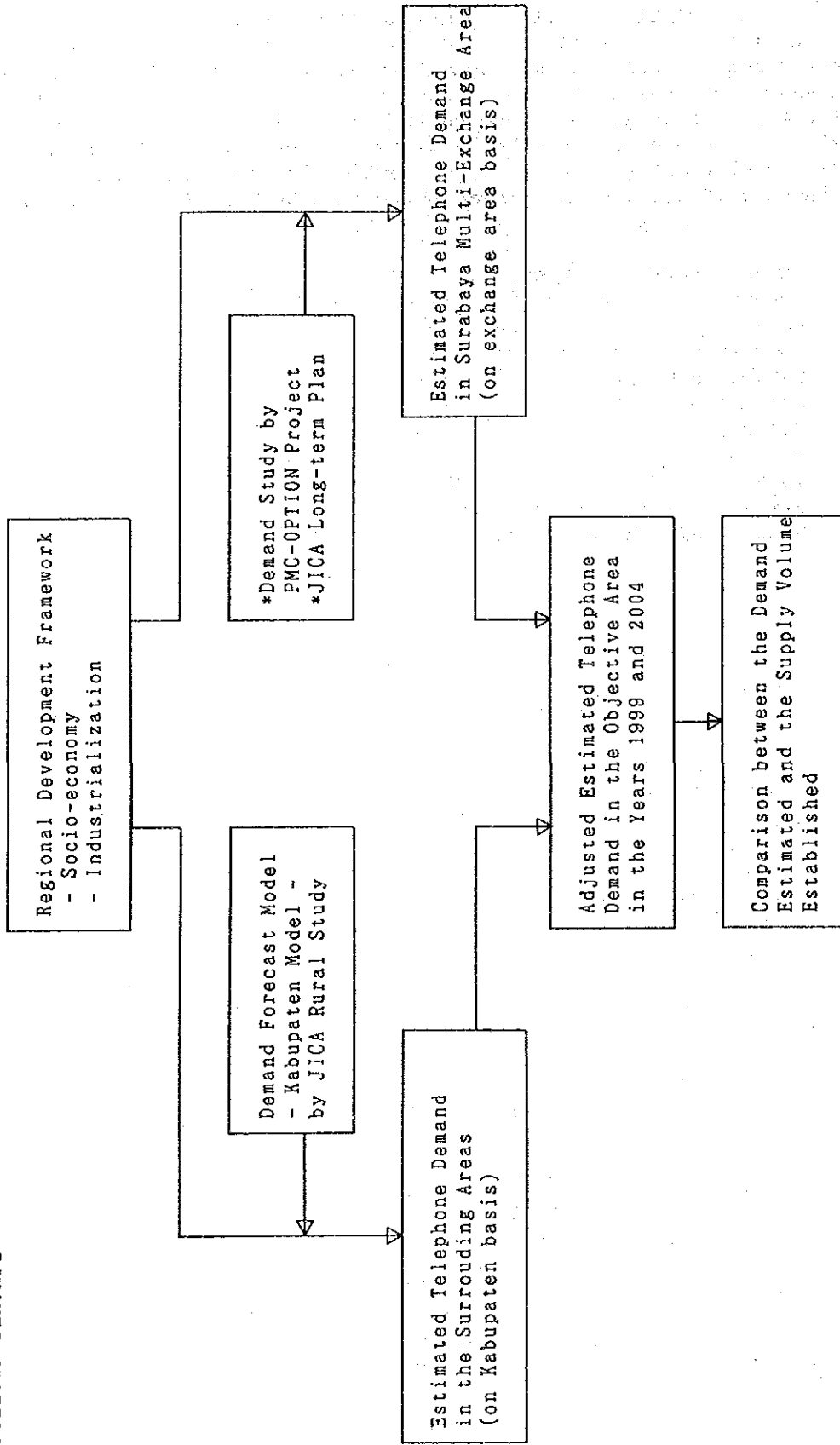


Figure 4.2.1 Work Flow of Subscription Demand Study

Table 4.2.1 Telephone Subscription Demand Estimated by PMC-OPTION Project

No.	Exchange Name	Macro Demand					Micro Demand					Micro/Macro Deviation (%)				
		1987	1992	1997	2002	2007	1987	1992	1997	2002	2007	1987	1992	1997	2002	2007
1	Kapasari	9,729	14,631	25,794	41,335	51,473	8,366	14,467	23,383	35,526	47,041	-14.0	-1.1	-9.3	-14.1	-8.6
2	Kebalen	13,633	15,897	22,660	31,020	34,936	-	-	-	-	-	-	-	-	-	-
3	Tanjung Perak	1,646	2,480	3,604	5,000	6,567	1,921	2,879	3,752	4,650	5,694	16.7	16.1	4.1	-7.0	-13.3
4	Kenjeran	3,464	6,299	12,442	21,570	28,183	3,163	5,629	10,975	18,573	24,903	-8.7	-10.6	-11.8	-13.9	-11.6
5	Darmo	12,923	16,396	25,196	36,845	43,989	-	-	-	-	-	-	-	-	-	-
	(Ngagel Area)	4,742	5,682	8,335	11,748	13,623	4,802	6,394	8,168	10,060	12,207	1.3	12.5	-2.0	-14.4	-10.4
6	Mergoyoso	14,618	23,219	35,440	51,256	69,426	16,022	26,558	36,473	47,099	59,218	9.6	14.4	2.9	-8.1	-14.7
7	Manyar(Menjangan)	7,560	13,512	24,744	39,215	48,324	7,167	13,844	23,059	35,097	49,885	-5.2	2.5	-6.8	-10.5	3.2
8	Tandes	3,045	6,119	13,772	28,433	46,440	-	-	-	-	-	-	-	-	-	-
9	Sopanjang	1,596	3,103	5,786	10,182	16,675	1,687	3,097	5,434	9,218	15,065	5.7	-0.2	-6.1	-9.5	-9.7
10	Karang Pilang	1,557	2,856	4,659	6,953	9,439	1,787	3,125	5,023	7,244	9,779	14.8	9.4	7.8	4.2	3.6
11	Kandangan	2,037	4,796	10,052	19,335	33,990	-	-	-	-	-	-	-	-	-	-
12	Kalianak	991	2,061	3,787	6,274	9,241	1,035	2,353	3,925	6,018	8,692	4.4	14.2	3.6	-4.1	-5.9
13	Bambe	455	856	1,455	2,327	3,453	499	855	1,338	2,040	3,018	9.7	-0.1	-8.0	-12.3	-12.6
14	Rungkut	6,550	12,409	24,799	42,495	54,427	6,597	13,007	23,127	36,278	51,574	0.7	4.8	-6.7	-14.6	-5.2
15	Injoko	3,267	5,070	9,187	15,080	19,205	3,040	4,442	7,860	12,847	17,457	-6.9	-12.4	-14.4	-14.8	-9.1
16	Maru	4,614	8,710	19,213	38,407	59,580	4,112	8,253	16,450	32,881	51,140	-10.9	-5.2	-14.4	-14.4	-14.2
	Total	87,685	138,414	242,590	395,727	535,348	60,198	104,803	168,967	257,531	355,673					

Source : Basic Design Reports by PMC Option Services

Note : Microscopic demand survey does not cover all the objective area.

Accordingly, the comparison between micro and macro demands is possible on exchange area basis.

FILE:KAB-DEM.MP2

Table 4.2.2 Kabupaten Demand Estimated by Kabupaten Model

Kab. / Kotamadya	Estimated Demand (PDA+PDB+ID+RD)		
	1989	1994	2004
Gresik Kab	6,931	9,484	33,963
Bangkalan Kab	2,883	3,705	7,679
Mojokerto Kab+Kota	3,660	4,507	7,285
Surabaya Kota	91,407	176,537	691,398
Sidoarjo Kab	7,933	16,135	56,273
Lamongan Kab	4,604	5,893	12,251
Jombang Kab	3,664	4,093	5,162

<Breakdown of Calculation Results by Demand Category>

Kab. / Kotamadya	Estimated Public Demand (A) (PDA)			Estimated Public Demand (B) (PDB)		
	1989	1994	1999	1989	1994	1999
Gresik Kab	564	607	653	96	105	114
Bangkalan Kab	504	519	534	84	87	90
Mojokerto Kab+Kota	572	618	667	96	105	115
Surabaya Kota	1,057	1,181	1,318	178	202	230
Sidoarjo Kab	609	676	750	100	113	128
Lamongan Kab	787	834	883	148	159	170
Jombang Kab	675	715	757	119	127	136

Kab. / Kotamadya	Estimated Industrial Demand (ID)			Estimated Residential Demand (RD)		
	1989	1994	1999	1989	1994	1999
Gresik Kab	1,442	1,600	1,861	4,829	7,172	14,846
Bangkalan Kab	1,092	1,188	1,292	1,203	1,911	3,041
Mojokerto Kab+Kota	1,286	1,417	1,565	1,706	2,367	3,319
Surabaya Kota	4,032	4,825	5,786	86,140	170,329	339,607
Sidoarjo Kab	1,666	2,023	2,414	5,558	13,323	28,208
Lamongan Kab	1,538	1,694	1,866	2,131	3,206	4,839
Jombang Kab	1,380	1,471	1,568	1,490	1,780	2,129

4.2.2 Telephone Supply Strategy

Investments in the telecommunications sector as well as those in other sectors in Indonesia have been made, in accordance with the priority on the administrative hierarchy and so on in national socio-economic development.

As one of sectors to support the national and regional socio-economic development, industrialization and business activity, the telecommunications sector should pay attention to the following priorities to establish a telephone supply strategy:

Area Priority

Area category	Priority
National capital	highest
Major provincial capitals	:
Other provincial capitals	:
Kotamadya	:
Kabupaten capitals	:
Kecamatan capitals	:
Desa	lowest

Subscriber Group Priority

Group Category	Priority
Administrative group	highest
Social group	:
Industrial group	:
Residential group	lowest

In fact, a considerable gap has been caused between the urbanized and rural areas in the telephone supply level in terms of the number of line units. This trend on the supply gap will continue up to the year 2004, because the telephone densities are still very low even in urbanized areas. In view of such situation, different telephone supply strategies have been established for multi-exchange area and its surrounding areas.

As a result of the study on exchange basis, the supply volumes are established, based on the respective strategies as detailed in the following and summarized below:

Supply volume established by each Repelita (Unit:line units)

Objective area	Repelita V	Repelita VI	Repelita VII
Surabaya M.E.A	179,108 (186,356)	265,000 (331,885)	408,000 (514,757)
Surrounding Areas	17,528 (37,461)	19,506 (44,060)	34,676 (65,856)

Note: The above figures are at the end of each Repelita. The figures in () show the demands according to the expansion of the multi-exchange area boundary by each Repelita.

(1) A Supply Strategy in Surabaya Multi-Exchange Area

In expanding the telephone service in the number of subscribers, top priority has always been given to Jakarta area. Consequently, the difference in supply volume between Jakarta area and other areas has been gradually magnified and it now stands at 7:1 in penetration ratio per 100 inhabitants as of the end of 1989. The difference between Jakarta and Surabaya areas as of 1989 is 1:0.7 in penetration and 1:0.2 in the number of line units. In order to improve such difference, the following two supply scenarios are established:

Supply scenarios up to the year 2004

Scenario 1 (Realistic Scenario)

The present supply difference between Jakarta and Surabaya areas in penetration ratio per 100 inhabitants will be kept up to the year 2004, when the magnification of the difference will stop.

Scenario 2 (Optimistic Scenario)

The present supply difference between Jakarta and Surabaya areas in penetration ratio per 100 inhabitants will be improved and the supply level in Surabaya area will become almost the same with that of Jakarta by the year 2004.

For each of the above two supply scenarios, a supply plan in the penetration ratio up to the year 2004 is established, based on the figures for Jakarta given in JICA JABOTABEK Report. The comparison is as follows:

Targets of telephone densities/100 inhabitants up to 2004

Area	Repelita V	Repelita VI	Repelita VII
<Jakarta M.E.A>			
Capacity Density	6.9	9.2	11.5
<Surabaya M.E.A on Scenario 1>			
Capacity Density	4.9	6.0	8.0
<Surabaya M.E.A on Scenario 2>			
Capacity Density	4.9	7.0	10.0

Note: The figures for Jakarta M.E.A are from JICA JABOTABEK Report.

Through the discussions with PERUMTEL and POSTEL, it was agreed upon that Scenario 1 which follows the trend of past investment balance between both areas is most recommendable, considering the National Development Policy.

In conclusion, the long-term and medium-term plans for regional telecommunications network development in Surabaya and surrounding areas are prepared, based on the realistic Scenario 1. That is, telephone supply targets are to raise penetration ratio per 100 inhabitants up to 6.0 on an average by the end of Repelita VI, and 8.0 by the end of Repelita VII.

The supply volume distribution on exchange basis has been drawn up giving due weights to exchange areas by demand densities estimated by the World Bank Project. The result is shown in Table 4.2.3.

The Table 4.2.3 also includes a supply volume, based on 7 million target as a reference. It was calculated in accordance with an output of JICA Long-Term Planning. (see References 1 and 2 attached)

FILE: SUP-URBN.MP2

Table 4.2.3 Supply Volume in Surabaya Multi-Exchange Area

(line units)

No.	Exchange Name	Repelita V (1994)	Repelita VI (1999)	Repelita VII (2004)	* Repelita VI 7 Mil. Target
1	KAPASAN	21,000	28,000	36,000	60,700
2	KEBALEN	15,000	23,000	30,000	50,600
3	TJ.PERAK	5,000	5,000	6,000	10,100
4	KENJERAN	5,000	8,000	19,000	32,000
5	GRESIK	3,000	6,000	9,000	15,200
6	KAMAL	(572)	1,000	2,000	3,400
7	DARMO	24,000	30,000	41,000	69,100
8	MERGOYOSO	31,608	40,000	48,000	80,900
9	MANYAR	13,500	16,000	34,000	57,300
10	TANDES	14,000	21,000	28,000	47,200
11	SEPANJANG	3,500	6,000	10,000	16,900
12	KARANG PILANG	3,000	4,000	6,000	10,100
13	KANDANGAN	1,000	10,000	19,000	32,000
14	KALIANAK	2,500	3,000	6,000	10,100
15	BAMBE	1,000	1,000	2,000	3,400
16	MENGANTI	(0)	(20)	5,000	8,400
17	RUNGKUT-I	20,000	23,000	24,000	40,500
18	RUNGKUT-II	3,000	7,000	14,000	23,600
19	INJOKO	4,000	8,000	13,000	21,900
20	WARU-I	4,000	6,000	11,000	18,500
21	WARU-II	5,000	7,000	11,000	18,500
22	SIDOARJO	(4,5)	12,000	19,000	32,000
23	PORONG	(0)	(80)	15,000	25,300
TOTAL		179,108	265,000	408,000	688,000

Note 1: Figures in () are not included in those of M.E.A.

Accordingly, the total does not include those of M.E.A.

Note 2: Supply volume of Repelita VI with * is in the case of 7 million line unit target by the year 1999 which are set up in July 1990. The figures were obtained based on the following conditions:

- supply share to the total WITEL VII is 63.0%.
- supply shares on exchange area basis are the same as those of Repelita VII of the above.

Note 3: 7 million target is not actually supply volume but demand estimated by JICA Long Term Planning 1987. In case the above figure is calculated based on demand share, the figure will become less.

FILE: JLTP-TTL.MP2

Reference 1 - Telephone Supply Plans by JICA Long-Term Planning

(Unit: 1,000)

Items	REPELITA-V (1994)	REPELITA-VI (1999)	REPELITA-VII (2004)
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<Plan 1 on 3% of average GDP growth rate / year>

Telephone Demand	3,709	5,496	7,633
Accumulated Capacity (LU)	2,100	3,200	4,500
Line Units / 100 POP	1.06	1.46	1.84
Capacity / Demand	0.57	0.58	0.59

<Plan 2 on 5% of average GDP growth rate / year>

Telephone Demand	4,431	6,930	9,872
Accumulated Capacity (LU)	2,650	4,300	6,200
Line Units / 100 POP	1.33	1.96	2.54
Capacity / Demand	0.60	0.62	0.63

Population in Indonesia	199,000	219,000	244,000
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<Supply Plan for WITEL VII on Plan 2>

Telephone Demand	694	1,092	1,561
Accumulated Capacity (LU)	398	645	930
Line Units / 100 POP	1.14	1.75	2.38
Capacity / Demand	0.57	0.59	0.60
Population in WITEL VII	34,972	36,771	39,156

Source: JICA Study on Long-term Planning 1987

Reference 2 - Subscription Demand and Telephone Supply by WITEL

WITEL	Population (x1000)	Demand (x1000)	Main Lines (x1000)	Share of ML (%)	Tel Density (/100 POP)
<at the end of Repelita V>					
I	15,514	386	239	9.0	1.54
II	7,487	125	77	2.9	1.03
III	20,266	217	132	5.0	0.65
IV	10,669	1,351	863	32.6	8.09
V	36,958	548	287	10.8	0.78
VI	33,479	429	236	8.9	0.70
VII	34,972	694	398	15.0	1.14
VIII	11,148	180	109	4.1	0.98
IX	10,132	199	123	4.6	1.21
X	14,178	240	146	5.5	1.03
XI	2,118	31	21	0.8	0.99
XII	1,777	30	19	0.7	1.07
Total	198,698	4,431	2,650	100.0	1.33

<at the end of Repelita VI>

I	17,185	609	387	9.0	2.25
II	8,262	196	125	2.9	1.51
III	24,520	351	215	5.0	0.88
IV	12,419	2,087	1,400	32.6	11.27
V	40,267	858	468	10.9	1.16
VI	35,194	669	383	8.9	1.09
VII	36,771	1,092	645	15.0	1.75
VIII	12,175	280	177	4.1	1.45
IX	11,628	314	198	4.6	1.70
X	15,700	377	237	5.5	1.51
XI	2,399	50	35	0.8	1.46
XII	2,036	47	30	0.7	1.47
Total	218,556	6,930	4,300	100.0	1.97

<at the end of Repelita VII>

I	18,981	869	558	9.0	2.94
II	9,135	278	180	2.9	1.97
III	30,180	513	310	5.0	1.03
IV	14,784	2,939	2,017	32.5	13.64
V	44,677	1,234	677	10.9	1.52
VI	37,396	954	552	8.9	1.48
VII	39,156	1,561	930	15.0	2.38
VIII	13,407	398	255	4.1	1.90
IX	13,514	448	286	4.6	2.12
X	17,553	539	341	5.5	1.94
XI	2,768	72	50	0.8	1.81
XII	2,356	66	44	0.7	1.87
Total	243,907	9,872	6,200	100.0	2.54

Source: JICA Study on Long-Term Planning
(based on 5% of average GDP growth rate
and a past supply trend by WITEL)

(2) A Supply Strategy in Surrounding Areas

The important things in the surrounding areas are to secure a civil minimum as telecommunications services and to expand the network coverage area. From those viewpoints, the automatic telephone supply for the surrounding areas should be secured discriminating in favor of following areas by each Repelita in accordance with the area priority in the national socio-economic development:

Network coverage area and civil minimum

<By the end of Repelita V>

- All the Kabupaten capitals.

<By the end of Repelita VI>

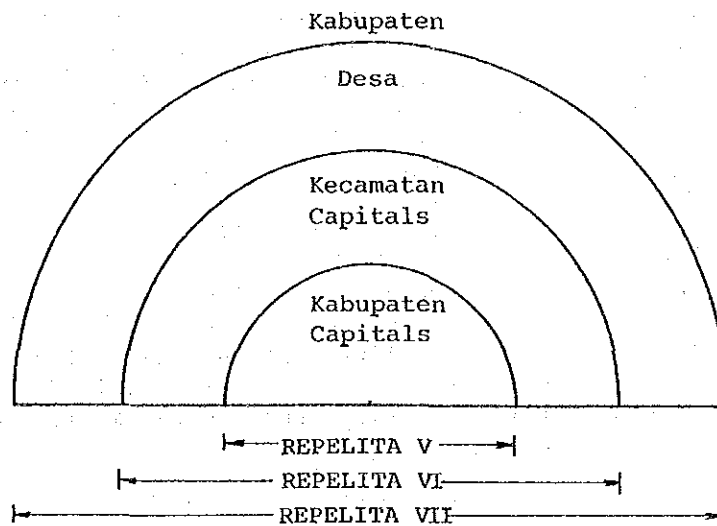
- All the Kecamatan capitals.
(at least 20 telephones)

<By the end of Repelita VII>

- All the Desas which are not Kecamatan capitals.
(at least 2 telephones consisting of one for the administration and the other for the public)
- Improvement of the telephone penetration ratio in the Kabupaten capitals up to the same level as that in the multi-exchange area.

Note: The above supply strategies are not applied to P. Bawean because it is a small island consisting of two Kecamatans of Kabupaten Gresik, it is 150 km away from Surabaya, and still remains to be a typical rural area of lower priority, as compared with surrounding areas of Surabaya.

A strategy on the expansion of the network coverage area in the objective area from Repelita V to VII is illustrated in the following figure:



Consequently, 8.0 telephones per 100 inhabitants will be secured not only in the multi-exchange area but also in all the Kabupaten capitals by the end of Repelita VII. However, in determining the telephone supply volume for the capital of Kabupaten Jombang, a slight downward adjustment was done in view of the Kabupaten demand estimated by the Kabupaten Model. In addition, At least 20 telephones are to be provided by the end of Repelita VII for all the Kecamatan capitals as a civil minimum and at least 2 telephones for all the Desas.

To determine the supply volumes for Kecamatan capitals and Desas, the following strategies are established considering the evaluated scores of the urbanization degree for each Desa and the results of the demand study by the Kabupaten Model:

The number of telephones by urbanization score range

Desa Category	Score Range	No. of Tel/Desa
<Desas which are Kecamatan capitals>		
Urban Kecamatan capitals	21 - 30	30
Rural Kecamatan capitals	0 - 20	20
<Desas which are not Kecamatan capitals>		
Urban Desas	26 - 30	10
Urban Desas	21 - 25	6
Rural Desas	0 - 20	2

Note: Central Bureau of Statistic gives scores indicating a degree of urbanization to each Desa. The score by Desa is the total points obtained by evaluating respective urbanization degrees on three socio-economic indexes. The best score is 30.

The estimated figures by demand category which are calculated by using the Kabupaten Model are as follows:

Administrative and social demands in 2004 by Kabupaten Mode>

Kabupaten	No. of Kec.	Adm demand	Social Demand	Average/Kec.
Gresik	18	700	124	45
bangkalan	18	548	93	35
Mojokerto	19	720	127	44
Sidoarjo	18	828	144	54
Lamongan	22	932	181	50
Jombang	20	798	145	47

Note: The above are figures at the end of 2004. The figures show only administrative and social demands out of total Kabupaten demand for comparison between the demand and the supply as a civil minimum.

In consequence of the above supply strategy, approximately 70 telephones will be supplied to Kecamatan on an average by the end of Repelita VII. This supply volume will cover not only administrative and social demands but also some of industrial demand. It is concluded that the supply levels for Kecamatan are reasonably established for their respective demands.

In addition to the above, additional demand and supply are considered based on the actual large scale industrial and regional development plans apart from the above criteria. The supply volumes established based on the above strategies were arranged into local exchange as a result of subscriber network planning. The volumes on exchange basis are shown in Table 4.2.4.

Table 4.2.4 Supply Volume in the Surrounding Areas

(unit: line units)				
No.	Exchange Name	End of Rep.V (1994)	End of Rep.VI (1999)	End of Rep.VII (2004)
<Surabaya Message Area>				
1	CERME	50	420	1,010
2	SEDAYU	0	150	434
3	KRIAN	190	700	1,718
4	BANGKALAN	1,000	2,880	5,486
5	KAMAL	572	(to MEA)	-
6	SIDOARJO	4,500	(to MEA)	-
Sub Total 1		6,312	4,150	8,648
<Mojokerto Message Area>				
7	MOJOKERTO	6,000	7,220	10,978
8	MOJOSARI	350	800	1,244
9	JOMBANG	3,500	2,830	4,788
10	MOJOAGUNG	200	430	878
11	PLOSO	100	240	586
Sub Total 2		10,150	11,520	18,474
<Lamongan Message Area>				
12	LAMONGAN	1,000	3,290	6,192
13	BABAT	250	540	1,356
Sub Total 3		1,250	3,830	7,548
<Sangkapura Message Area>				
14	Sangkapura	0	6	6
Sub Total 4		0	6	6
Total		17,712	19,506	34,676

Note: (to MEA) means that the objective areas integrate into Surabaya multi-exchange area (MEA) at the Repelita.

4.2.3 Network Development Strategy

Telephone network development strategies for the objective area including Kabupaten Jombang consist of the following two items:

a) A development scenario on telephone network up to 2004

The development scenario is established, in due consideration of the area priority in regional socio-economic development and aiming at the effective investment on telecommunications system expansion.

b) An expansion strategy for Surabaya multi-exchange area up to 2004

Surabaya multi-exchange area is to be expanded by each Repelita phasing, keeping pace with the expansion of socio-economic activities in the area.

(1) A Development Scenario on Telephone Network

A development scenario on telephone network in the objective area is established considering the regional development policies, telecom. sector's policies and the national development trend, as well as the national telecommunications network development.

Telecommunications development will surely contribute to the national development and support socio-economic activities as one of important infrastructures. Major telecommunications network development items are as follows:

a) Expansion of exchange capacity to cope with an increase of demand (especially industrial demand).

b) Expansion of service coverage area to improve accessibility to the services.

c) Digitalization of the network for enhancement of the services toward ISDN.

A scenario of strategic telephone network development for Surabaya multi-exchange area and its surrounding areas by each Repelita is shown in Table 4.2.5.

Table 4.2.5 A Development Scenario on Telephone Network up to 2004

=====

STEP 1: < During Repelita V >

- a) Digitalization of most of the existing analog exchanges;
- b) Completion of optical fiber junction network in Surabaya multi-exchange area;
- c) Completion of digital four local tandem switching configuration in Surabaya multi-exchange area;
- d) Integration of Gresik Exchange into Surabaya multi-exchange area;
- e) Completion of automatization in Surabaya multi-exchange area; and
- f) Improvement and expansion of regional transmission network.

=====

STEP 2: < By the end of Repelita VI >

- a) Expansion of the existing digital exchange capacities;
- b) Completion of digitalization of all the existing analog exchanges;
- c) Completion of automatization of all the existing manual exchanges;
- d) Modernization of local network in all the Kecamatan capitals; (at least 20 telephones by radio links and cables)
- e) Completion of digital switching network in GKS;
- f) Completion of digital transmission network in GKS;
- g) Integration of Sidoarjo and Kamal Exchanges into Surabaya multi-exchange area; and
- h) Integration of Bangkalan message area (0323) into Surabaya message area (031).

=====

STEP 3: >< By the end of Repelita VII >

- a) Expansion of the existing digital exchange capacities;
- b) Establishment of new exchanges covering following areas:
 - areas targeted in regional and industrial developments,
 - areas isolated from telecommunications services,
 - important Kecamatan capitals aiming at an effective expansion of the network.
- c) Expansion of the network to all the Desas by using radio systems and cable systems. At least 2 telephones are to be provided in a Desa for the administration and the public (public call office - PCO).

=====

Note: The above development scenario up to the year 2004 was determined through the discussions with organizations concerned in the telecommunications sector.

(2) A Concept on Telephone Network

The regional telephone network in the objective area at the end of Repelita VII can be broadly divided into two, i.e., "Urban Network" covering Surabaya multi-exchange area and "Outskirts Network" covering its surrounding areas. The relations among these two networks, message areas and administrative areas are as follows:

1) Urban Network

a) Surabaya multi-exchange area network
(Trunk code: 031)

- Kotamadya Surabaya;
- a half of Kabupaten Sidoarjo;
- a part of Kabupaten Gresik;
- a part of Kabupaten Bangkalan.

2) Outskirts Network

a) Surabaya message area network except MEA
(Trunk code: 031)

- Kabupaten Gresik
- Kabupaten Sidoarjo
- Kabupaten Bangkalan

b) Mojokerto message area network
(Trunk code: 0321)

- Kotamadya Mojokerto
- Kabupaten Mojokerto
- Kabupaten Jombang

c) Lamongan message area network
(Trunk code: 0322)

- Kabupaten Lamongan

d) Sangkapura message area network
(Trunk code: 0325)

- P. Bawean
(two Kecamatan of Kabupaten Gresik)

At present, Bangkalan message area consists of Kabupaten Bangkalan and Kabupaten Sampang. However, it is recommended that Kamal is included into Surabaya multi-exchange area by the end of Repelita VI and Kabupaten Bangkalan is included into Surabaya message area considering socio-economic growth in Surabaya area. In addition, Kabupaten Sampang is included into Pamekasan message area.

A concept of urban and outskirts networks and message area configuration in 2004 is indicated in Figure 4.2.2. A target telephone switching network configuration in 2004 is shown in Figure 4.2.3.

(3) Expansion of Surabaya Multi-Exchange Area up to 2004

As stated in the Table 4.2.5 "A Development Scenario on Telephone Network up to 2004", PERUMTEL is going to expand multi-exchange area boundaries not only in Jakarta area but also Surabaya area phasing, keeping pace with the expansion of socio-economic activities. According to this policy, Surabaya multi-exchange area will be gradually extended over the Kotamadya Surabaya boundary. Areas which will be combined into Surabaya multi-exchange area by each Repelita are as follows:

1) During Repelita V

- Gresik

2) During Repelita VI

- Sidoarjo
- Kamal

3) During Repelita VII

- Porong
- Menganti
(adjacent area to Kalianak, Kandangan, Bambe and Sepanjang)

Surabaya multi-exchange area boundaries to be expanded in each Repelita (from V to VII) are shown in Figures 4.2.4. In this connection, a time distance map by vehicle from the center of Surabaya is shown in Figure 4.2.5. This time distance map was quoted from "JICA Urban Development Planning on GERBANGKERTOSUSILA Region 1983". The map indicates the distances accessible by using vehicle within a certain times from the center of Surabaya. The map was prepared before the completion of highway in the area.

Comparing the distance from the center of Surabaya in terms of the necessary time (0.5 hours, 1.0 hours, 1.5 hours and 2.0 hours) with the Surabaya multi-exchange area boundaries in each Repelita from V to VII, it is found that the distance lines by the time quite coincide with the Surabaya multi-exchange area boundaries in each Repelita.

(4) Future Network Configuration in Surabaya Multi-Exchange Area

PERUMTEL is expanding the existing Surabaya multi-exchange area network to cope with future big demand and is going to change from the existing two tandem configuration to new digital four tandem configuration. These four tandem exchanges have already been installed; however, the installation of junction circuit facility by fiber optic transmission system is still on-going. By the end of Repelita V, it will be completed. The new configuration is essential and will continuously be employed after the year 2004 also.

The network cost is, in general, relatively insensitive to the number of tandem exchanges. A relatively wide range in that number gives approximately equal costs if locations are optimum. In this sense the problem is not critical. On the other hand, locations of new tandem exchanges in the area are quite reasonable considering future multi-exchange area. In the number of tandem exchanges, four (4) is also reasonable on maintainability and administrative activity and more endurable to traffic congestion. The local tandem configuration in 2004 and homing arrangement by tandem area are shown in Figure 4.2.6 and 4.2.7, respectively.

(5) Subscriber Number Capacity in Surabaya Multi-Exchange Area

The numbering in Surabaya multi-exchange area including intra-area within the same message area is classified by the first digit as follows:

The numbering in Surabaya message area

```

=====
First digit  Kinds of connections
=====
"0"         Trunk connections
"1"         Emergency and special services connections
"2"         Local connections
"3"         :
:           :
:           :
"7"         :
"8"         Local connections
"9"         Intra-area connections
=====

```

Note: The details of the numbering in Surabaya multi-exchange area including intra-area are shown in Table 4.2.6.

As a result of the study, it is concluded that the number of digits for local connection should be changed to seven (7) digits from five (5) or six (6) digits during the following periods depending on supply scenarios:

- a) Supply scenario 1: by the year 2005
 - b) Supply scenario 2: by the year 2003
- (refer to the Figure 4.2.8)

At present, the maximum subscriber number capacity for Surabaya multi-exchange area is 700,000, as it is possible to use from "2" to "8" as the first digit. However, the actual number capacity is limited to approximately 50% of the maximum number capacity taking into account the empirical percentages of number losses to the maximum number capacity as seen in other countries.

Consequently, it is recommendable that the total number of digits for local connections in the area should be changed from 5 or 6 to 7 by the end of Repelita VII. The detail of a relation between the subscriber number capacity and the supply volume is shown in Figure 4.2.8.

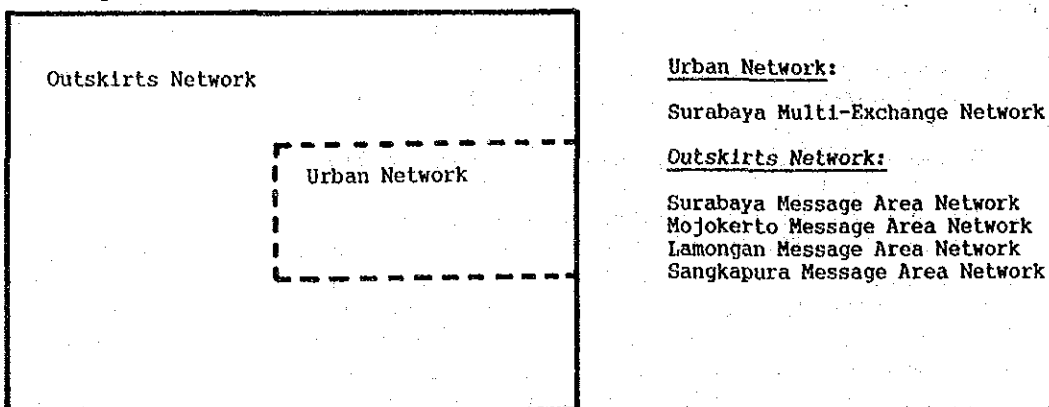
In relation to the change of the number of office code digits (6D to 7D), it is recommended that S3 digit is added to the existing office code as follows:

<u>Existing numbering</u>	<u>New numbering</u>
S1+S2+XXXX	S1+S2+(S3)+XXXX

(6) Decentralization of Surabaya Tertiary Center

Surabaya tertiary center is a most important trunk exchange in not only east Jawa but also east half of Indonesia. Accordingly, a system-down of this exchange will seriously affect the nationwide socio-economic activities. In order to avoid a risk of such damage to the socio-economic activities due to the system-down, a substitute trunk exchange for Surabaya trunk exchange should be placed in Tandes exchange after Repelita VII. Tandes exchange is located at a more suitable place for future expansion of Surabaya multi-exchange and has enough spaces in building and land.

A concept on Urban and Outskirts Networks



A concept on Message Area Configuration in GERBANGKERTOSUSILA Area in 2004

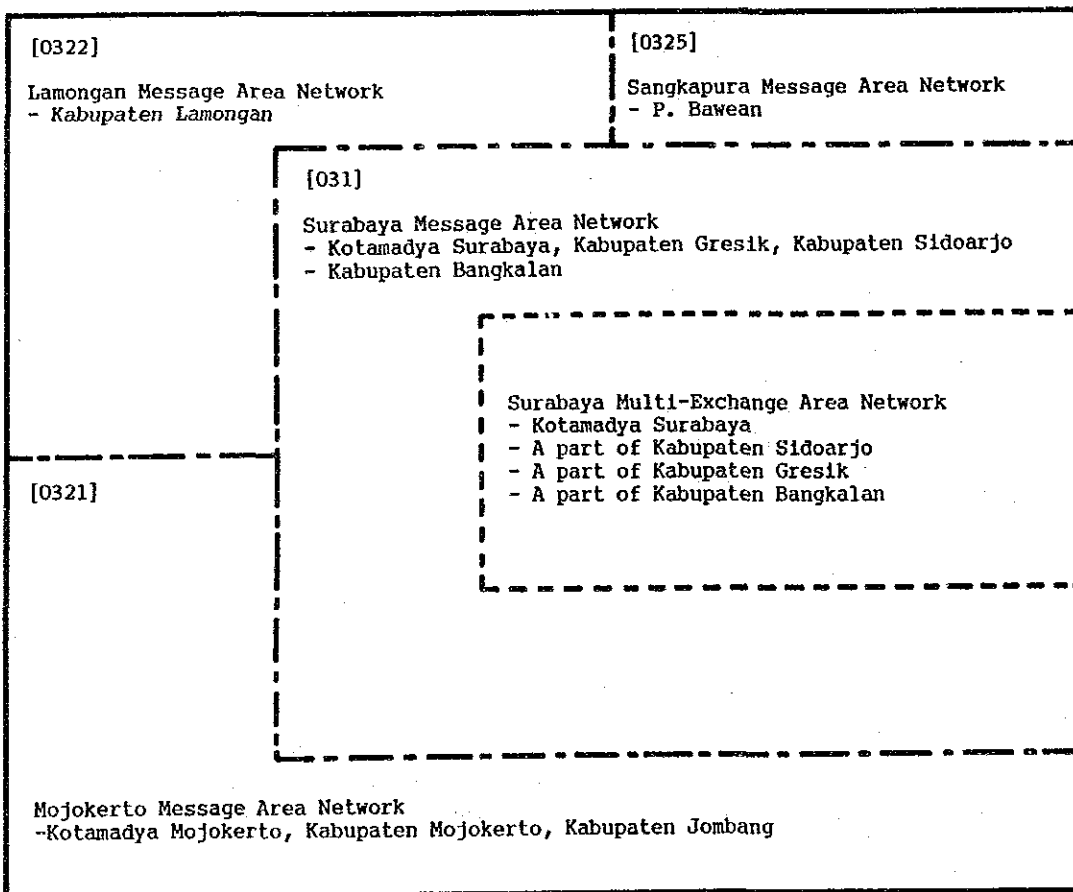


Figure 4.2.2 A Concept on Telephone Network in 2004

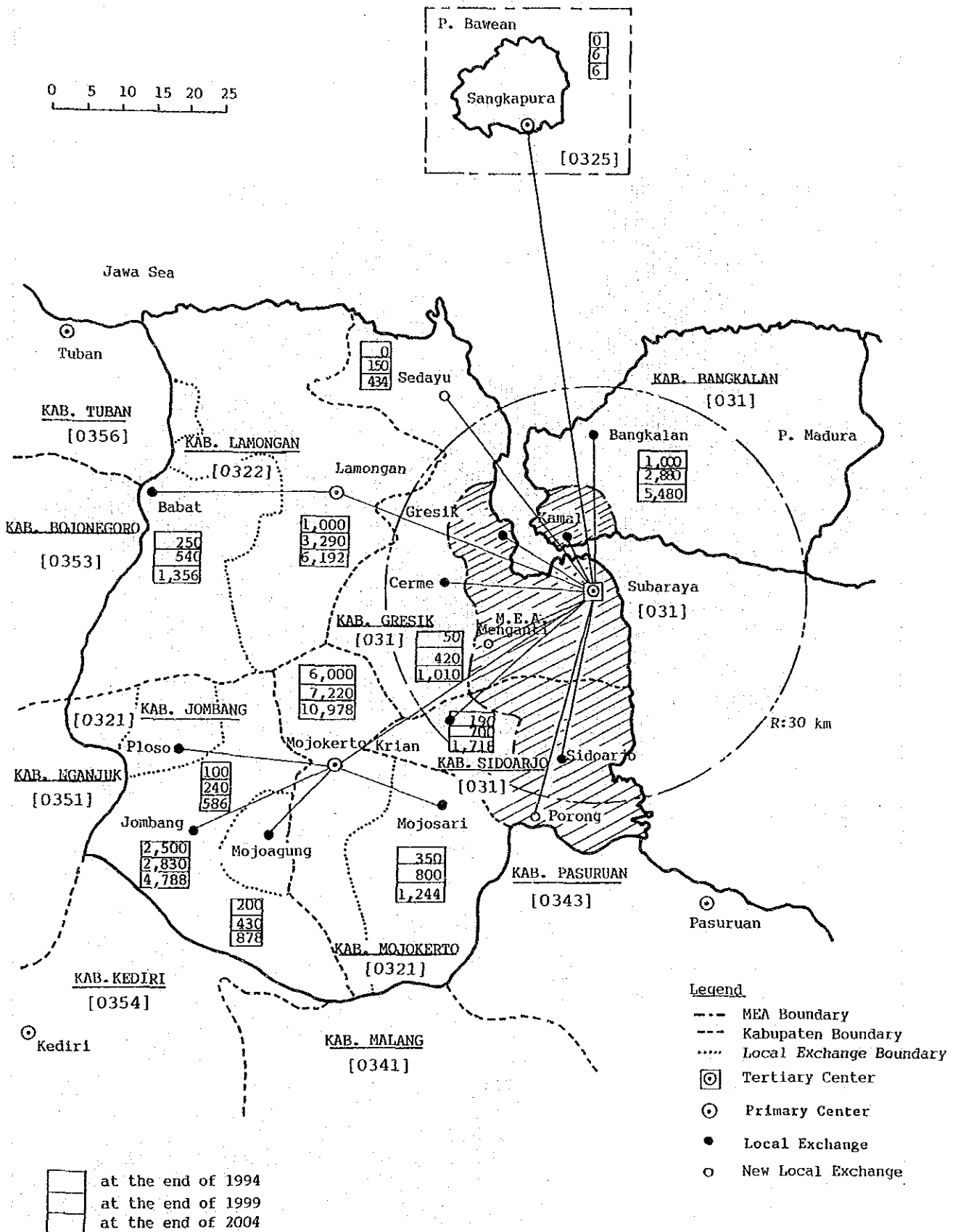
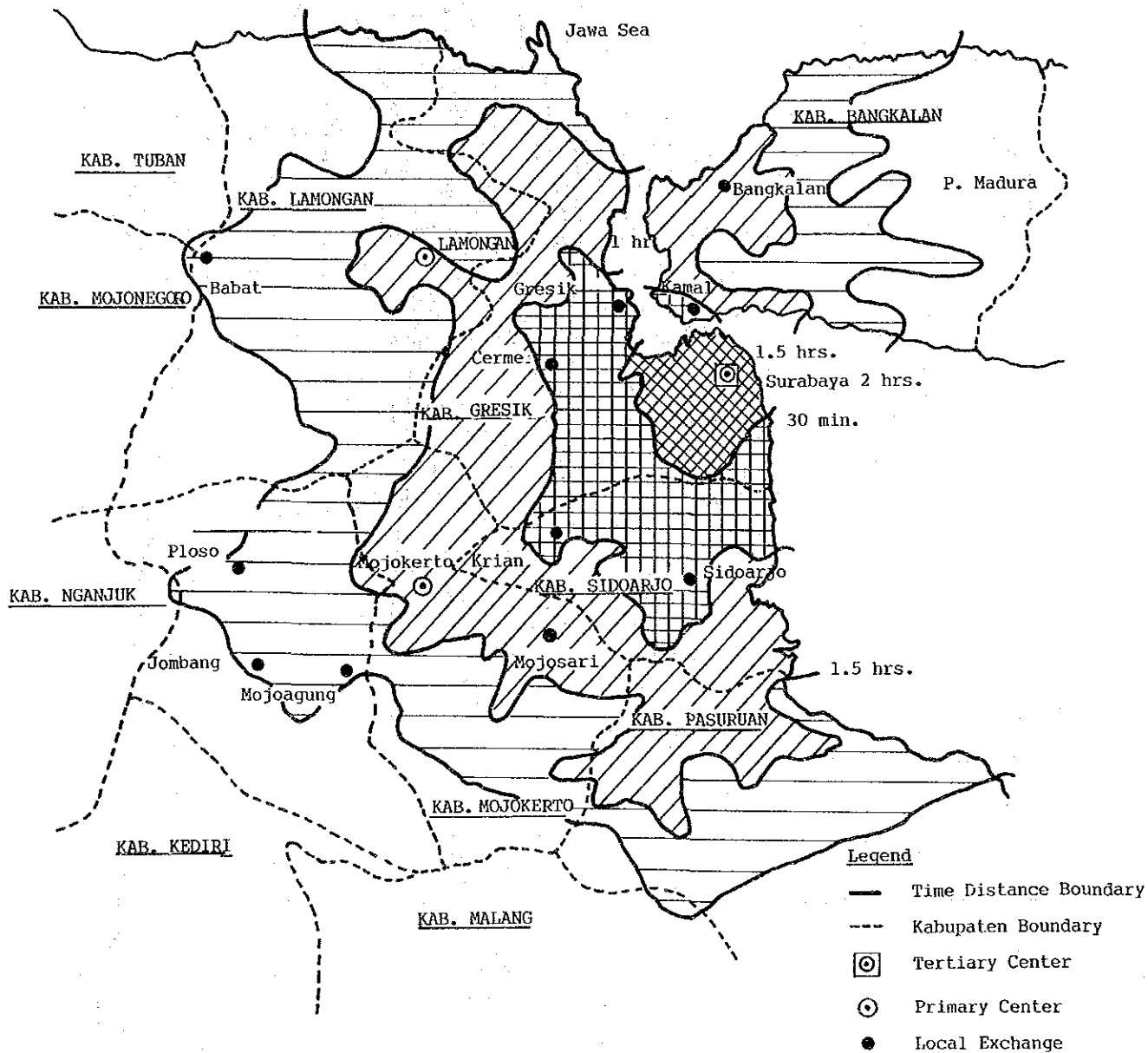
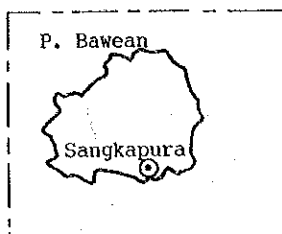
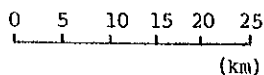


Figure 4.2.3 Telephone Switching Network Configuration in 2004



Source: JICA Urban Development Planning on GERBANGKERTOSUSILA Region

Figure 4.2.5 Time Distance Map by Vehicle from Central Area of Surabaya

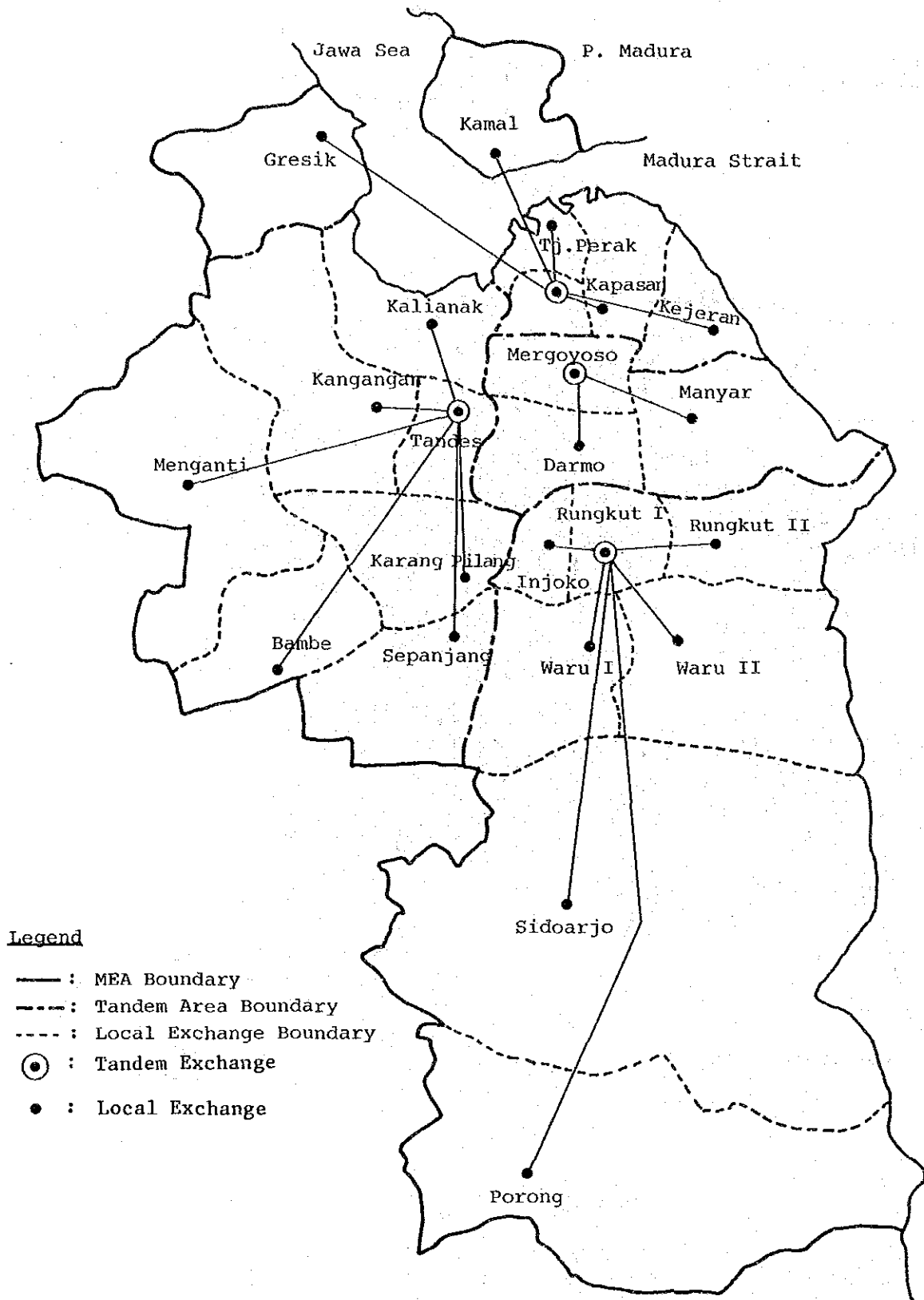
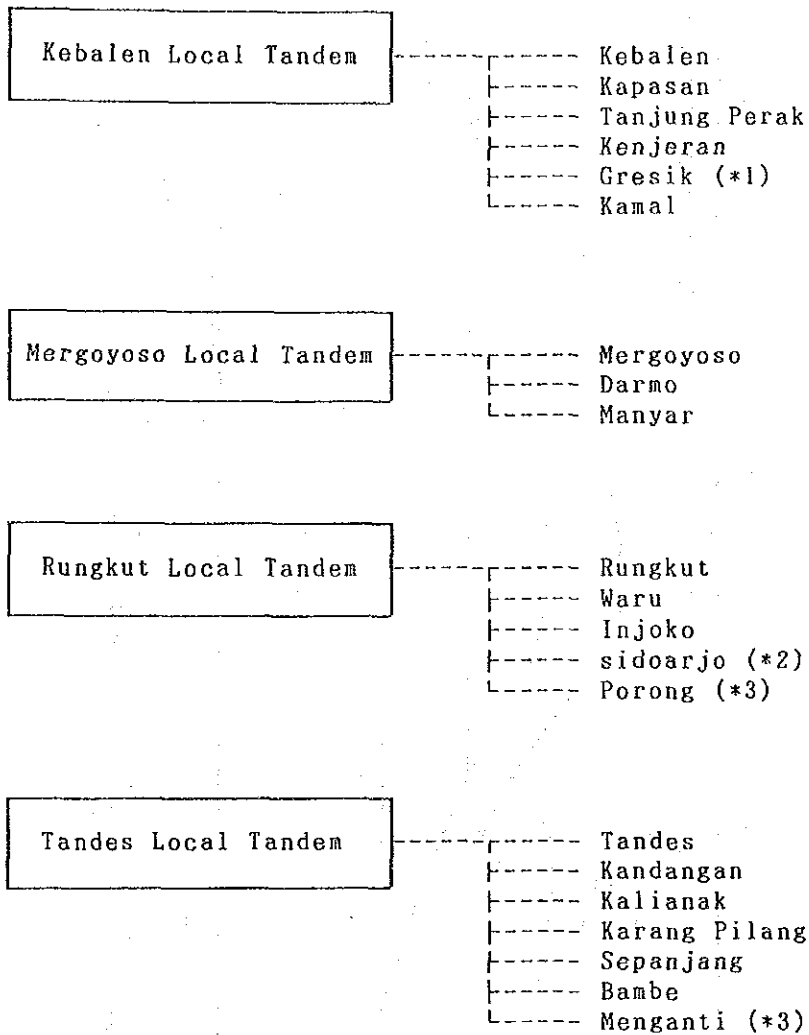


Figure 4.2.6 Local Tandem Configuration in 2004



Note:

- *1: to be included by the end of Repelita V
- *2: to be included by the end of Repelita VI
- *3: to be included by the end of Repelita VII

Figure 4.2.7 Homing Arrangement on Four Tandem Switching Configuration

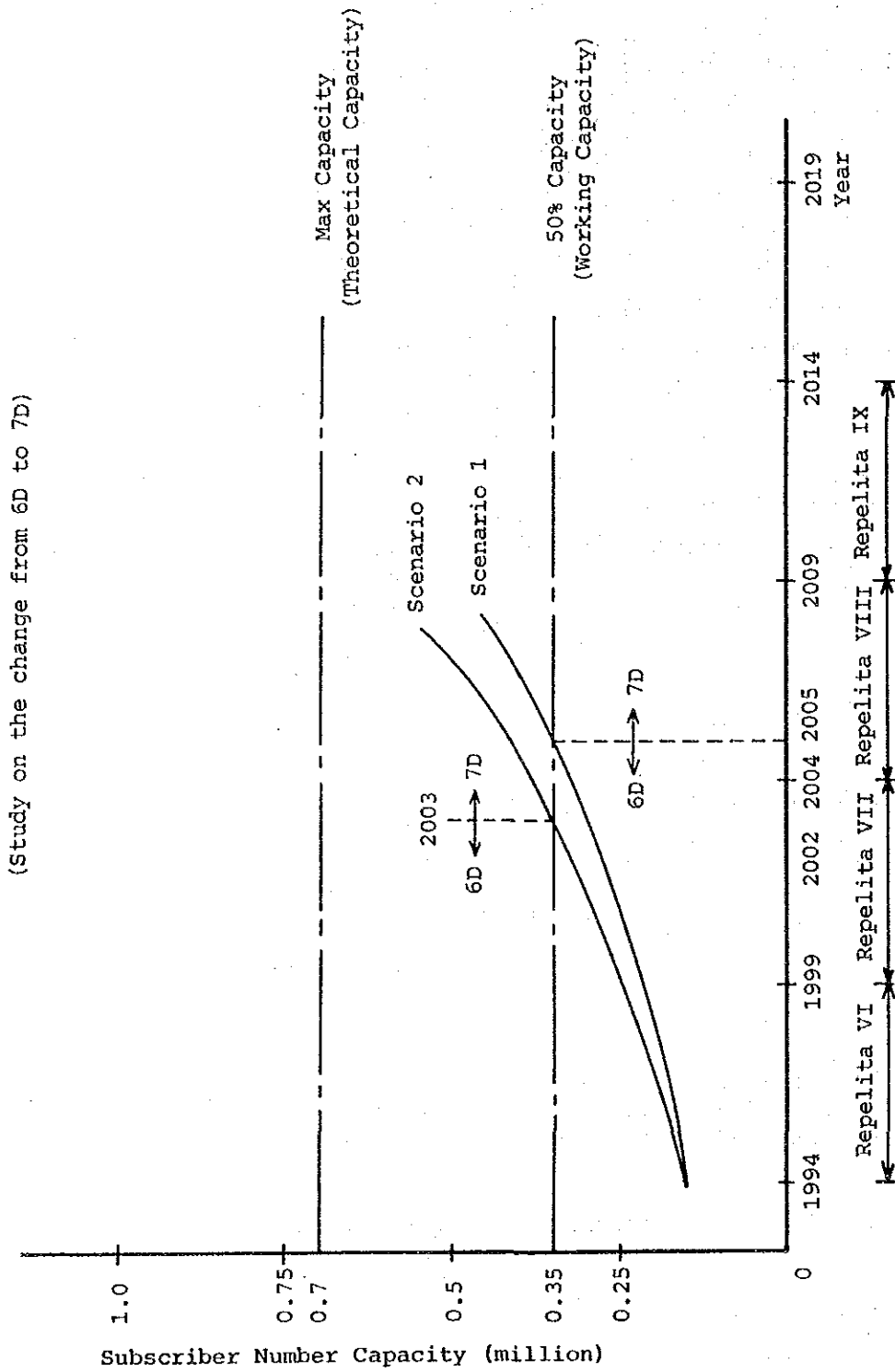


Figure 4.2.8 Subscriber Number Capacity in Surabaya Multi-Exchange Area

Table 4.2.6 Existing and Future Numbering (1/3)

< Surabaya Message Area (031) >

I	II	0	1	2	3	4	5	6	7	8	9
0		*** Originating for SLDD ***									
1		*** Originating for Special Services ***									
2		<-----><-----><-----><-----><-----><-----><-----><-----><-----><-----><-----><----->				KBL-A			KBL-A	KJR	PRK
						5D			6D	6D	6D
3		KPS-A	KPS-A	KBL-B		KBL-B			KPS-B	KPS-C	
		<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
		6D	6D	6D		6D			6D	6D	6D
4		<-----><-----><-----><-----><-----><-----><-----><-----><-----><-----><----->				MGO-A			MGO-A		
						5D			6D		
5		MNR-C	MGO-B	MGO-B	MGO-C			DMO-B			MNR-A
		<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
		6D	6D	6D	6D			6D			6D
6		DMO-A		MNR-C					DMO-A		
		<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
		5D		6D					5D		
7		MNI	TDS	TDS		KDN	SPJ	BBE	KPL	KLK	
		<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
		6D		6D		6D	6D	6D	6D	6D	6D
8			RKT-IA	RKT-IB	RKT-IB	RKT-II (JGR)		IJK		WRU-I	WRU-II
			<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
			6D	6D	6D	6D		6D		6D	6D
9			KML	SDA*1	SDA	SDA*2	BKL	PRG		GRS*3	
			<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
			6D	9+5D	9+5D	9+5D	6D	6D		9+5D	

Note: == existing numbering.
 --- future numbering.
 *1 21xxx to 921xxx for Sidoarjo
 *2 41xxx to 922xxx for Sidoarjo
 94xxxx for krian, sedayu and Cerume after the change for SDA*2
 *3 9+5D to 98xxxx with no prefix for Gresik

Table 4.2.6 Existing and Future Numbering (2/3)

< Mojokerto Message Area (0321) >

I	II	0	1	2	3	4	5	6	7	8	9
0		*** Originating for SLDD ***									
1		*** Originating for Special Services ***									
2	MR <-----> 5D	MR <=====> 5D						MR 5D			
3	MJS <-----> 5D										
4	MJA <-----> 5D										
5	PSO <-----> 5D										
6											
7											
8		JB <=====> 5D			JB <-----> 5D						
9											

Note: === existing numbering.
 --- future numbering.

Trunk code for Sangkapura message area is 0325 in FTP 1985.

Table 4.2.6 Existing and Future Numbering (3/3)

< Lamongan Message Area (0322) >

I	II	0	1	2	3	4	5	6	7	8	9
0		*** Originating for SLDD ***									
1		*** Originating for Special Services ***									
2		←-----				LMG	-----→				
						5D					
3		BBA	←-----								
		5D									
4											
5											
6											
7											
8											
9											

Note: === existing numbering.

--- future numbering.

Trunk code for Sangkapura message area is 0325 in FTP 1985.

4.2.4 Switch Expansion Plan

Based on the supply volumes for Surabaya multi-exchange area and its surrounding areas which have been established in accordance with the supply strategies described in the previous Paragraph 4.2.2, a switch expansion plan is drawn up on exchange basis. The plan is made on condition that the maximum exchange capacity per unit is approximately 20,000 in the number of line units and analog exchanges will be completely replaced with digital exchanges by the end of Repelita VI.

The switch expansion plan including establishment of new exchanges for the surrounding areas is formulated as a result of subscribers' network planning. The subscribers' network in the surrounding areas is established by using small local exchanges, cable system and radio system. In consequence of the above, the switch expansion plans for Surabaya multi-exchange area and the surrounding areas are made as given in Tables 4.2.7 and 4.2.8, respectively.

Table 4.2.7 Switch Expansion Plan for Surabaya Multi-Exchange Area

(unit: line units)

No.	Exchange Name	End of Rep.V		End of Rep.VI		End of Rep.VII	
		Capacity	Type	Capacity	Type	Capacity	Type
1	KAPASAN A	10,000	MC10C	---	---	---	---
2	KAPASAN B	11,000	STDI	28,000	STDI	28,000	STDI
3	KAPASAN C	---	---	---	---	8,000	STDI
4	KEBALEN A	<-10,000>	EMD	---	---	---	---
5	KEBALEN B	15,000	STDI	23,000	STDI	30,000	STDI
6	TJ.PERAK	5,000	STDI	5,000	STDI	6,000	STDI
7	KENJERAN	5,000	STDI	8,000	STDI	19,000	STDI
8	GRESIK A	<-1,200>	EMD	---	---	---	---
9	GRESIK B	3,000	STDI	6,000	STDI	9,000	STDI
10	KAMAL	(572)	STDI-K	1,000	STDI	2,000	STDI
11	DARMO A(B)*	24,000	STDI	30,000	STDI	30,000	STDI
12	DARMO B(C)*	---	---	---	---	11,000	STDI
13	MERGOYOSO A	<-10,200>	EMD	---	---	---	---
14	MERGOYOSO B	31,608	STDI	28,000	STDI	28,000	STDI
15	MERGOYOSO C	---	---	12,000	STDI	20,000	STDI
16	MANYAR A	3,000	PRX205	---	---	---	---
17	MANYAR B	10,500	STDI	16,000	STDI	28,000	STDI
18	MANYAR C	---	---	---	---	6,000	STDI
19	TANDES	14,000	STDI	21,000	STDI	28,000	STDI
20	SEPANJANG	3,500	STDI	6,000	STDI	10,000	STDI
21	KARANG PILANG	3,000	STDI	4,000	STDI	6,000	STDI
22	KANDANGAN	1,000	DLU	10,000	STDI	19,000	STDI
23	KALIANAK	2,500	DLU	3,000	STDI	6,000	STDI
24	BAMBE	1,000	DLU	1,000	DLU	2,000	STDI
25	MENGANTI	(0)	---	(0)	---	5,000	STDI
26	RUNGKUT-I A	10,000	MC-10C	---	---	---	---
27	RUNGKUT-I B	10,000	STDI	23,000	STDI	24,000	STDI
28	RUNGKUT-II*	3,000	DLU	7,000	STDI	14,000	STDI
29	INJOKO	4,000	STDI	8,000	STDI	13,000	STDI
30	WARU-I	4,000	STDI	6,000	STDI	11,000	STDI
31	WARU-II	5,000	STDI	7,000	STDI	11,000	STDI
32	SIDOARJO A	(2,000)	EMD	---	---	---	---
33	SIDOARJO B	(2,500)	STDI	12,000	STDI	19,000	STDI
34	PORONG	(0)	---	(0)	---	15,000	STDI
TOTAL		179,108		265,000		408,000	

Note 1: Expansion plan during Repelita V is still ongoing.

The plan might be changed according to situation.

Note 2: Figures in () are not included in those of M.E.A.

Note 3: Darmo A of the above is not existing EMD but new unit A of (*) STDI, because EMD will be removed after completion of STDI.

Note 4: RUNGKUT-II* is named JAGIR.

Table 4.2.8 Switch Expansion Plan for the Surrounding Areas

(unit: line units)

No.	Exchange Name	End of Rep.V		End of Rep.VI		End of Rep.VII	
		Capacity	Type	Capacity	Type	Capacity	Type
<Surabaya Message Area>							
1	CERME A	50	ABK206	---	---	---	---
2	CERME B	---	---	420	STDI	1,010	STDI
3	SEDAYU	---	---	150	STDI-K	434	STDI-K
4	KRIAN A	190	ABK206	---	---	---	---
5	KRIAN B	---	---	700	STDI	1,718	STDI
6	BANGKALAN	1,000	DLU	2,880	STDI	5,486	STDI
7	KAMAL	572	STDI-K	(to MEA)		---	---
8	SIDOARJO A	2,000	EMD	---	---	---	---
9	SIDOARJO B	2,500	STDI	(to MEA)		---	---
Sub Total 1		6,312		4,150		8,648	
<Mojokerto Message Area>							
10	MOJOKERTO A	2,000	EMD	---	---	---	---
11	MOJOKERTO B	4,000	STDI	7,220	STDI	10,978	STDI
12	MOJOSARI A	350	ABK206	---	---	---	---
13	MOJOSARI B	---	---	800	STDI	1,244	STDI
14	JOMBANG A	1,000	EMD	---	---	---	---
15	JOMBANG B	2,500	STDI	2,830	STDI	4,788	STDI
16	MOJOAGUNG A	200	ABK206	---	---	---	---
17	MOJOAGUNG B	---	---	430	STDI-K	878	STDI-K
18	PLOSO A	100	ABK206	---	---	---	---
19	PLOSO B	---	---	240	STDI-K	586	STDI-K
Sub Total 2		10,150		11,520		18,474	
<Lamongan Message Area>							
20	LAMONGAN	1,000	STDI	3,290	STDI	6,192	STDI
21	BABAT A	250	ABK206	---	---	---	---
22	BABAT B	---	---	540	STDI	1,356	STDI
Sub Total 3		1,250		3,830		7,548	
<Sangkapura Message Area>							
23	Sangkapura	---	---	6	SBK	6	SBK
Sub Total 4		---	---	6		6	
Total		17,712		19,506		34,676	

Note: (to MEA) means that the objective areas integrate into Surabaya multi-exchange area (MEA) in each Repelita.

4.2.5 Traffic and Circuit Demands

Traffic and circuit demands between exchanges are estimated separately for the multi-exchange area and for its surrounding areas, because there is a big difference in supply level between the multi-exchange area and its surrounding areas and, therefore, it is not realistic to adopt the same calculation method for both areas. The traffic routing, etc. are in accordance with the "Fundamental Technical Plan, 1985".

(1) Traffic and Circuit Demands for Surabaya Multi-Exchange Area

The calculation is made by using "Traffic & Circuit Calculation Model". The model consists of a traffic distribution by gravity model and circuit calculation by the method recommended by CCITT in "Local Network Planning". The detail of calculation procedure is as follows:

The calculation procedure of traffic and circuit

Calculation items	Input items
Traffic distribution	- outgoing traffic by exchange unit (*1) - distance between exchanges (*2) - community factor (*3)
Circuit calculation	- distributed traffic matrix (*4) - incremental cost between exchanges (*5) - routing condition (*6)

- Note: *1: (line units)x(originating calling rate) (Annex 4.2.1)
 *2: crow flight distance (Annex 4.2.2)
 *3: 0.03 is applied, because the factor in multi-exchange area is not so much dependent on the distance.
 *4: a result of traffic calculation. (Annex 4.2.3)
 *5: the same figures as those used in JICA JABOTABEK report. (Annex 4.2.4 and 4.2.5)
 *6: the terminating tandem routing is applied with alternative routing. (Annex 4.2.6)

The adopted originating calling rates per subscriber by each exchange in Surabaya multi-exchange area are those authorized by PERUMTEL for the purpose of planning. The calling rates applied for exchanges in the multi-exchange area are shown in Annex 4.2.3. The results of traffic and circuit calculation for the multi-exchange area are shown in Annex 4.2.7.

(2) Traffic and Circuit Demands for the Surrounding Areas

The traffic and circuit calculation for the surrounding areas is made by using a different method from that for the multi-exchange area. The calculation is made on section by section between exchanges in each primary area as shown below:

Exchange sections to be calculated

- =====
- *1 Surabaya TC - Primary Centers
- *2 Surabaya TC - Local Exchanges outside Surabaya M.E.A
- *3 Primary centers - Local Exchanges within own Primary Area
- =====

The calculation for the above exchange sections was made in accordance with the following procedure:

TC = OGC x 2
 OGC = SUB x CR x TDS

where,

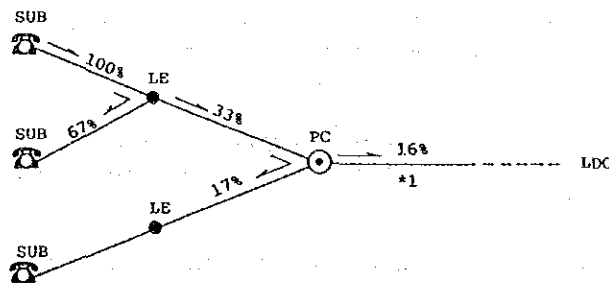
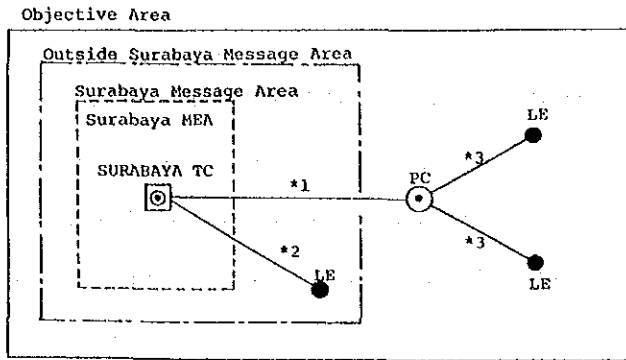
- TC : the required number of circuits for the objective exchange section.
- OGC: the required number of outgoing circuits for the objective exchange section.
- SUB: the number of subscribers concerned with the calculation of the required number of outgoing circuits for the objective exchange section.
- CR : the average originating traffic intensity per subscriber in Erlang.
- TDS: the traffic distribution ratios by exchange section as obtained from the JICA Rural Telecom Study. The ratios are as follows:

Traffic distribution ratios

Exchange sections	Distribution ratios (%)
Within own exchange (LE)	67.0
LE - own PC	33.0
PC - own SC or TC	16.0

Note: LE: local exchange
 PC: primary center
 SC: secondary center
 TC: tertiary center

The above traffic distribution ratios applied for the estimates of traffic and circuit demands in the surrounding areas are illustrated in the following figures:



The average originating traffic intensity per subscriber in Erlang is determined for the planning of the outskirts network consisting of primary area networks. The figures are obtained from the calculation for an average Kecamatan as assumed below:

Feature of typical Kecamatan

Desa categories	No. of subscribers		
	Administration	Public	Total
Kecamatan capital	15	5	20
Other Desas	20	20	40
Total subscribers	35	25	60
Total traffic in Erl	1.75	4.0	5.75

Note: The number of other Desas is 20.
 The total calling rates for administration and public are assumed to be 0.16 Erl and 0.05 Erl, respectively, considering SDP standard.

In consequence of the above assumptions, the average total traffic intensity per subscriber of both originating and terminating calls is assumed to be 0.096 Erl. This figure is important for planning a subscriber network by using multi-access subscriber radio system. The detail is described in paragraph 4.3. The result of traffic and circuit calculation for the surrounding areas is shown in Annex 4.2.8.

4.3 Development Framework for Transmission Network

4.3.1 Development Target

(1) Overall Targets for Transmission Network Development

The transmission network development targets up to the year 2004 are as follows:

- Deployment of IDN (Integrated Digital Network) in the objective area to provide commercial ISDN services.
- Construction of rural area networks in all Desas in the study area, aiming at the elimination of "no telephone service" Desas.
- Improvement and expansion of the junction network, including route diversity, keeping pace with the expansion of the multi-exchange area.

To formulate a development program for the above targets, the transmission network in this objective area are categorized into the following network portions:

- Junction network in Surabaya multi-exchange area.
- Trunk network connecting TC, PC and LE.
- Rural area networks connecting subscribers in Desas.

The development targets by each Repelita from V to VII are summarized as follows:

(2) Targets during Repelita V

- a) Junction Network in Surabaya Multi-Exchange Area
 - Completion of the ongoing TELECOM-III OSP Project.
- b) Trunk network
 - Completion of the ongoing Remote Area Project.
- c) Rural area networks
 - Completion of the ongoing Rural Area Project.

Besides the above, the following should be done additionally during Repelita V:

- d) Installation of additional junction cables to be required in consequence of the integration of Gresik into the multi-exchange area.
- e) Installation of additional trunk network to be required in consequence of the telephone exchange digitalization in Surabaya-Sidoarjo, Mojokerto-Jombang and Gresik-Bangkalan (system grade up).

(3) Targets during Repelita VI

a) Junction network in Surabaya multi-exchange area

- Installation of junction cables to be required in consequence of the integration of Sidoarjo and Kamal into Surabaya multi-exchange area.
- Expansion of the existing transmission facilities to cope with the demand increase.

b) Trunk network

- Construction of a digital trunk network to connect PC with all LEs.

c) Rural area network

- Construction of rural area networks to cover all Kecamatan capitals, providing more than 20 telephones in each capital.
- Re-configuration of existing rural area networks, where necessary, in consideration of telephone exchanges to be constructed anew.

(4) Targets during Repelita VII

a) Junction Network in Surabaya Multi-Exchange Area

- Installation of junction cables where necessary in consequence of the integration of Menganti and Porong into Surabaya multi-exchange area.
- Expansion of existing transmission facilities to cope with the demand increase, including route diversity, where necessary.

b) Trunk network

- Expansion of existing facilities to cope with the demand increase.

c) Rural area network

- Expansion of rural area networks established during Repelita VI and provision of more than 2 telephones in each Desa office.
- Expansion of existing facilities to cope with the increase of subscribers.

4.3.2 Development Framework

To reach the targets established, the development framework is formulated for each network component categorized as follows:

(1) Junction Network in Surabaya Multi-Exchange Area

The junction network development framework for Surabaya multi-exchange area has been formulated, based on the telephone exchanges integration plan. Telephone exchanges to be integrated into the multi-exchange area during Repelita V through Repelita VII are shown in Figure 4.3.1.

The junction network expansion work is now being carried out by the TELECOM-III Project, with the World Bank loan assistance, in accordance with the framework thus formulated. It is expected to be completed in 1994.

In formulating the development framework, studies were made for the following:

- Calculation of the necessary number of junction systems (2 Mbit/s).
- Study of the junction system to be employed.
- Study of route diversity on the junction network.

Study results are summarized below:

a) Calculation of necessary number of junction systems

The number of junction 2 Mbit/s systems to be required during Repelita VI and VII periods has been calculated, taking into account the systems to be completed by the TELECOM-III Project. The necessary number of the systems between each two telephone exchanges at the end of Repelita VI and VII are shown in Annexes 4.3.1 (1/2 - 2/2) and 4.3.2 (1/2 - 2/2), respectively. Figures 4.3.2 and 4.3.3 present the junction network configuration in each Repelita.

b) Study of junction system to be employed

To ensure satisfactory compatibility with the existing system, 140 Mbit/s fiber optic cable transmission system, the same system with the existing one, is to be adopted for the junction network of this multi-exchange area. With respect to the optical fiber cable, however, single mode system will be adopted, instead of the multi mode system now being used. This is because the former can realize the longer repeater spacing, larger transmission capacity, and lower price.

c) Study of route diversity on junction network

In association with the expansion works to be made on the existing cable routes during Repelita VII, route diversity is to be made in two sections, i.e., Kebalen-Kalianak and Sepanjang-Waru I, as shown in Figure 4.3.3. With this, a ring configuration will be formed on the junction network connecting main telephone exchanges.

Concept of route diversity for junction network is shown in Figure 4.3.4.

(2) Trunk Network

The trunk network development framework has been formulated in due consideration of the telephone exchanges digitalization program. In formulating the development framework, studies were made for the following:

- Calculation of the necessary number of trunk circuits.
- Study of the system to be employed.
- Study of the trunk network configuration.

Study results are summarized below:

a) Calculation of the necessary number of trunk circuits

The number of trunk circuits has been calculated, assuming that trunk calls originating from LE in each message area are transmitted to the destination via a trunk exchange of PC in the same message area. Trunk traffic between PC and LE in the same message area, and the necessary number of trunk circuits are available in ANNEX 4.2.8.

b) Study of the system to be employed

For a trunk network, two systems are generally applicable, i.e., fiber optic system and microwave system.

Fiber optic system is suitable for large capacity transmission with, for example, several thousand circuits. In Indonesia, this system has been adopted for the junction cable networks in multi-exchange areas in a number of major cities, such as Jakarta, Surabaya, etc., and also for the basic trunk connecting Jakarta and Surabaya, of which construction work is now under way. In other words, this system is not preferable for the trunk system of this study area which is designed to cover only a limited district with transmission capacity requirements ranging from 8 Mbit/s - 34 Mbit/s over several hundred circuits at the maximum.

On the other hand, microwave system is advantageous for this objective area, because:

- Half of the microwave stations of the planned network lie in the existing radio stations, and the existing antenna towers can be utilized, serving for the cost economization.

- It is easy with the microwave system to meet the equipment requirements which vary with the transmission capacity ranging from 8 to 34 Mbit/s.
- Factors which often result in the delay in construction work progress, such as acquisition of road utilization permit, etc. can be avoided.

In view of the above, the medium capacity microwave system as outlined below is to be adopted for this network, in principle. This system has been already adopted in many sites of the Remote Area Project.

<u>Frequency band</u>	: 2 GHz band
	: 1.5 GHz band
<u>Transmission Capacity:</u>	: 34 Mbit/s (2 GHz band)
	: 17 Mbit/s (2 GHz band)
	: 8 Mbit/s (1.5 GHz band)
<u>Standby System</u>	: Route standby system (2 GHz band)
	: Equipment standby system (1.5 GHz band)

c) Configuration of trunk network

Figures 4.3.5 through 4.3.6 present the trunk routes and trunk network configurations at the end of Repelita VI and Repelita VII, respectively.

(3) Rural Area Network

Differing from common remote rural areas, the rural area studied herein is located within 2-hour distance from Surabaya by vehicle and rather density populated. In other words, this area is not isolated from the urban center geographically but isolated, so to speak, from the telecommunication services.

The power and road in this area are considerably well maintained. The commercial power is expected to become available in all Desas by 2004. All Desas are located within a 20-kilometer radius of respective nearby exchanges. Therefore, it will not be so difficult to offer the telephone services to all Desas. It is planned to provide more than 20 telephones in every Kecamatan capital by the end of Repelita VI, and 2 telephones in every Desa office by the end of Repelita VII.

a) Number of telephones to be provided

The number of telephones to be provided in each Kecamatan capital and Desa office has been calculated, based on the supply strategy discussed in Paragraph 4.2.2.

The service areas of radio subscriber terminal in each Kabupaten are shown in Figure 4.3.7 (1/6 - 6/6).

Some of Kecamatan capitals and Desa offices will be connected to near radio subscriber terminal or LE by subscriber cables.

b) Traffic

Out of 20 telephones in each Kecamatan capital, 15 will be for administrative use and 5 for public use on an average, and in Desa office, one each for administrative and public use.

Traffic of administrative use and public use telephones are estimated to be 0.05 Erl/telephone and 0.16 Erl/telephone, respectively, inclusive of both outgoing and incoming traffic, based on the "Fundamental Study on Rural Telecommunications Network" made by JICA Study Group in 1985. In consequence, average traffic in Kecamatan will be 0.096 Erl/telephone.

c) Study of transmission engineering standard

The Fundamental Technical Plan formulated by POSTEL in 1985 has been applied to the transmission engineering standard for the rural area network of this objective area.

The area wherein subscribers are directly connected with LE by subscribers' cables is the area within a 6 km radius from LE, i.e., 8.4 km in cable length, when 0.8 mm diameter cable is used. When rural MAS (Multi Access Subscriber) system is employed together with subscriber cables, the distance from LE to a radio subscriber terminal of rural MAS system is 40 km at the maximum, and each radio subscriber terminal covers subscribers within a 4 km radius, i.e., 6.0 km in cable length, from the radio subscriber terminal.

d) Study of system to be employed

For rural communication system, two alternative systems, i.e., cable system and radio system, are conceivable. Decision should be made in consideration of the number of subscribers, their distribution, geographical features, etc.

Under this study, it is targeted to provide telephone service to all Desas by 2004. This means that a small number of subscribers are to be scattered in all directions in a wide area with LE as its center. If cable system is adopted, cable PCM system (or fiber optic system) and DLU (or STDI-K) must be employed for the area beyond 6 km radius from LE to compensate the cable loss.

Presently PERUMTEL is introducing STDI-K instead of DLU. Therefore, if the cable system is adopted, a number of STDI-K will have to be installed, posing a problem in cost and maintenance. In case of PCM system, a number of repeaters to be installed on the cable at an interval of 2-3 km will also pose a serious problem in maintenance.

In view of the above, radio system which can be free from the above problems is considered preferable for this area.

Furthermore, radio system has an advantage in that radio subscriber terminal can be established, when digital MAS system is adopted, at any site within a 40 km radius from LE, accommodating approx. 500 subscribers per system.

In addition, the radio system can (1) realize efficient operation and maintenance because the base station is set up in the telephone exchange office, and (2) be free from unfavourable factors that may result in delay of construction work, such as acquisition of road occupancy permit, etc.

e) Outline of digital MAS radio system

An outline of digital MAS radio system is given below:

Radio frequency : 1.5/2.4/2.6 GHz Band

Transmission capacity : 4 Mbit/s

Max. no. of subscribers : 500 in case loss probability is 0.01 and average traffic is 0.096 Erl/subscriber.

Access system : DAMA (Demand Assigned Multiple Access)

Figure 4.3.5 presents the configuration of digital MAS radio system.

Digital MAS radio system is composed of radio subscriber terminal to accommodate subscribers, repeater stations and a base station to be set up in a telephone exchange office. Operation and maintenance of this system is to be carried out at the base station by centralized supervisory and control system.

When the number of subscribers per base station exceeds 500, addition of one more system is feasible.

In case a repeater station is installed between a base station and a radio subscriber terminal, this station can accommodate up to 64 subscribers, the same as a radio subscriber terminal.

Radio frequency band for this system should be other than 1.5 GHz band which is used by the Remote Area Project.

In implementing the current plan, the existing rural area networks should be transferred to other district than this study area, with a view to preventing frequency interference and achieving uniformity in maintenance.

4.3.3 Transmission Expansion Plan

(1) Junction Network in Surabaya Multi-Exchange Area

a) During Repelita V

Junction networks to be completed during Repelita V are shown in Figure 4.3.2. During this period, Gresik is integrated into Surabaya multi-exchange area. Along with this integration, junction networks should be installed to connect Gresik with each telephone exchange in Surabaya. (Refer to Figure 4.3.3). This installation work should be carried out as an additional work because this has not been included in the original Repelita V target.

b) During Repelita VI

Construction of junction networks in connection with the integration of exchanges into Surabaya multi-exchange area

During the period of Repelita VI, 2 (two) exchanges, Sidoarjo and Kamal, are planned to be integrated into Surabaya multi-exchange area. Along with this integration, junction networks should be installed to connect these exchanges with all telephone exchanges in Surabaya (Refer to Figure 4.3.3). For Sidoarjo which is planned to be equipped with digital switching system during Repelita V, fiber optic cables will be installed as the trunk circuits, during the same Repelita V period. During Repelita VI, system increase will be made on this route to utilize it as the junction network.

For Kamal, the existing Surabaya-Kamal microwave transmission system is to be utilized as the junction network because the completion of a trans-strait bridge connecting Surabaya and Madura during Repelita VI is not certain. In this connection, transmission capacity of this system should be increased through transmission system modification.

Expansion of existing junction network to meet demand increase

Junction network to be constructed anew and 140 Mbit/s system expansion is shown in Table 4.3.1 (1/2).

c) During Repelita VII

Construction of junction network in connection with integration of exchanges into Surabaya multi-exchange area

During Repelita VII period, Menganti and Porong are planned to be integrated into Surabaya multi-exchange area. In this connection, junction networks should be constructed to connect these two exchanges with all exchanges in Surabaya.

The number of 140 Mbit/s systems to be accommodated for the above is given in Figure 4.3.3.

Expansion of existing junction network and route diversity to satisfy demand increase

Most of the construction works to be executed under Repelita VII are expansion works to meet the demand increase. Table 4.3.1

(2/2) presents the scope of expansion work for fiber optic system.

For two sections, Kebalen - Kalianak and Waru I - Sepanjang, fiber optic cable routes are to be installed anew for route diversity.

(2) Trunk Network

a) During Repelita V

Installation works for Surabaya - Sidoarjo (140 Mbit/s, fiber optic cable), Mojokerto - Jombang (34 Mbit/s, 2 GHz) and Gresik - Bangkalan (system grade up from 8 Mbit/s to 34 Mbit/s, 2 GHz) are not included in the original target under Repelita V. Therefore these works must be executed as "Essential Project" to be referred to later.

Since Sidoarjo is planned to be integrated into Surabaya multi-exchange area under Repelita VI, the same transmission system as the existing junction system is to be adopted for the trunk route.

During the period of Repelita V, transmission system between Surabaya and Mojokerto is to be realized via Jakarta - Surabaya fiber optic cable route (SKSO) to be completed soon.

For Bangkalan, DLU system is to be introduced under Repelita V. In consequence, transmission capacity between Bangkalan and its parent exchange, Gresik, is to be improved from 8 Mbit/s to 34 Mbit/s.

b) During Repelita VI

To cope with the digitalization of existing exchanges and resultant, traffic increase, the installation of new exchanges, installation of digital transmission lines and upgrading of existing transmission systems will be required. During Repelita VI, digitalization of all trunk networks will be completed.

Trunk routes to be constructed anew, existing routes to be expanded in capacity are summarized in Table 4.3.2.

c) During Repelita VII

Main construction works under Repelita VII are expansion works for carrier terminal facilities to cope with the demand increase.

(3) Rural Area Network

a) During Repelita V

Presently, rural area network construction works are ongoing in the 4 areas as referred to below, under the Rural Area Project.

All the works for radio sections except for the subscribers' cables have already been completed.

Ongoing rural area network project

Base stations	Rural radio stations	No. of subs
Surabaya	Kamal, Krian, Juanda, Kedamean, Wringinanom, Driyorejo	152
Sidoarjo	Sukodono, Wonoayu,	32
Mojokerto	Mojosari, Trawas, Pacet, Dlanggu	392
Bojonegoro	Babat, Sukodadi, Sugio, Ngimbang	80

b) During Repelita VI

During the period of Repelita VI, more than 20 telephones will be provided to every Kecamatan capital in the area. There are a total of 118 Kecamatan capitals, all of which will be connected to LE via the rural area networks, excepting those directly connected. Rural area network to be installed anew is summarized in Tables 4.3.3 and 4.3.4.

For Bawean Island, which is located approx. 150 Km apart from Surabaya, and has a rather small population of 65,000, the telephone service is to be provided for two Kecamatan capitals, i.e., Sangkapura and Tambak, and the areas within a 6 Km radius from respective capitals.

At present, several trunk circuits are being provided in Sangkapura by satellite communication system. For Tambak, several trunk circuits are to be provided also by satellite communication system with a small earth station to be installed during Repelita VI period.

The rural area networks established under Repelita V should be re-configured, including the transfer of some area to other districts, in consideration of the achievements under Repelita VI, i.e., establishment of new exchanges, expansion of Surabaya multi-exchange area and extension of the network to Kecamatan capitals and Desas.

c) During Repelita VII

During the period of Repelita VII, more than 2 telephones are to be provided to every Desa in the objective area.

The number of Desas in this area totals 2,076. All of them are to be connected to LE through rural area networks, excepting those directly connected to LE. Most of the construction works during this period are expansion works, such as unit increase, for the basic facilities installed under Repelita VI. Number of subscribers covered by rural area network is shown in Tables 4.3.3 and 4.3.4.

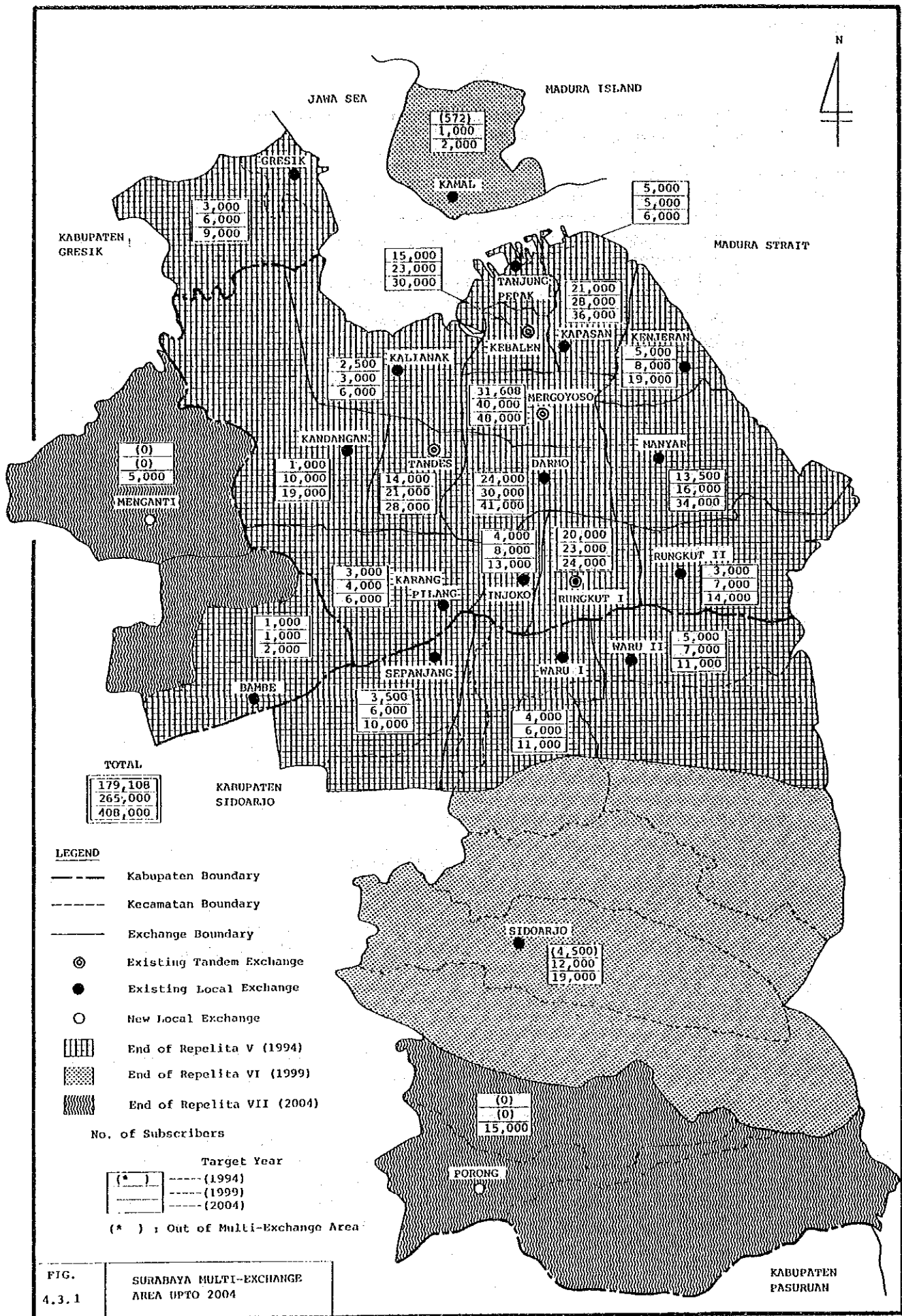
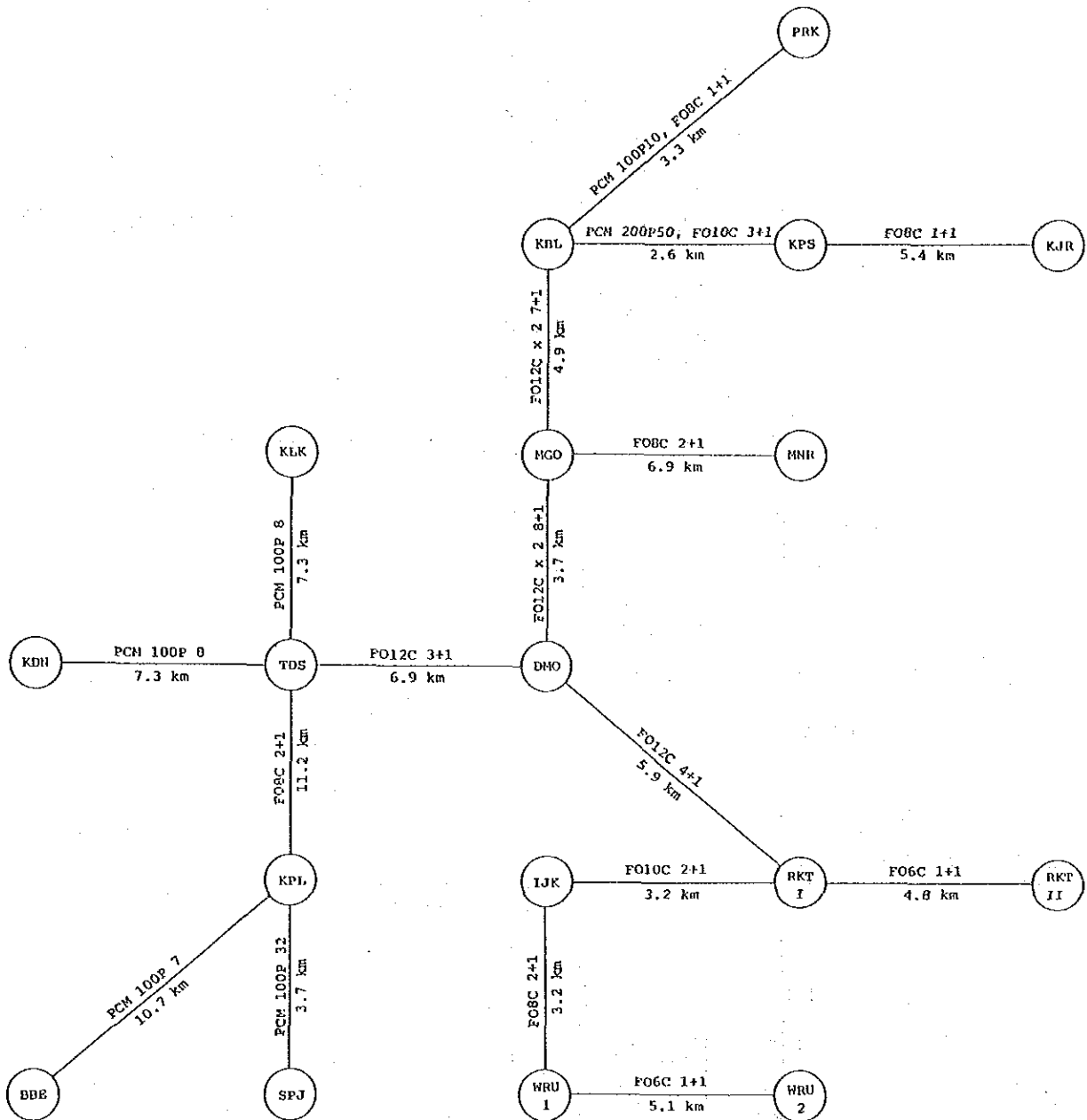


FIG. 4.3.1 SURABAYA MULTI-EXCHANGE AREA UPTO 2004



LEGEND

No. of System/140 Mbits

FO12C 3+1

SOURCES: BIDDING DOCUMENTS OF TELECOM III (OSP)

FIG. 4.3.2	JUNCTION NETWORK CONFIGURATION FOR SURABAYA MULTI-EXCHANGE AREA (1994)
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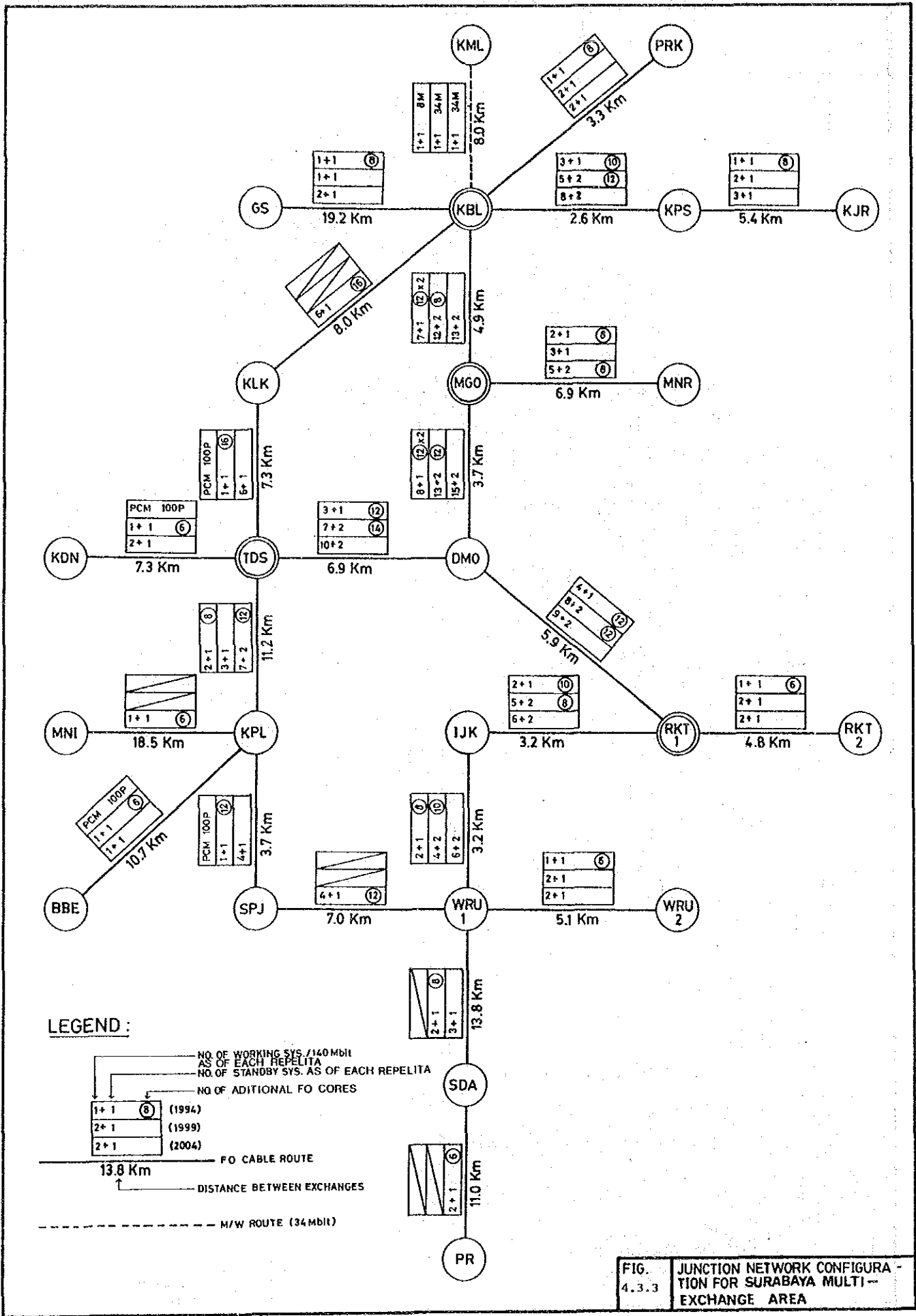
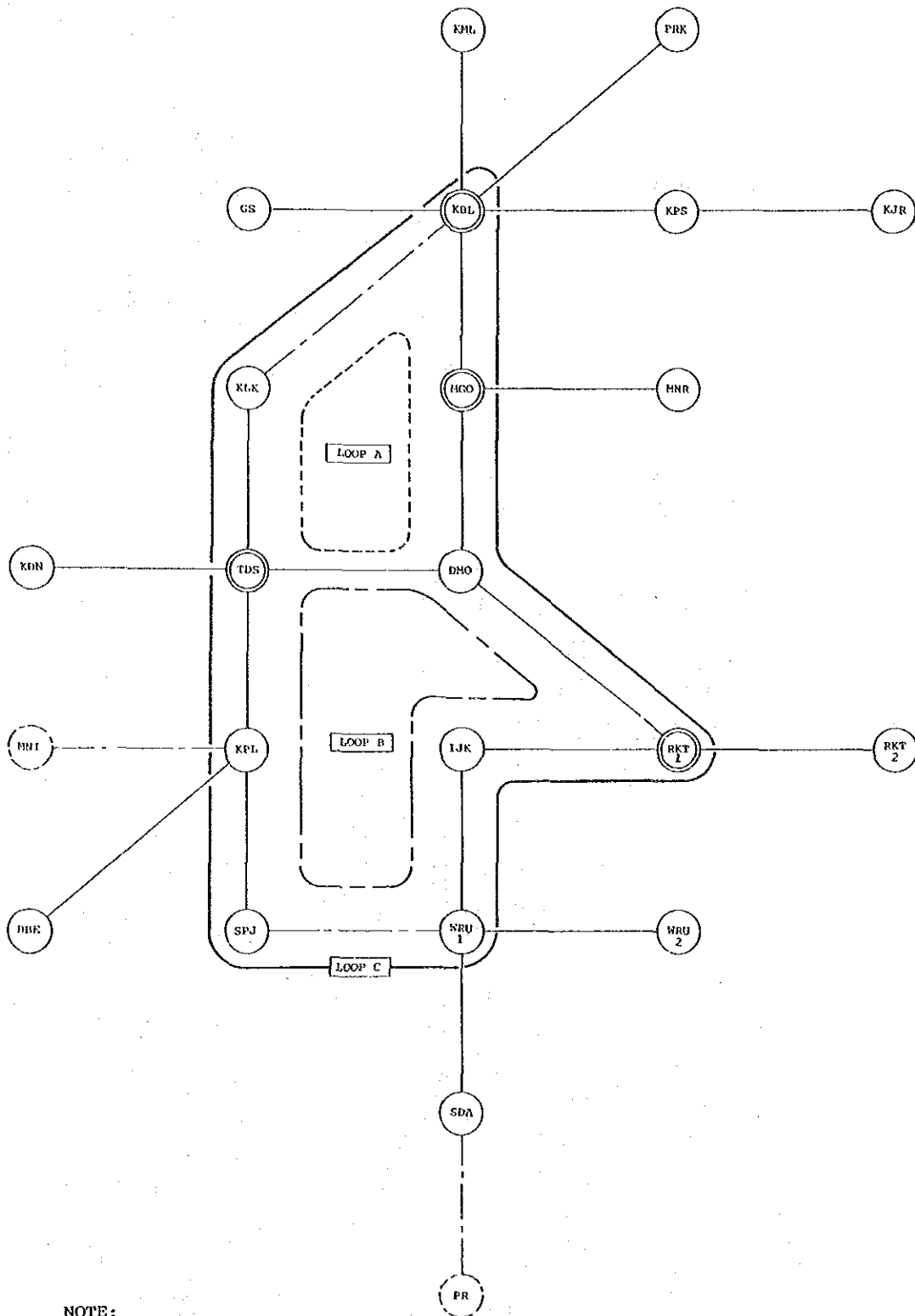


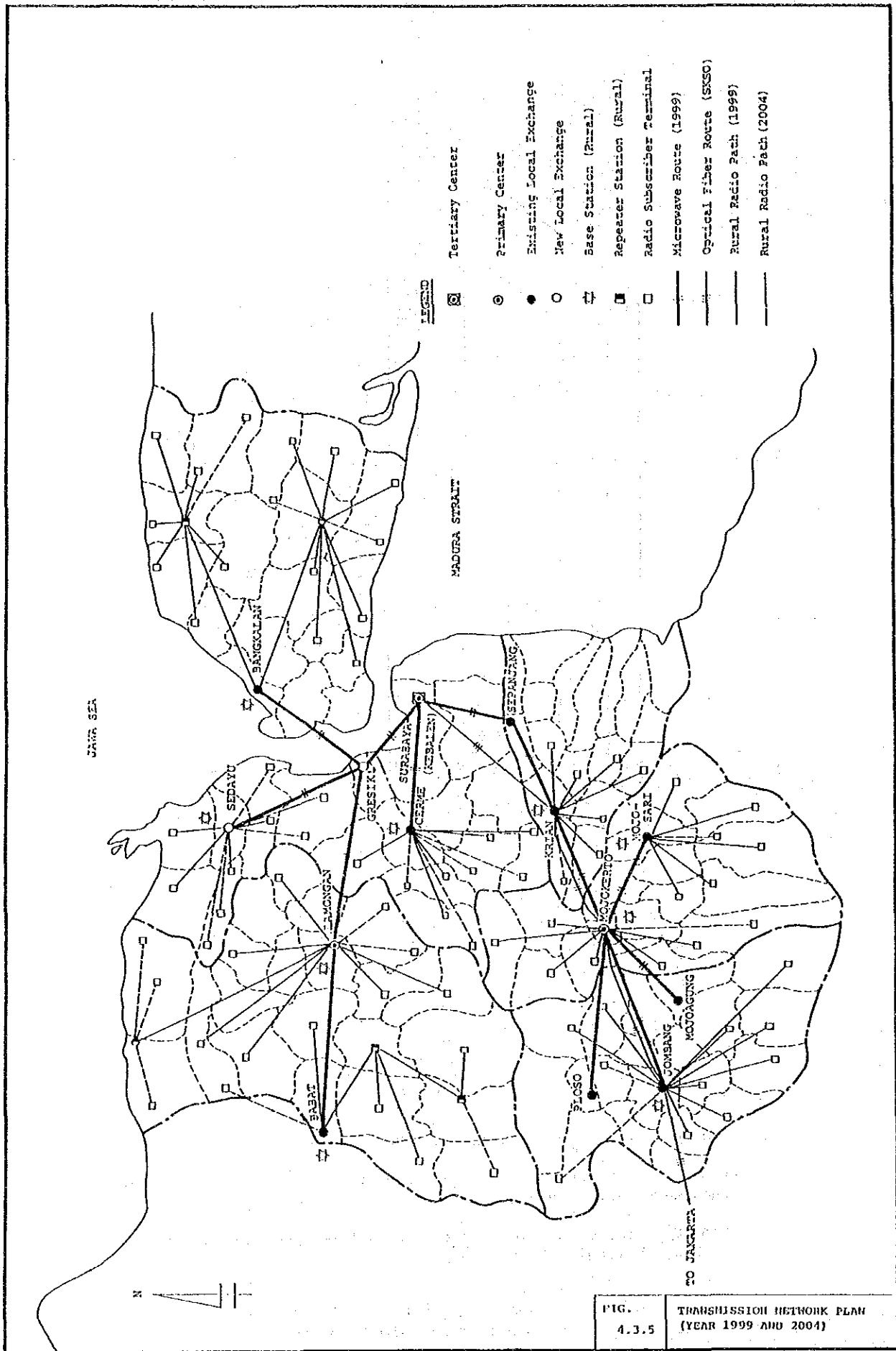
FIG. 4.3.3 JUNCTION NETWORK CONFIGURATION FOR SURABAYA MULTI-EXCHANGE AREA



NOTE:

1. Loop A is for connection of TDS, DMO, MGO, KBL and KLG.
2. Loop B is for connection of KPL, SPJ, WRU1, IJK and RKT1, via TDS and DMO when necessary (and not for connection of TDS and DMO).
3. Loop C is for connection between an exchange belonging to Loop A and an exchange belonging to Loop B.

Fig. 4.3.4 Concept of Route Diversity for Junction Cable Network



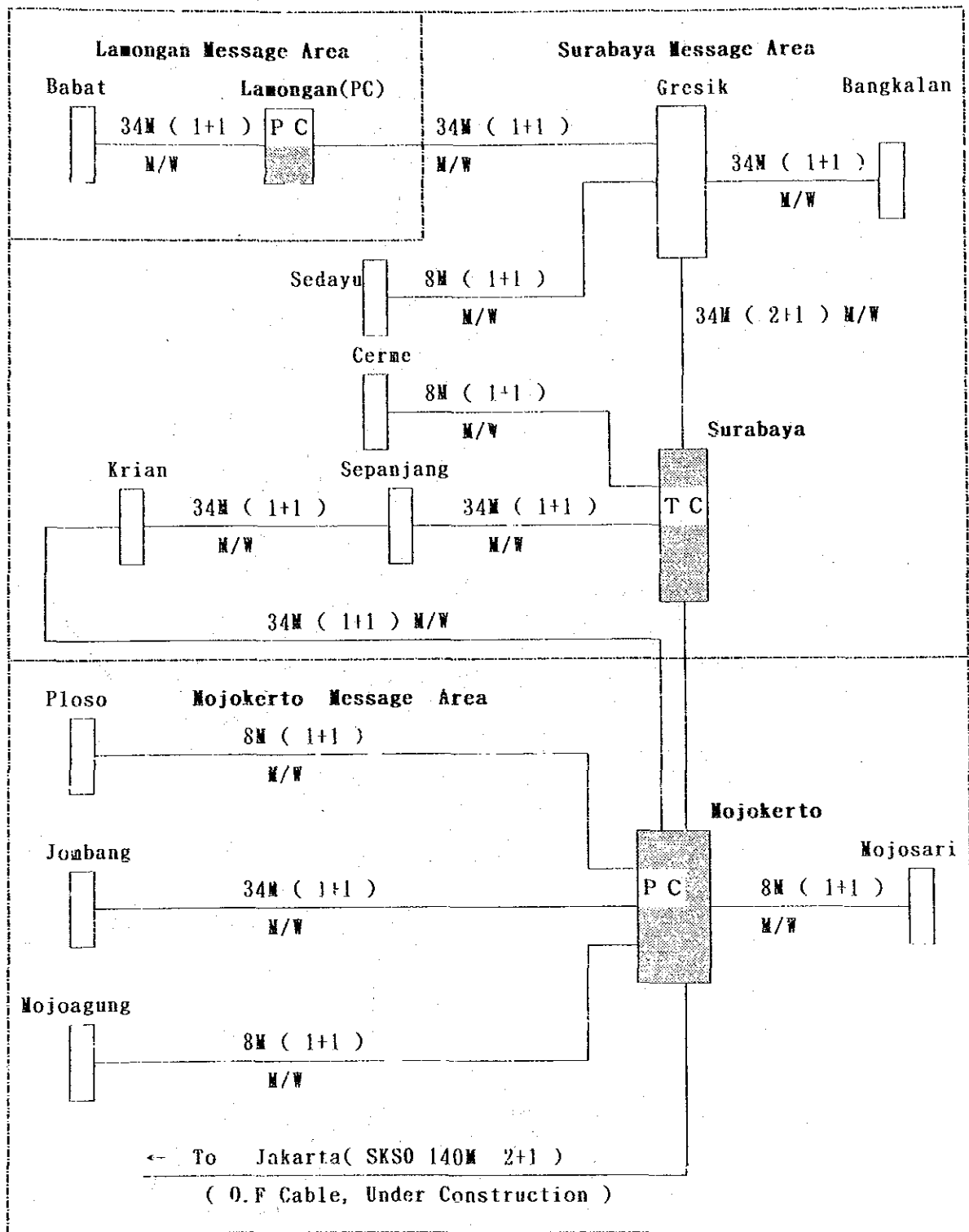
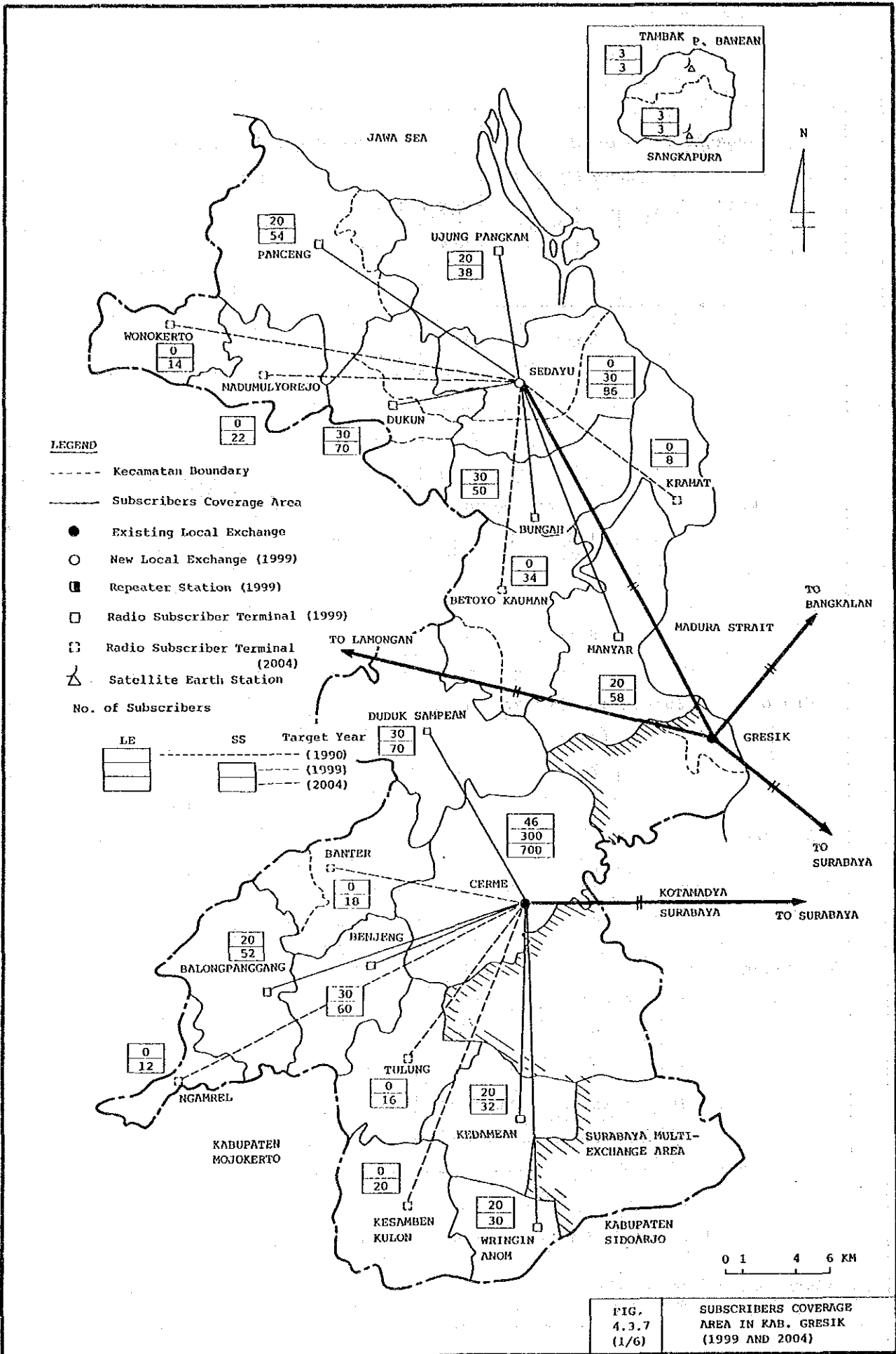


FIG. 4.3.6 Configuration of Trunk Network (1999 and 2004)



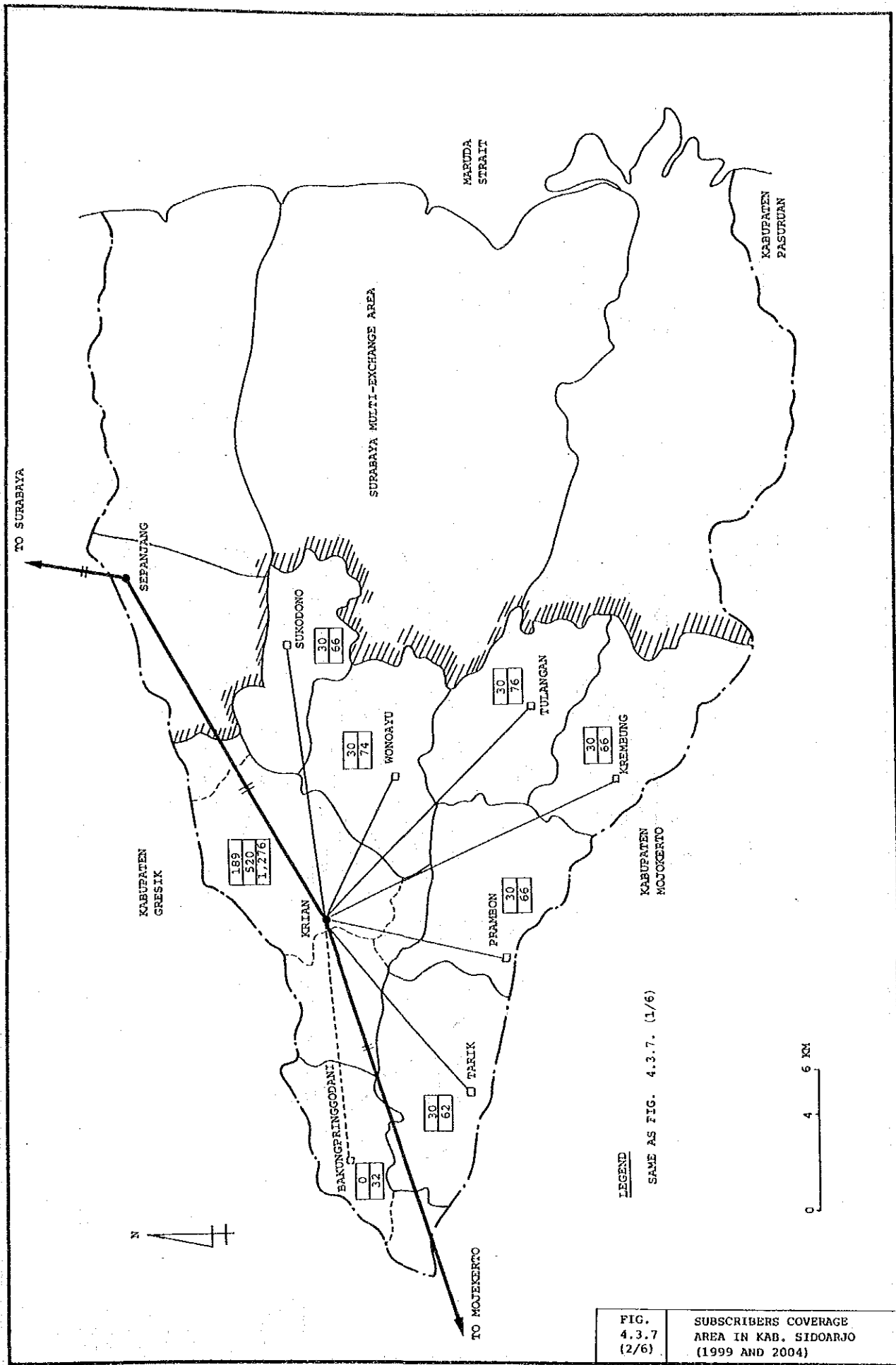


FIG. 4.3.7 SUBSCRIBERS COVERAGE AREA IN KAB. SIDOARJO (2/6) (1999 AND 2004)