Table IV-2 Homing Arrangement in Indonesian Telephone Network (4/9)

Tertiary Area		Secondary Area		Primary Area		Province
Code	Trunk Center	Code	Trunk Center	Code	Trunk Center	
4	UJUNG PANDANG	40	KENDARI	401	KENDARI	Sulawesi Tenggara
				2	Baubau	
				3	Raha	
				4	Papalia	
				5	Kolaka	
				6	Malamala	
				7	Wawotobi	
5	BANJARMASIN	51	BANJARMASIN	511	BANJARMASIN	Kalimantan Selatan
				2	Pleihari	
				3	KualaKapuas	
				4	Palangharaya	
				5	Buntok	
				6	Tanjung	
				7	Kandangan	
				8	Kotabaru	
				9	Muarateweh	
		53	SAMPIT	531	SAMPIT	
				2	Panghalanbun	
				3	Nangatayap	
				4	Ketapang	
				5	Sukadana	
				6	Senamang	
				7	Kualakurun	
				8	Purukcau	
		54	SAMARINDA	541	SAMARINDA	Kalimantan Timur
				2	Balikparan	
				3	Tanahgrogot	
				4	Muarasiram	
				5	Longberang	
				6	Tabang	
				7	Sangkulirang	
		55	TARAKAN	551	TARAKAN	
				2	Tanjungselor	
				3	Binuang	
				4	Tanjungredeb	
				5	Longnawan	

Table IV-2 Homing Arrangement in Indonesian Telephone Network (5/9)

Tertiary Area		Secondary Area		Primary Area		Province
Code	Trunk Center	Code	Trunk Center	Code	Trunk Center	
5	BANJARMASIN	56	PONTIANAK	561	PONTIANAK	Kalimantan Barat
				2	Singkawang	
				3	Ngabang	
				4	Sanggau	
				5	Sintang	
				6	Semitau	
				7	Putusibau	
				8	Nangapinoh	
				9	P. Karimata	
6	MEDAN	64	LANGSA	641	LANGSA	D.I. ACEH
				2	Blangkejeren	
				3	Tekeungon	
				4	Biroun	
				5	Lhokseumawe	
				6	Idi	
		65	BANDA ACEH	651	BANDA ACEH	
				2	Sabang	
				3	Sigli	
				4	Calang	
				5	Meulaboh	
				6	Tapaktuan	
				7	Bakongan	
				8	Singkil	
				9	Kep. Banyak	
				0	Sinabang	
		61	MEDAN	61	MEDAN	Sumatera Utala
		62		621	Tebingtinggi	
				2	Pematangsian-tar	
				3	Tanjungbalai	
				4	Rantauprapat	
				5	Bangansiapi-api	
				6	Pangururan	
				8	Kabanjahe	
				9	Kutacane	
				0	Pallgkalanber-andan	

Table IV-2 Homing Arrangement in Indonesian Telephone Network (6/9)

Tertiary Area		Secondary Area		Primary Area		Province
Code	Trunk Center	Code	Trunk Center	Code	Trunk Center	
7	MEDAN	63	SIBOLGA	631	SIBOLGA	
				2	Balige	
				3	Tarutung	
				4	Padangsidem-puan	
				5	Gunungtua	
				6	Kotanopan	
				7	Natal	
				8	Pulautelo	
				9	Gunungsitoli	
7	PALEMBANG	75	PADANG	751	PADANG	Sumatera Barat
				2	Bukittinggi	
				3	Lubuksikaping	
				4	Sijunjung	
				5	Solok	
				6	Painan	
				7	Tapan	
				8	Matobe	
				9	Muarasiberut	
		76	PAKANBARU	761	PAKANBARU	Rian
				2	Bangkinang	
				3	Pasirpanjara-yan	
				4	Siaksriindra-pura	
				5	Dumai	
				6	Bengkalis	
				7	Selatpanjang	
				8	Tembilahan	
				9	Rengat	
				0	Telukkuantan	
		77	TANJUNG-PINANG	771	TANJUNGPINANG	
				2	Terempa	
				3	Genting	
				4	Natuna Selatan	
				5	Tambelan	
				6	Dabo	
				7	Tanjungbalai-Karimun	
				8	Tanjunguban	

Table IV-2 Homing Arrangement in Indonesian Telephone Network (7/9)

Tertiary Area		Secondary Area		Primary Area		Province
Code	Trunk Center	Code	Trunk Center	Code	Trunk Center	
7	PALEMBANG	74	JAMBI	741	JAMBI	Jambi
				2	Kualatungkal	
				3	Muaratembesi	
				4	Muaratebo	
				5	Sarolangun	
				6	Bangko	
				7	Muarabungo	
				8	Sungaipenuh	
		71	PALEMBANG	711	PALEMBANG	Sumatera Selatan
				2	Kayuagung	
				3	Payakabung	
				4	Sekayu	
				5	Muntok	
				6	Pangkalpinang	
				7	Koba	
				8	Tanjungpandan	
		73	LAHAT	731	LAHAT	
				3	Lubuklinggau	
				4	Muaraenim	
				5	Baturaja	
				7	Muaraaman	
				8	Surulangun	
				9	Mukomuko	
				0	Barhau	
				732	Curup	Bengkulu
				6	Manna	
		72	TANJUNG-KARANG	721	TANJUNGKA-RANG	Lampung
				2	Kotaagung	
				3	Krui	
				4	Kotabumi	
				5	Metro	
				6	Menggala	

Table IV-2 Homing Arrangement in Indonesian Telephone Network (8/9)

Tertiary Area		Secondary Area		Primary Area		Province
Code	Trunk Center	Code	Trunk Center	Code	Trunk Center	
9	AMBON	91	AMBON	911	AMBON	Maluku
				2	Piru	
				3	Namlea	
				4	Masohi	
				5	Bula	
				6	Tual	
				7	Dobo	
				8	Saumlaki	
				9	Tepa	
				0	Bandanaera	
		92	TERNATE	921	TERNATE	
				2	Jailolo	
				3	Daruba	
				4	Tobelo	
				5	Weda	
				6	Umela	
				7	Labuha	
				8	Laiwui	
				9	Sanana	
		95	SORONG	951	SORONG	Irian Jaya
				2	Samate	
				3	Atkri	
				4	Inanwatan	
				5	Babo	
				6	Fakfak	
				7	Kaimana	
				8	Mimika	
		96	JAYAPURA	961	Biak	
				2	Manokwari	
				3	Serui	
				4	Nabire	
				5	Waren	
				6	Sarmi	
				7	JAYAPURA	
				8	Beoga	
				9	Wamena	
				0	Kive	

Table IV-2 Homing Arrangement in Indonesian Telephone Network (9/9)

Tertiary Area		Secondary Area		Primary Area		Province
Code	Trunk Center	Code	Trunk Center	Code	Trunk Center	
9	AMBON	97	MERAUKE	971	MERAUKE	
				2	Okaba	
				3	Kiman	
				4	Koba	
				5	Tanah Merah	
				6	Agats	
				7	Cumbuyua	
				8	Waropko	

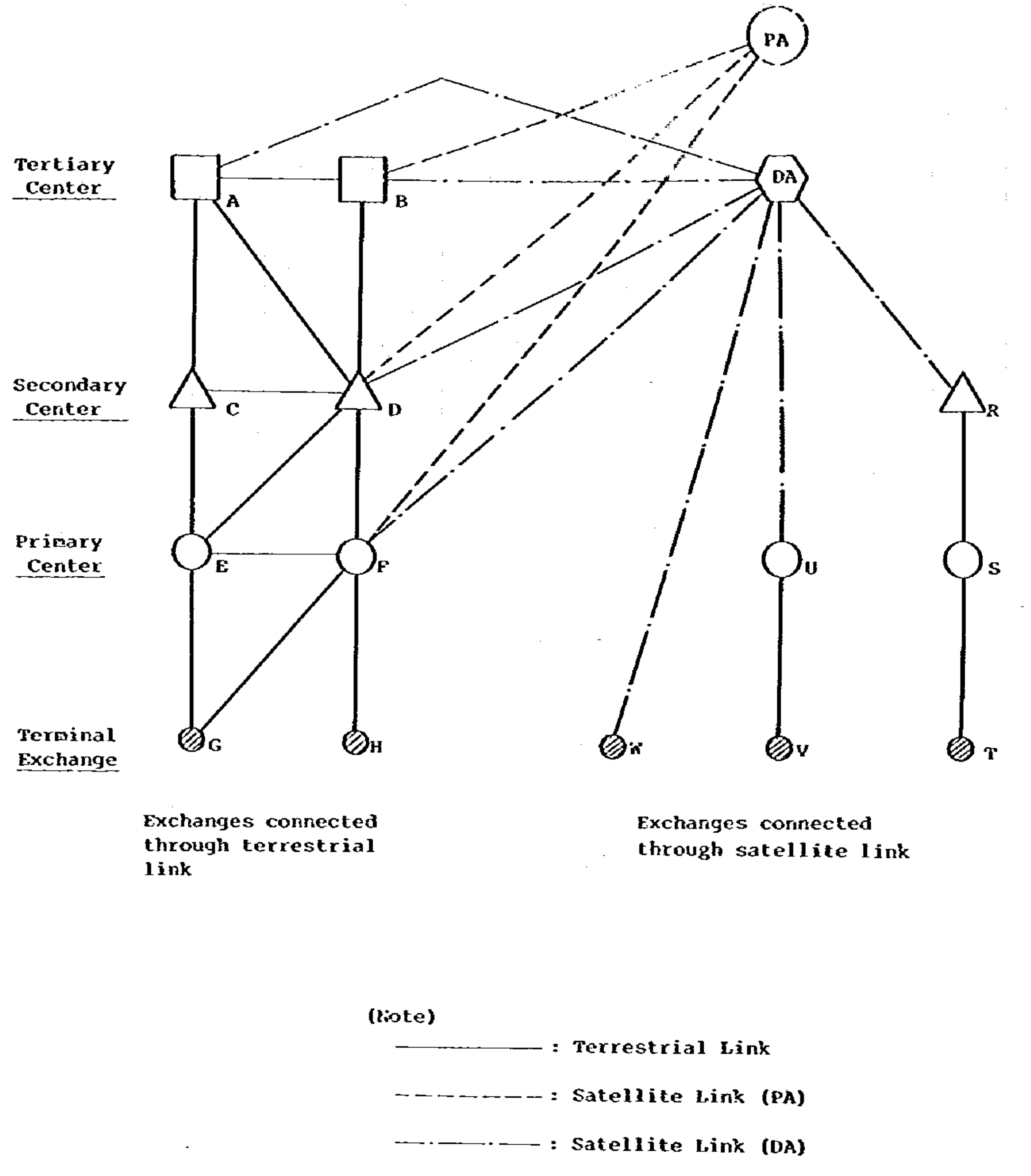
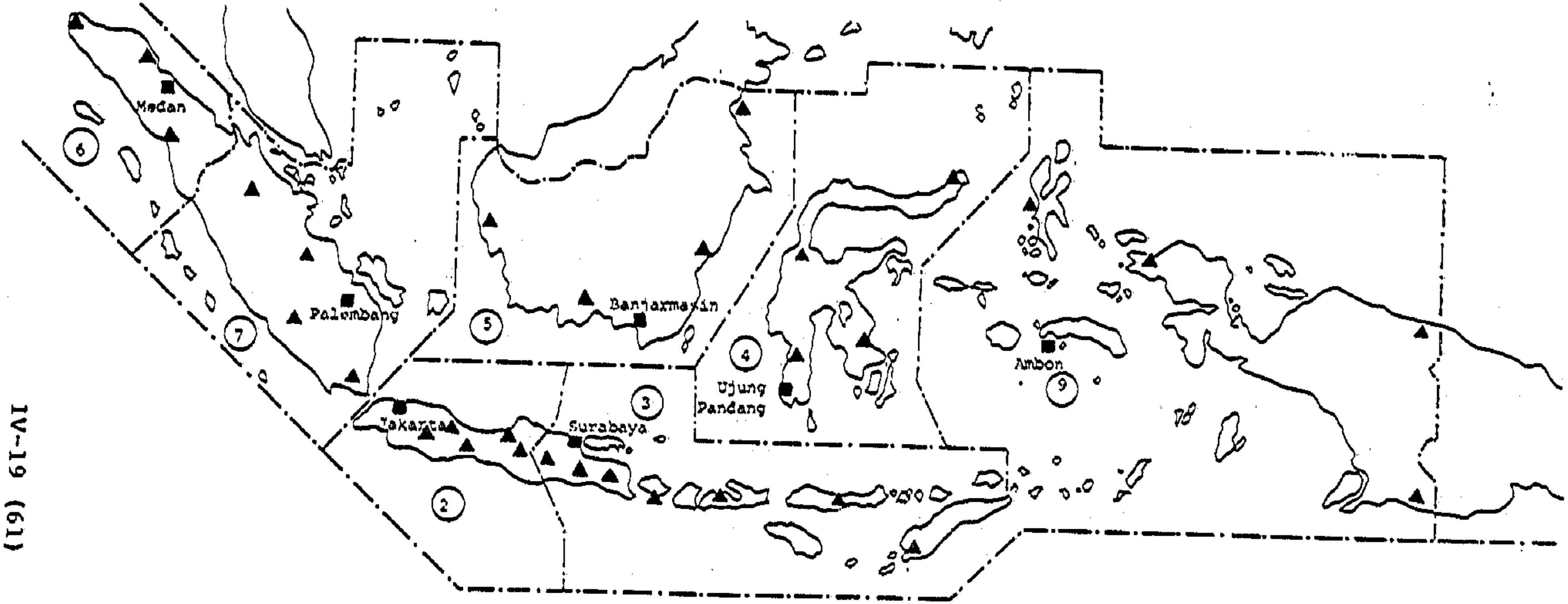


Figure IV-1 Hierarchy of Indonesian Telephone Trunk Network (Fundamental Routing Plan)



2. Jakarta
3. Surabaya
4. Ujung Pandang
5. Banjarmasin
6. Medan
7. Palembang
9. Ambon

LEGEND:

"A" Code Boundary

Tertiary Trunk Center

Secondary Trunk Center

Figure IV-2 Tertiary Areas of Indonesian Telephone Trunk Network

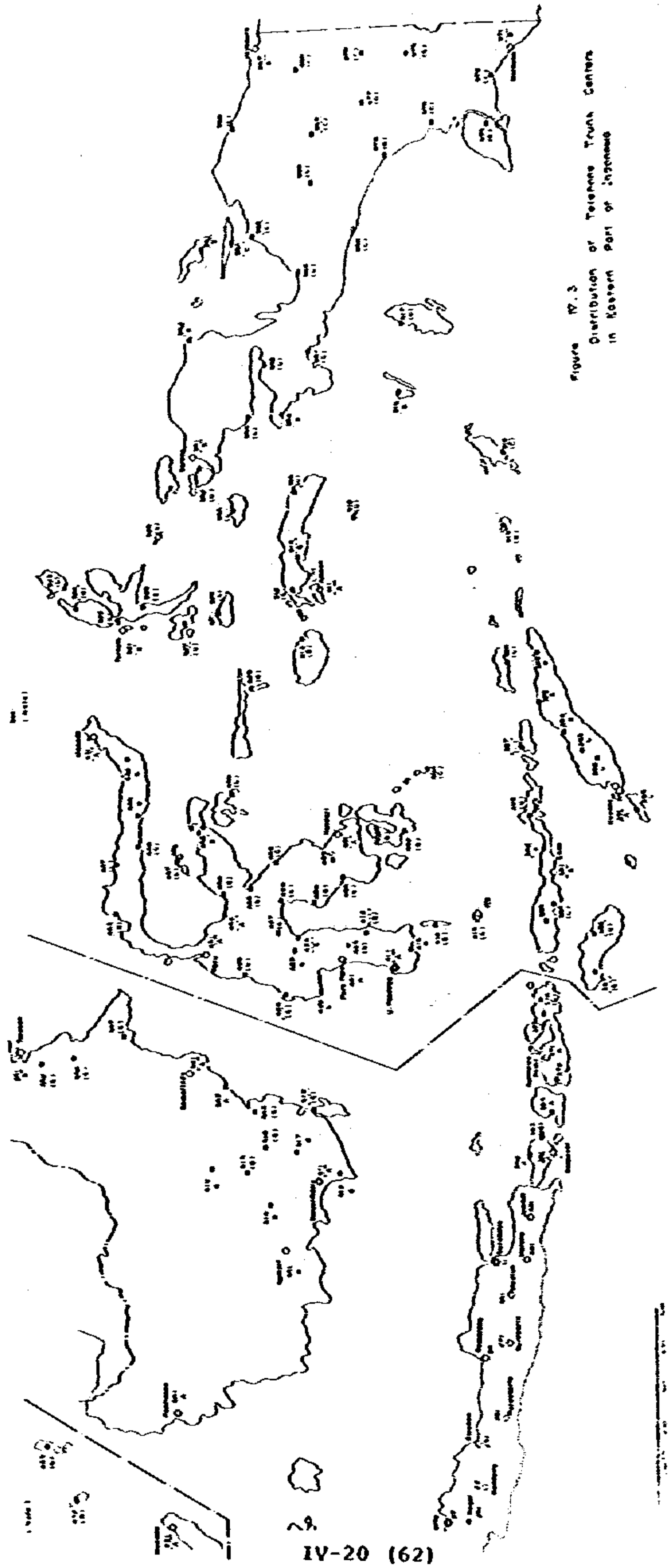


Figure IV.3 Distribution of Telephone Trunk Centers in Eastern Part of Indonesia

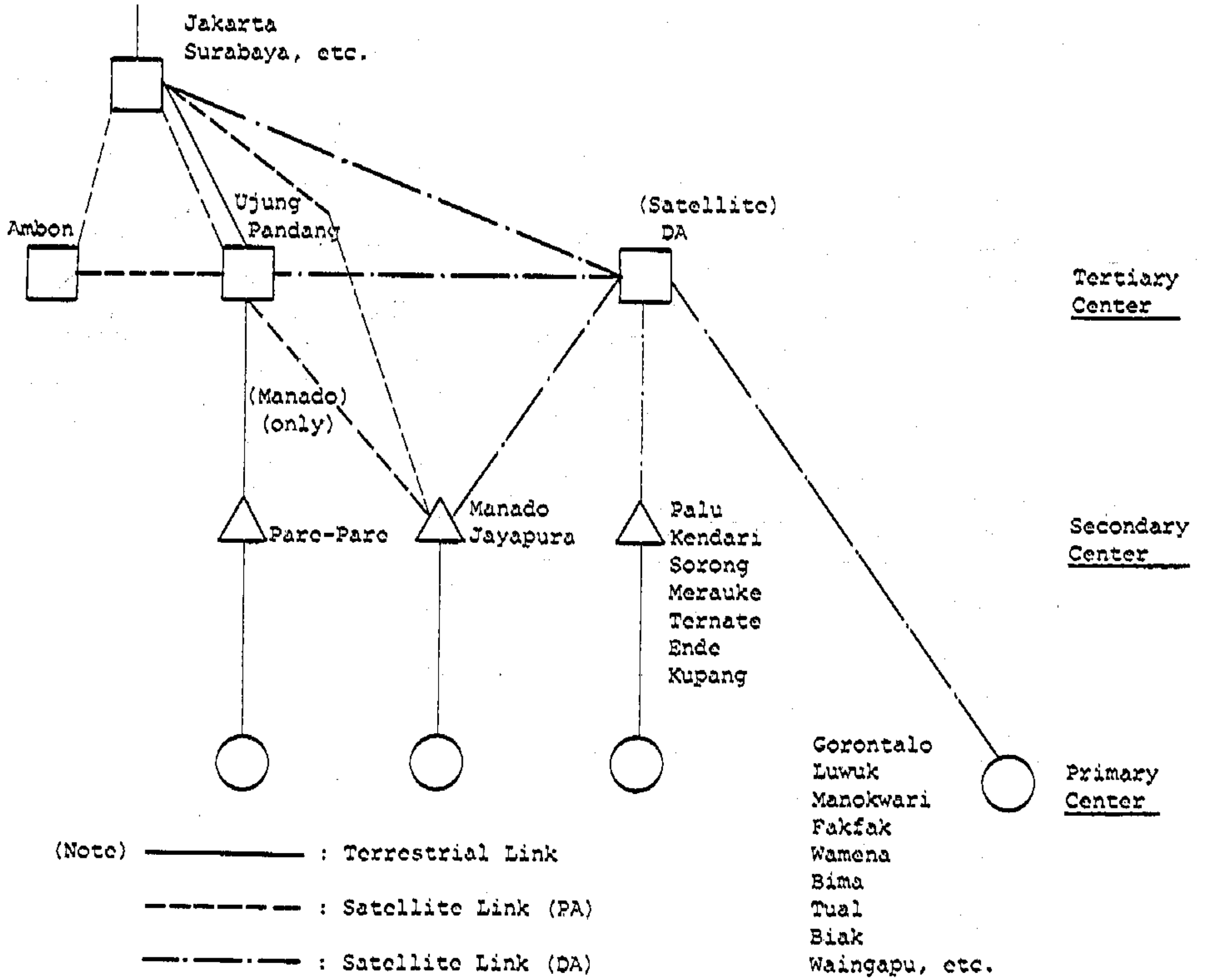


Figure IV-4 Hierarchy of Telephone Trunk Network in Eastern Part of Indonesia (Present Trunk Route)

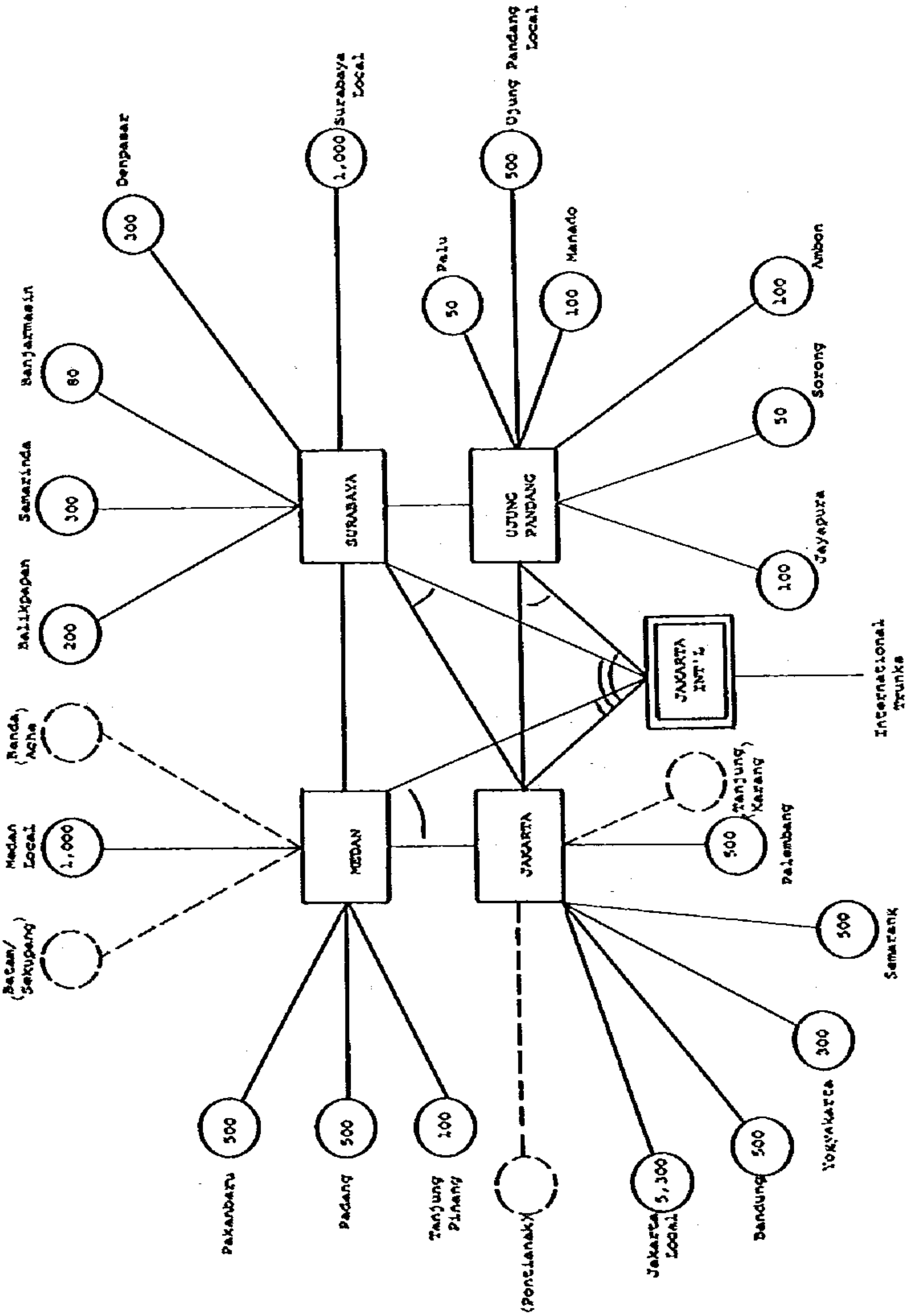


Figure IV.5 Present Gentex Network in Indonesia

(Note)
□ : Tandem Exchanges
○ : Local Exchanges

3. PERUMTEL's Telecommunications Development Plan

3.1 Development Plan in Repelita III

Attainment objectives of telecommunications development five-year plan in Repelita III were already described in Chapter II. According to the attainment objectives, the telephone exchange installation plan and the telegraph exchange installation plan have been prepared as shown in Appendix IV-1 and Appendix IV-2, respectively.

3.2 Long-term Development Plan

To realize telecommunications services compatible with the future phases of social and economic structures of Indonesia, PERUMTEL has already prepared its "Long-term Plan by the Year 2000." Attainment objectives for all kinds of services, envisaged in the "Long-term Plan", are as follows:

3.2.1 Telephone Service

Increased telephone installation objectives in the coming servies of five-year plans are shown below.

Final Year of Each Five-Year Plan	Increased Installation objective
1989 (Repelita IV)	1,181,500 line units
1994 (Repelita V)	1,889,100 line units
1999 (Repelita VI)	3,017 300 line units
2000	3,295,200 line units

The number of telephones installed at the end of each five-year plan, as contemplated by the above installation plan, is estimated as follows:

Final Year of Each Five-Year Plan	Number of Telephones Installed
1989 (Repelita IV)	1,000,000
1994 (Repelita V)	1,600,000
1999 (Repelita VI)	2,560,000
2000	2,800,000

Telephone exchange to be newly established in and after Repelita IV will be equipped with the digital switching system.

New line unit installation objectives according to Primary Center zones in the final year of each five-year plan up to the year 2000 are shown in Appendix IV-3.

3.2.2 Telegraph Service

The new equipment installation plan to improve telegraph service is based on the long-term demand forecast up to the year 2000. The nationwide demand forecast and the new line unit installation objective as of the final year of each five-year plan follow:

Final Year of Each Five-Year Plan	Demand Forecast	Installation Objecitve (line unit)
1989 (Repelita IV)	20,760	28,100
1994 (Repelita V)	31,175	41,300
1999/2000 (Repelita VI)	46,780	62,900

Demand and line units to be installed as of the final year of each five-year plan up to the year 2000 and in Witel I - XII breakdown appear in Appendix IV-4.

3.2.3 New Service

Demand for data communication service is roughly estimated below.

Final Year of Each Five-Year Plan	Demand Forecast
1989 (Repelita IV)	2,400
1994 (Repelita V)	3,550
1999/2000 (Repelita VI)	4,000

4. Demand Forecast for Telecommunications Services

4.1 Historical Trend of Service Demand in Indonesia

4.1.1 Nationwide Demand Trend

Trends of demand for telephone, telex and telegram services and for leased circuits during the period from 1971 through 1980 are presented in Tables IV-3, IV-4, and IV-5. Itemized summary comments follows:

(1) Telephone

The number of telephones and line units recorded an approximately 9% growth annually so that the number of both items in 1980 increased to more than twice the number in 1971. The number of telephones per 100 persons increased from 0.18 in 1971 to 0.36 in 1980.

(2) Telegram

The number of domestic telegrams increased by 11.7% annually, this growth rate being greater than that of telephones. As a result, the number of telegrams handled in 1980 was 2.7 times the number in 1971. On the other hand, the number of international telegrams continues to decrease since 1975 by about 13% annually. The number in 1980 fell to about 60% of the number in 1971.

(3) Telex and Leased Circuits

Telex and leased circuits present almost the same growth trend. The annual growth rate since 1971 is about 24%. For both items, the 1980 record is nearly seven times the 1971 record.

4.1.2 Demand Distribution by Areas

The distribution of demand for telecommunications services by areas is shown in the Table IV-6. Itemized summary comments follow:

(1) Telephone

Up to 55% of demand for telephones is concentrated in Jakarta area. The remaining 45% is distributed in all other parts of the country according to regional population ratios.

(2) Telegram

The rate of telegram service utilization is high in the eastern part of the country, including Sulawesi, Maluku and Irian Jaya.

(3) Telex

Demand for telex service is concentrated in Jakarta area, especially the municipality of Jakarta. The concentration ratio is as high as 66%. The remaining 34% is distributed in all other parts of the country according to regional population ratios.

Excepting that the demand for telephone and telex services is concentrated especially in the municipality of Jakarta, the demand distribution is proportional to the regional population ratios. This can be considered to reflect the fact that the economy in each area of Indonesia is basically agriculture oriented, and this fact, in turn, is evident in that GDP per capita shows no much difference from area to area.

The high rate of telegram utilization in the eastern region of Indonesia is due, after all, to the lag of telephone and telex diffusion in the region.

4.1.3 Demand Distribution in Objective Area of Investigation

The distribution of demand for telecommunications services in the objective area of this investigation is compiled in Table IV-7. Following are the itemized summary comments:

(1) Telephone and Telex

Demand for telephone and telex services is distributed at the same rate as province by province population ratios.

(2) Telegram

Except the municipality of Ujung Pandang and its environs, the telegram utilization rate in the objective area of this investigation is remarkably higher than the national average.

4.2 Macroscopic Demand Forecast

4.2.1 Means of Forecast

(1) Base Years of Forecast

The years 1989, 1994, 1999 and 2005 included in the master plan period (1985 - 2005) are used as the base years of demand forecast.

(2) Methodology of Forecast

(a) For the macroscopic demand forecast for telephone service, the strong correlation between GDP per capita and telephone density per 100 persons is utilized.

(b) The macroscopic demand forecast for non-telephone services is based on the analysis of all kinds of demand factors. Those demand factors are:

- o Growth outlook of Indonesian economy
- o PERUMTEL's long-term telecommunications network expansion plan
- o Demand growth phases for all kinds of telecommunications services
- o Demand trends for all kinds of telecommunications services in developed and developing countries
- o Trends of demand concurrences among all kinds of telecommunications services

4.2.2 Macroscopic Demand Forecast for Telephone Service

(1) Telephone Density

The regression line formula that indicates the relationship between telephone density (number of subscriber telephones per 100 persons) and GDP per capita (at constant 1973 market prices) can be obtained as follows:

$$Y = 0.000331\ X^{1.3352}$$

where

Y : Telephone density (number of telephones per 100 persons)

X : GDP per capita (in U.S. dollars - at constant 1973 market prices)

This is the regression line formula with correlation data for telephone density and GDP per capita in 92 countries graphically plotted. For such correlation data, see Appendix IV-5.

(2) Population Forecast

Based on the population forecast up to the year 2001 as per Table II-4 of Chapter II, forecast is made for population in each base year of forecast. Forecast results appear in Table IV-8.

(3) Growth Outlook of GDP per Capita

As seen in Table II-2 and Table II-8 of Chapter II, GDP per capita during the period from 1973 to 1979 recorded an about 5% per year growth. In Repelita III, the annual growth rate of GDP is calculated to be 6.5%. The rate of population increase during Repelita III period is estimated at 2.0% annually. Thus the calculated growth rate of GDP per capita during the period stands at 4.5% annually. Granting that during and after Repelita IV also the comfortable GDP growth as at present will continue, the annual growth of GDP per capita in the range of 4-6%, mostly 5%, can be expected.

Table IV-9 presents GDP per capita estimates for the base years of forecast, on the assumption that the growth will be at the rate of 4%, 5% or 6% annually.

(4) Main Telephones Ratio

In Indonesia, during the 10-year period from 1971 to 1980, the main telephones ratio to the total number of telephones reached 70% or thereabouts. The main telephones ratio in other countries also is in the neighborhood of this percentage. Therefore, in this forecast also, the main telephones ratio of 70% is used.

(5) Calculation of Forecasted Values

The total number of telephones and the number of main telephones in each base year of forecast are calculated as follows:

Total number of telephones = Telephone density x 1/100 x Forecasted population

Number of main telephones = Total number of telephones x 70/100 (main telephones ratio)

Demand forecasts for telephone service by GDP per capita growth estimates at annual growth rates of 4%, 5% and 6%, respectively, are given in Table IV-10.

Although, for the forecast in each base year of forecast, GDP per capita growth estimates at growth rates of 4-6% annually are used, the mean growth rate of 5% is used for the macroscopic demand forecast.

4.2.3 Macroscopic Demand Forecast for Non-Telephone Services

(1) Analysis of Demand Factors

(a) Growth Outlook of Indonesian Economy

This forecast is based on the past records and, at the same time, presupposes that the Indonesian economy will continue to grow at almost the same rate as the Government's annual GDP growth objective in Repelita III, i.e., 6.5% . (Refer to Paragraph 4.2.2 - (3).)

(b) Trend of Past Demand Growth

During 10 years from 1971 to 1980, the demand for telephone, telegram and telex services in Indonesia continued the rapid growth at annual rates of 9%, 12% and 24%, respectively. (Refer to Paragraph 4.1.)

(c) PERUMTEL's Long-term Telecommunications Development Plan (up to 2000)

To attain the telegraph and telephone service objectives in the year 2000, the telephone and telex facilities have to be expanded at high tempo of more than 7% and more than 15%, respectively, in the annual averages. (Refer to Paragraphs 3.2.1 and 3.2.2.)

(d) Demand Trends in Developed and Developing Countries

As detailed in Appendix IV-6, historical demand trends worth special attention are as follows:

In the developing countries, the demand for domestic telegram service continues to increase.

In the developed countries, in spite of the rapid growth of new services, such as data communication and facsimile services, the demand for telex service remains on the uptrend.

(e) Trend of Demand Concurrence among Services

As detailed in Appendix IV-7, demand concurrence is taking place among all kinds of services. Generally, the demand is shifting from the conventional telegram service to telex service and further to such new services as data communication and facsimile services.

From the result of analysis of demand factors, it can be forecasted that, for non-telephone services as a whole, PERUMTEL's long-term objective will be attained as scheduled, and, for this outlook, the continued steady growth of domestic economy and the strong demand potentials among business organizations and governmental offices can be pointed out.

For individual non-telephone services, the conventional domestic telegram and telex services will continue to enjoy the demand increase. With regard to new services, such as data communication and facsimile services scheduled to come into practice in the near future, the demand will show the rapid growth trend approximate to the uptrend among the developed countries. Furthermore, due to demand concurrence among services, the demand for domestic telegram service will reach the saturation point earlier than the demand for telex service.

(2) Demand Prospect for Non-Telephone Services

(a) Domestic Telegrams

From the short-range viewpoint, it can be assumed that the demand for domestic telegram service will continue to increase at the same growth rate as up to the present, i.e., nearly 12% annually. However, from the long-term viewpoint, the demand growth rate will gradually slow down. For, the diffusion of telex system among business organizations and governmental offices is bound to shift the demand to telex service from domestic telegram service.

As for the saturation point of demand, one indication can be found in the fact that in Malaysia the demand hit the peak in 1974 and is on the downtrend since that time. The reality in Malaysia as of 1973, i.e., GDP per capita of US$520 and telephone density of 2.1, will come true in Indonesia between the years 2000 and 2005, provided that the real annual growth rate of GDP per capita is 5%. At this level of economy, the possibility of telephone diffusion among general households is considered to be slim. Therefore, even at that time, the demand for telegram service will not immediately decrease but will remain in the state of saturation for a certain period.

(b) International Telegrams

In and after 1974, the demand for international telegram service continues to decrease by 13% annually. For the time being, this downtrend will still continue and, ultimately, the demand is anticipated to come down to the minimum level of 100,000 telegrams/year or thereabouts.

(c) Telex

The short-term prospect is that the demand will continue to grow at the average annual growth rate of 24% thus far attained.

From the long-term viewpoint, the demand for telex service will indisputably be replaced with the demand for such new services as data communication and facsimile services. And this trend is already taking shape in the developed countries. However, at the initial stage of diffusion of such new services, the demand for telex service will still continue to make steady growth.

In this forecast, the judgement is that during the period up to the year 2005 the growth rate of demand for telex service will slow down as part of the demand transfers to new services; however, the demand itself will not yet reach the saturation point.

(d) New Services, such as Data Communication and Facsimile

Judging from the situation in the developed countries, the initial growth of demand for new services will be by 20% or more annually. Main users of data communication and facsimile services are business organizations and governmental offices so that the size of demand depends upon the type of information that the users deal with and also upon the user distribution by business category. Although the demand forecast at the present stage is difficult, it is assumed that the combined demand for telex, data communication and facsimile services mainly used by business organizations and governmental offices will continue to make a 10% growth annually.

(3) Calculation of Forecast Values

The results of calculation of the demand forecast values based on the foregoing demand prospects for non-telephone services appear in Tables IV-11 and IV-12 and Figures IV-6 and IV-7.

(a) Domestic Telegrams

The assumption is that up to 1999 the annual growth rate of 12% thus far attained will be maintained, and after 1999 the demand will reach the saturation point. As the result, the diffusion rate as of 2005 is forecasted to be 10.9 per 100 persons.

(b) Telex

For the long-term demand prospect after 1989, the forecast value is the mean point value (Pattern II) between the optimistic forecast (Pattern I) and the pessimistic forecast (Pattern III). (Refer to Figure IV-7). As the result, the diffusion rate as of 2005 is forecasted to be 0.25 per 1,000 persons.

(c) New Services

The demand for data communication and facsimile services, including the demand for leased circuits and public service circuits, is forecasted to grow by 20%. The forecast value of demand for telex and new services combined is graphically presented in Figure IV-8. In this case, the growth rate of demand up to 2005 averages 10% annually.

(d) Leased Circuits

Judging from the user category and utilization purpose, the demand forecast is based on the same growth rate as in the case of telex service.

4.3 Microscopic Demand Forecast

4.3.1 Means of Forecast

(1) Forecast Area

(a) Demand for Telephone Service

The telephone network configuration from the long-range viewpoint will be the star network configuration centering upon the existing seven Tertiary Center areas. Therefore, the demand forecast is made for each existing Tertiary Center area.

(b) Demand for Non-Telephone Services

The demand for telex and data communication services as of 2005 is forecasted to be about 20% of the existing telephone demand and about 2% of the telephone demand as of 2005. Considering this demand size, judgement is made that the existing telegraph network centering upon four tandem exchanges, as against the telephone network centering upon seven tandem exchanges, is of proper scale for the prototype network for non-telephone services of the future. Therefore, the demand forecast for non-telephone services is made for each tandem exchange area of the existing telegraph network.

(2) Forecast Blocs in Objective Area of Investigation

The demand forecast blocs necessary for the transmission route plan in the objective area of this investigation are established as follows:

(a) Demand for Telephone Service

The forecast is made for each Primary Center area.

(b) Demand for Non-Telephone Services

Judging form the regional distribution of business organizations and governmental offices as main users of non-telephone services, decision has been made that, in the non-telephone service network, the local exchange area or the line concentrator area is almost the same as the Secondary Center area in the telephone network.

4.3.2 Demand Prospect by Areas

(1) Telephone and Telex

No especially big change can be expected in the future population distribution and GDP attainment. Hence the judgement is made that the demand distribution by area for telephone and telex services will not broadly depart from the existing demand distribution.

(2) New Services

Considering the user category and utilization purpose, the demand distribution by areas for new services will be almost the same as that for telex service.

(3) Telegrams

In Maluku and Irian Jaya areas, the telegram utilization rate per 100 persons is already five times or so larger than the rate in any other area. By the diffusion of telephone and telex services in the future, the demand for telegram service in the said two areas will be rapidly replaced with the demand for the latter service. Thus the growth rate of demand for telegram service in the two areas, as compared with other areas, will slow down. The demand distribution in other areas will not change drastically from the existing status.

4.3.3 Demand Forecast by Areas

(1) Telephone Service

(a) Telephone demand forecast by Tertiary Center areas is given in Table IV-13.

(b) Microscopic demand forecast by Primary Center areas in the objective area of this investigation appears in Table IV-14. This demand forecast is based on PERUMTEL's long-term plan but contains corrections by field survey findings. Given below is the comparison between the forecast values allocated to Sulawesi and Maluku/Irian Jaya areas out of Table IV-13 macroscopic and the corresponding microscopic forecast values.

(Unit: 10^3 lines)

	Sulawesi (Ujung Pandang)		Maluku/Irian Jaya (Ambon)	
	Macro	Micro	Macro	Micro
1984	31	31	16	13
1989	48	50	24	24
1994	75	79	37	39
1999	115	127	57	60
2005	189	191	94	92

Judgement can be made from the above table that the difference between macroscopic and microscopic forecast values is not so large as to impede the formulation of transmission route plan. Hence, for telephone demand by which to forecast inter-trunk center traffic, the microscopic forecast values in Table IV-14 are used.

(2) Non-Telephone Services

(a) The nationwide area by area demand forecast for non-telephone services consists of the allocation of macroscopic forecast values to each tandem exchange area in the future network, based on the demand outlook. The result of this allocation is given in Table IV-15 (1/3) - (3/3).

(b) The demand forecast for non-telephone services in the objective area of this investigation consists of the allocation of Table IV-15 data to each local exchange area, based on field survey findings. The result of this allocation is in Table IV-16.

Table IV-3 Number of Telephones, Number of Direct Exchange Lines (D.E.L.) and Telephone Exchange Capacity in Whole Indonesia (1971 - 1980)

Item		Statistics 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Annual Growth Rate (%)
Population (Million)		120.15	* 122.30	* 124.49	* 126.72	* 128.99	131.30	133.94	136.63	139.38	142.18	
Number of Telephones	Main	152,146	168,205	183,365	197,571	207,478	219,428	241,019	275,125	317,932	369,843	
	Extension	69,633	72,623	83,072	91,403	97,710	99,491	108,079	117,438	124,169	143,037	
	Total	221,779	240,828	266,437	288,974	305,188	319,919	349,098	392,563	442,101	512,880	8.7
	Density /100 inhabit	0.18	0.20	0.21	0.23	0.24	0.24	0.26	0.29	0.32	0.36	
Number of Direct Exchange Lines (D.E.L.)	Auto	77,437	95,414	105,762	115,298	130,752	138,722	156,358	192,857	253,696	319,303	
	Manual	74,709	72,791	77,603	82,273	76,726	50,706	54,661	82,268	63,419	50,540	
	Total	152,146	168,205	183,365	197,571	207,478	219,428	241,019	275,125	317,115	369,843	9.3
	Density /100 inhabit	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.20	0.23	0.26	
Exchange capacity	Auto	90,660	110,860	121,460	125,000	144,100	161,100	218,320	367,200	460,100	524,860	19.2
	Manual	102,292	105,509	103,663	106,974	99,858	103,992	107,292	108,253	87,772	73,762	-3.3
	Total	192,952	216,429	225,123	232,964	243,958	265,092	325,612	475,453	547,872	598,622	12.0
D.E.L./Telephone Station		0.69	0.70	0.69	0.68	0.68	0.69	0.69	0.70	0.72	0.72	
D.E.L./Exchange Capacity		0.79	0.78	0.81	0.85	0.85	0.83	0.74	0.58	0.58	0.62	

(Source) Traffic Dalam Angka 1979 - 1980

Table IV-4 Number of Telex Lines, Telex and Telegram Traffics and Gentex Exchange Capacities in Whole Indonesia (1971 - 1980)

Item	Year	Statistics										Annual Growth Rate (%)
		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
Telex	No. of Lines	746	897	979	1,194	1,571	2,397	2,397	3,200	4,009	5,259	24.2
	No. of Pulses (*) (Domestic)	7,124	8,839	11,558	15,400	23,428	33,779	89,103	52,812	63,115	87,733	32.2
	Paid Minutes (*) (Int'l)	648	921	1,430	1,863	2,595	2,928	3,885	4,511	5,508	6,946	30.2
Telegram	No. of Messages (*) (Domestic)	2,390	2,696	3,590	3,776	3,574	4,070	4,404	4,905	5,503	6,455	11.7
	No. of Messages (*) (Int'l)	379	411	488	494	470	400	351	308	268	232	-13.4 (1974 - 80)
Gentex Exchange Capacity		1,100	1,210	1,210	1,810	2,330	3,130	5,890	9,230	9,230	11,530	29.8
No. of Telex Lines/ Ex. Capacity		0.68	0.74	0.81	0.66	0.67	0.77	0.41	0.35	0.43	0.46	-

(*) : x 1000

(Source) Traffic Dalam Angka 1979 - 1980

Table IV-5 Number of Telegraph Leased Circuits in Whole Indonesia (1971 - 1980)

Item \ Year	Statistics										Annual Growth Rate (%)
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
No. of Circuits	44	51	63	76	105	124	150	172	202	294	23.5

(Source) Traffic Dalam Angka 1979 - 1980

Table IV-6 Percentage of Demand Distribution in Whole Indonesia (1980)

Item / Area	% of Telecomm Demand			% Population	% GDP - 1978	* GDP per capita - 1978
	Telephone	Telegram	Telex			
North Sumatera (Medan)	8	12	9	8	9	US$ 240
South Sumatera (Palembang)	8	5	5	9	9	217
West and Central Jawa (Jakarta)	55	34	66	43	46	218
East Jawa, Bali and Nusa Tenggara (Surabaya)	19	21	12	26	21	175
Kalimantan (Banjarmasin)	3	6	3	5	6	290
Sulawesi (Ujung Pandang)	5	13	3	7	7	216
Maluku + Irian Jaya (Ambon and Jayapura)	2	9	2	2	2	241
Total	100	100	100	100	100	US$ 215

(Source) Traffic Dalam Angka 1979 - 1980

Note: Parenthesized are representative municipalities in each region.

*: at constant 1975 market prices

Table IV-7 Percentage of Demand Distribution in Eastern Part of Indonesia (1980)

Item / Area	% of Telecomm. Demand			% Population	% GDP - 1978	* GDP per capita - 1978
	Telephone	Telegram	Telex			
Sulawesi Selatan (Ujung Pandang)	2.9	4.9	1.5	4.3	4.0	US$ 216
Sulawesi Tengah (Palu)	0.4	3.4	0.3	0.9	0.6	
Sulawesi Tenggara (Kendari)	0.2	1.1	-	0.6	0.4	
Sulawesi Utara (Manado)	1.5	3.4	1.1	1.5	2.2	
Maluku (Ambon)	0.7	5.1	0.9	1.0	1.0	228
Irian Jaya (Sorong, Jayapura)	1.0	3.8	0.8	0.8	0.9	250
Nusa Tenggara (Kupang)	0.7	5.0	-	2.2	1.1	143
% of Total Indonesia	7.4	26.7	4.6	11.3	10.2	US$ 215

(Source) Traffic Dalam Angka 1979 - 1980

*: at constant 1975 market prices

Table IV-8 Population Forcast -Indonesia

(thousands)

1973	*124,490
1974	
1975	*128,990
1976	131,304
1977	133,940
1978	136,631
1979	139,376
1980	142,179
1981	145,039
1982	147,940
1983	150,901
1984	153,924
1985	157,010
1986	160,159
1987	
1988	
1989	*169,713
1990	
1991	176,401
1992	
1993	
1994	*186,319
1995	
1996	193,240
1997	
1998	
1999	*203,264
2000	
2001	210,234
2002	
2003	
2004	
2005	*224,015

* : estimated by JICA

Source; Proyeksi Penduduk Indonesia
Seri K NO. 2 BPS/

Table IV-9 Population, Gross Domestic Products and Gross Domestic Products per Capita in Indonesia

Item	Year	Statistics				Forecast					Remark
		1973	1975	1977	1979	1984	1989	1994	1999	2005	
Population	unit ; million	124.49	128.99	133.94	139.38	153.92	169.52	186.25	203.62	225.29	
	Ave. Annual Growth Rate (%)	-	2.00	2.00	2.00	2.00	1.95	1.90	1.80	1.70	
G.D.P.	At Current Price (Billion Rp.)	6,753.4	12,642.5	19,046.7	30,660.7						
	At 1973 Constant Price (Billion Rp.)	6,753.4	7,630.8	8,870.9	9,936.2						
	Ave. Annual Growth Rate (%)	-	6.30	7.82	5.84						
G.D.P. per Capita	At Current Price (Rp.)	54,249	98,011	142,203	219,979						
	At 1973 Constant Price (Rp.)	54,249	59,158	66,230	71,289						
	At 1973 Constant Price (US$)	130.7	142.5	159.6	171.8	229.9	307.7	411.7	551.0	781.6	by 6% growth
						219.3	279.8	357.2	455.9	610.9	by 5% growth
						209.0	254.3	309.4	376.4	476.3	by 4% growth

1 US$ = Rp. 415 (in 1973)

Table IV-10 Demand Forecast for Telephone Service - Whole Indonesia

Item	Year	Statistics	Forecast				
		1979	1984	1989	1994	1999	2005
Pattern I 6% growth of GDP per capita	GDP per capita (US$)	171.8	229.9	307.7	411.7	551.0	781.6
	Telephone Density (/100 inhabit)	0.32	0.62	0.93	1.39	2.07	3.37
	No. of Telephone Stations ($x10^3$)	442	954	1,577	2,589	4,215	7,592
	No. of DEL ($x10^3$)	317	668	1,104	1,812	2,951	5,081
Pattern II 5% growth of GDP per capita	GDP per capita (US$)	171.8	219.3	279.8	357.2	455.9	610.9
	Telephone Density (/100 inhabit)	0.32	0.58	0.81	1.14	1.60	2.39
	No. of Telephone Stations ($x10^3$)	442	893	1,373	2,123	3,258	5,384
	No. of DEL ($x10^3$)	317	625	961	1,486	2,281	3,769
Pattern III 4% growth of GDP per capita	GDP per capita (US$)	171.8	209.0	254.3	309.4	376.4	476.3
	Telephone Density (/100 inhabit)	0.32	0.54	0.71	0.93	1.22	1.70
	No. of Telephone Stations ($x10^3$)	442	831	1,204	1,732	2,484	3,830
	No. of DEL ($x10^3$)	317	582	843	1,212	1,739	2,681

Table IV-11 Demand Forecast for Telegraph Services - Whole Indonesia

(Domestic Telegram)

Item \ Year	Statistics	Forecast				
	1980	1984	1989	1994	1999	2005
No. of Messages ($x10^3$)	6,455	10,157	15,628	20,917	24,245	24,245
Growth Rate (%)	11.7	12.0	9.0	6.0	3.0	0

(Oversea Telegram)

	1980	1984	1989	1994	1999	2005
No. of Messages ($x10^3$)	232	150	100	100	100	100
Growth Rate (%)	-13.4	-12.0	-	-	-	-

(Telex Lines)

		1980	1984	1989	1994	1999	2005
Pattern I	No. of Lines	5,309	12,800	22,600	39,900	61,300	87,000
	Growth Rate (%)	24.2	25.0	12.0	12.0	9.0	6.0
Pattern II	No. of Lines	5,307	12,800	22,600	34,800	46,600	55,600
	Growth Rate (%)	24.2	25.0	12.0	9.0	6.0	3.0
Pattern III	No. of Lines	5,307	12,800	22,600	30,300	35,100	35,100
	Growth Rate (%)	24.2	25.0	12.0	6.0	3.0	0

(Telegraph Leased Circuit)

	1980	1984	1989	1994	1999	2005
No. of Circuits	294	720	1,270	1,950	2,610	3,500
Growth Rate (%)	23.5	25.0	12.0	9.0	6.0	6.0

Table IV-12 Demand Forecast for New Telecomm. Services - Whole Indonesia

Item \ Year	Estimated 1980	Data and Facsimile Terminals, etc. 1984	1989	1994	1999	2005
No. of Lines	200	420	1,000	2,600	6,400	19,000
- Public Network	60	120	500	1,800	5,200	17,000
- Leased Circuit	140	300	500	800	1,200	2,000
Growth Rate (%)		20.0	20.0	20.0	20.0	20.0

Table IV-13 Microscopic Telephone Demand Forecast by Tertiary Center Areas

Area \ Year	Main Telephones (No. of D.E.L) x10^3				
	1984	1989	1994	1999	2005
Medan	53	82	126	194	320
Palembang	47	72	111	171	283
Jakarta	346	533	825	1,265	2,092
Surabaya	113	173	267	411	678
Banjarmasin	19	29	45	68	113
Ujung Pandang	31	48	75	115	189
Ambon	16	24	37	57	94
Total - Indonesia	625	961	1,486	2,281	3,769

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (1/8)

(Nusa Tenggara Timur)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
381	ENDE	1,050	1,700	2,800	4,500	6,800
382	Maumere	550	800	1,000	1,600	2,400
383	Larantuka	100	200	400	600	900
384	Bajawa	200	400	600	800	1,200
385	Ruteng	580	900	1,500	2,400	3,600
386	Waingapu	0	200	400	600	900
387	Waikabubak	100	200	400	600	900
	(Total - ENDE)	(2,580)	(4,400)	(7,100)	(11,100)	(16,700)
391	KUPANG	3,040	4,000	6,000	10,000	15,000
392	Soe	150	200	400	600	900
393	Kefamenanu	120	200	400	600	900
394	Atambua	400	600	1,000	1,600	2,400
395	Baa	50	100	200	300	500
396	Seba	0	100	100	200	300
397	Kalabahi	200	400	600	800	1,200
398	Ilwaki	0	100	100	200	300
399	Baukau	200	400	600	1,000	1,500
390	Dili	900	1,500	2,500	4,000	6,000
	(total-KUPANG)	(5,060)	(7,600)	(11,900)	(19,300)	(29,000)
Total Line Capacity - Nusa Tenggara		7,640	12,000	19,000	30,400	45,700
Forecasted Lines - Nusa Tenggara		6,500	10,200	16,200	25,800	38,800

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (2/8)

(Sulawesi)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
411	UJUNG PANDANG	14,650	23,000	37,500	60,000	90,000
412	Watampone	450	600	800	1,000	1,500
413	Bantaeng	950	1,500	2,400	3,600	5,400
414	Benteng	400	600	1,000	1,600	2,400
415	Tanajampea	0	100	100	200	300
	(Total-UP)	(16,450)	(25,800)	(41,800)	(66,400)	(99,600)
421	PARE - PARE	3,200	5,000	8,000	13,000	19,500
422	Majene	300	400	700	1,100	1,700
423	Rantepao	200	300	500	800	1,200
424	Palopo	300	500	500	600	900
425	Sengkang	400	400	600	800	1,200
426	Mamuju	200	300	500	800	1,200
427	Masamba	0	100	200	300	500
428	Malili	0	100	200	300	500
429	Karosa	0	100	200	300	500
	(Total-PARE2)	(4,600)	(7,200)	(11,400)	(18,000)	(27,200)
431	MANADO	6,800	11,000	17,000	28,000	42,000
432	Tahuna	200	400	600	800	1,200
433	Beo	0	100	100	200	300
434	Kotamobagu	400	600	800	1,100	1,700
435	Gorontalo	2,040	3,000	5,000	8,000	12,000

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (3/8)

(Sulawesi)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
436	Tilamuta	0	100	200	300	500
437	Pale leh	0	100	200	300	500
	(Total-MANADO)	(9,440)	(15,300)	(23,900)	(38,700)	(58,200)
451	PALU	2,400	3,800	6,000	9,800	14,700
452	POSO	900	1,400	2,300	3,600	5,400
453	Toli-toli	640	1,000	1,600	2,500	3,800
454	Tojo	0	100	100	200	300
455	Kolonedale	0	100	100	200	300
456	Bungku	0	100	100	200	300
457	Katugo	0	100	100	200	300
458	Luwuk	1,000	1,500	2,100	3,100	4,700
459	Banggai	0	100	100	200	300
	(Total-PALU)	(4,940)	(8,200)	(12,500)	(20,000)	(30,100)
401	KENDARI	1,000	1,600	2,500	4,000	6,000
402	Baubau	100	200	400	600	900
403	Raha	0	100	100	200	300
404	Papalia	0	100	100	200	300
405	Kolaka	200	200	400	600	900
406	Malamala	0	100	100	200	300

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (4/8)

(Sulawesi)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
407	Wawotobi	0	100	100	200	300
	(Total-KENDARI)	(1,300)	(2,400)	(3,700)	(6,000)	(9,000)
Total Lines Capacity - Sulawesi		36,730	58,900	93,300	149,100	224,100
Forecasted Lines - Sulawesi		31,200	50,000	79,300	126,700	190,500

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (5/8)

(Muluku)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
911	AMBON	3,600	6,000	9,000	14,000	21,000
912	Piru	0	100	200	300	500
913	Namlea	100	200	300	500	800
914	Masohi	120	200	300	500	800
915	Bula	0	100	200	300	500
916	Tual	600	1,000	1,600	2,500	3,800
917	Debo	220	300	500	800	1,200
918	Saumlaki	0	100	200	300	500
919	Tepa	0	100	200	300	500
910	Bandanaera	0	100	200	300	500
	(Total-AMBON)	(4,640)	(8,200)	(12,700)	(19,800)	(30,100)
921	TERNATE	1,100	1,800	3,000	5,000	7,500
922	Jailolo	0	100	200	300	500
923	Daruba	0	100	200	300	500
924	Tobelo	200	300	500	800	1,200
925	Weda	0	100	200	300	500
926	Umela	0	100	200	300	500
927	Labuha	0	100	200	300	500
928	Laiwui	0	100	200	300	500

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (6/8)

(Maluku)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
929	Sanana	0	100	200	300	500
	(Total-TERNATE)	(1,300)	(2,800)	(4,900)	(7,900)	(12,200)
Total Lines Capacity - Maluku		5,940	11,000	17,600	27,700	42,300
Forecasted Lines - Maluku		5,000	9,300	15,000	23,500	36,000

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (7/8)

(Irian Jaya)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
951	SORONG	1,450	2,300	3,600	5,800	8,700
952	Samate	0	100	200	300	500
953	Atkri	0	100	200	300	500
954	Inanwatan	0	100	200	300	500
955	Babo	0	100	200	300	500
956	Fakfak	800	1,300	2,100	3,300	5,000
957	Kaimana	100	200	300	500	800
958	Mimika	0	100	200	300	500
	(Total-SORONG)	(2,350)	(4,300)	(7,000)	(11,100)	(17,000)
961	Biak	1,000	1,600	2,500	4,000	6,000
962	Manokwari	1,000	1,600	2,500	4,000	6,000
963	Serui	400	600	1,000	1,600	2,400
964	Nabire	200	300	500	800	1,200
965	Waren	0	100	200	300	500
966	Sarmi	0	100	200	300	500
967	JAYAPURA	3,000	5,000	8,000	12,000	18,000
968	Beoga	0	100	200	300	500
969	Wamena	200	300	500	800	1,200
960	Kive	0	100	200	300	500
	(Total-JAYAPURA)	(5,800)	(9,800)	(15,800)	(24,400)	(36,800)

Table IV-14 Microscopic Telephone Demand Forecast in Eastern Part of Indonesia (by Primary Areas) (8/8)

(Irian Jaya)

Primary Area		Line Capacity				
Area Code	Area Name	1984	1989	1994	1999	2005
971	MERAUKE	1,200	2,000	3,400	5,500	8,300
972	Okaba	0	100	200	300	500
973	Kiman	0	100	200	300	500
974	Koba	0	100	200	300	500
975	Tanah Merah	0	100	200	300	500
976	Agats	0	100	200	300	500
977	Cumbuyum	0	100	200	300	500
978	Waropko	100	200	300	500	800
	(Total-MERAUKE)	(1,300)	(2,800)	(4,900)	(7,800)	(12,100)
Total Lines Capacity - Irian Jaya		9,450	16,900	27,700	43,300	65,900
Forecasted Lines - Irian Jaya		8,000	14,300	23,500	36,800	56,000

Table IV-15 (1/3) Microscopic Demand Forecast for Non-Telephone Service by Tandem Areas (Telegram)

Area \ Year	Telegram Messages ($x10^3$)				
	1984	1989	1994	1999	2005
Medan Tandem Area	1,308	2,076	2,817	3,266	3,266
Jakarta Tandem Area	3,924	6,228	8,453	9,799	9,799
Surabaya Tandem Area	2,943	4,672	6,339	7,349	7,349
- Jawa Timur	1,413	2,243	3,043	3,528	3,528
- Bali and Nusa Nusa Tenggara	706	1,121	1,521	1,764	1,764
- Kalimantan	824	1,308	1,775	2,057	2,057
Ujung Pandang Tandem Area	1,982	2,652	3,305	3,831	3,831
- Sulawesi	1,169	1,564	1,983	2,298	2,298
- Maluku	466	624	760	881	881
- Irian Jaya	347	464	562	652	652
Total - Indonesia	10,157	15,628	20,914	24,245	24,245

Table IV-15 (2/3) Microscopic Demand Forecast for Non-Telephone Service by Tandem Areas (Telex)

Year / Area	No. of Lines				
	1984	1989	1994	1999	2005
Medan Tandem Area	1,250	2,190	3,300	4,950	5,850
Jakarta Tandem Area	8,220	14,510	21,800	32,675	38,850
Surabaya Tandem Area	1,780	3,040	4,520	6,805	8,100
- Jawa Timur	1,190	2,100	3,150	4,725	5,620
- Bali and Nusa Tenggara	190	340	520	780	930
- Kalimantan	400	600	850	1,300	1,550
Ujung Pandang Tandem Area	593	1,020	1,555	2,350	2,800
- Sulawesi	393	670	1,030	1,555	1,840
- Maluku	80	150	225	350	420
- Irian Jaya	120	200	300	450	540
Total - Indonesia	11,843	20,760	31,175	46,780	55,600

Table IV-15 (3/3) Microscopic Demand Forecast for Non-Telephone Services by Tandem Areas (New Telecom. Services)

Year / Area	Estimated 1980	Data and Facsimile Terminals, etc.				
		1984	1989	1994	1999	2005
Medan Area	(20)	40	90	230	580	1,700
Jakarta Area	(140)	300	710	1,850	4,540	13,500
Surabaya Area	(30)	60	150	390	960	2,800
- Jawa Timur		40	100	250	620	1,800
- Bali and Nusa Tenggara		10	25	70	160	450
- Kalimantan		10	25	70	180	550
Ujung pandang Area	(10)	20	50	130	320	1,000
- Sulawesi		20	30	80	180	580
- Maluku			10	20	60	160
- Irian Jaya			10	30	80	260
Total-Indonesia	(200)	420	1,000	2,600	6,400	19,000

Table IV-16 Microscopic Demand Forecast for Non-telephone Service - the Year 2005 - Eastern Part of Indonesia

Service / Area	Telegram (10^3 Messages)	Telex (No. of Lines)	Telegraph Leased Circuit No. of cct	New Service Subscriber		Remark
				Public Network	Leased Circuit	
Ujung Pandang (Sulawesi- Selatan)	1,034	890	60	250	30	
Kendari (Sulawesi-Tenggara)	161	70	5	20	-	
Palu (Sulawesi-Tengah)	414	330	20	90	10	
Marado (Sulawesi-Utara)	689	550	35	160	20	
Ambon (Maluku)	881	420	30	140	20	
Jayapura, Meranke (East Irian Jaya)	430	380	25	160	20	
Sorong (West Irian Jaya)	222	160	10	70	10	
Kupang (Nusa Tenggara Timur)	529	140	10	45	5	
Total - Eastern Indonesia	4,360	2,940	195	935	115	

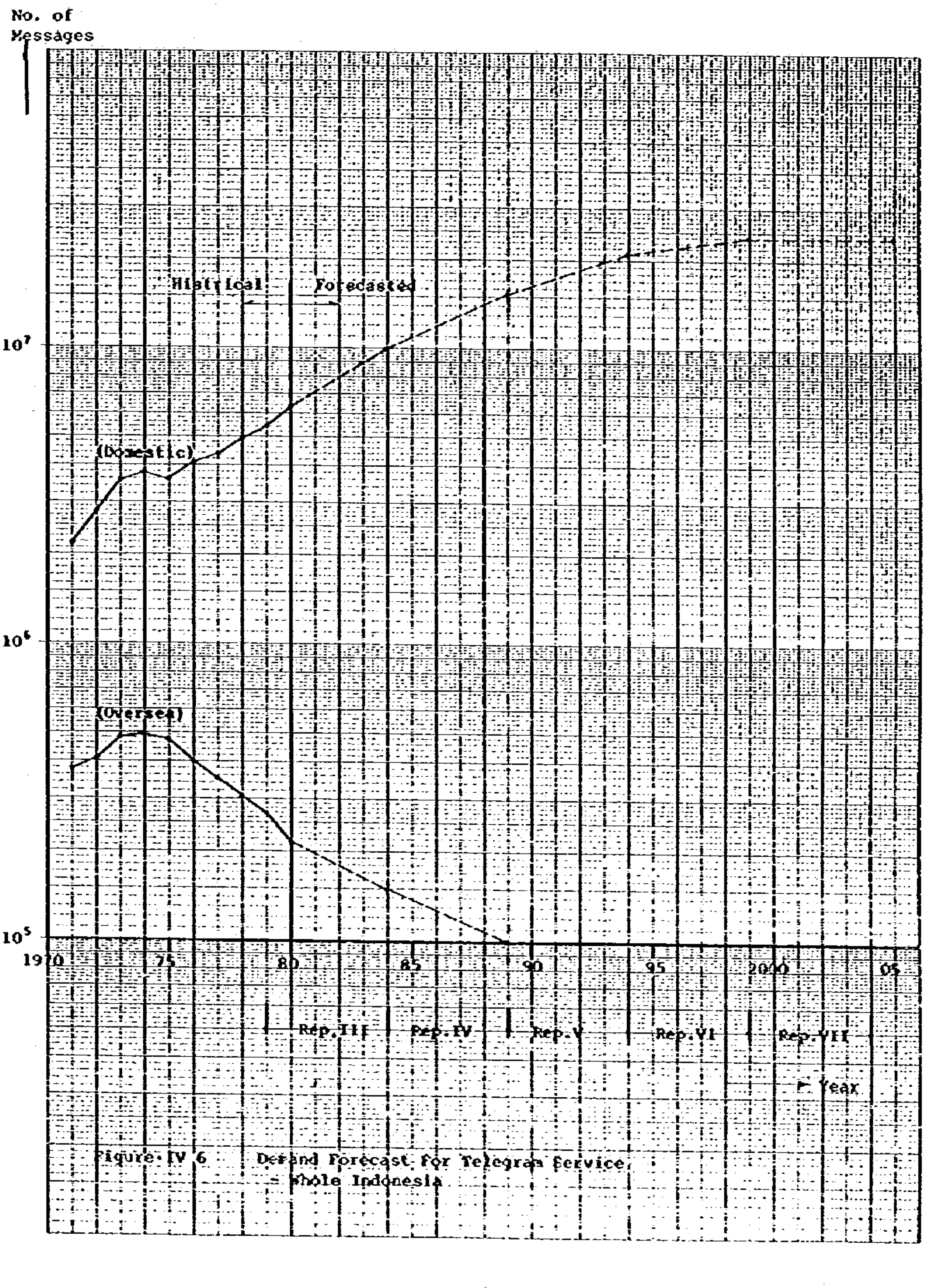


Figure IV 6 Demand Forecast for Telegram Service - Whole Indonesia

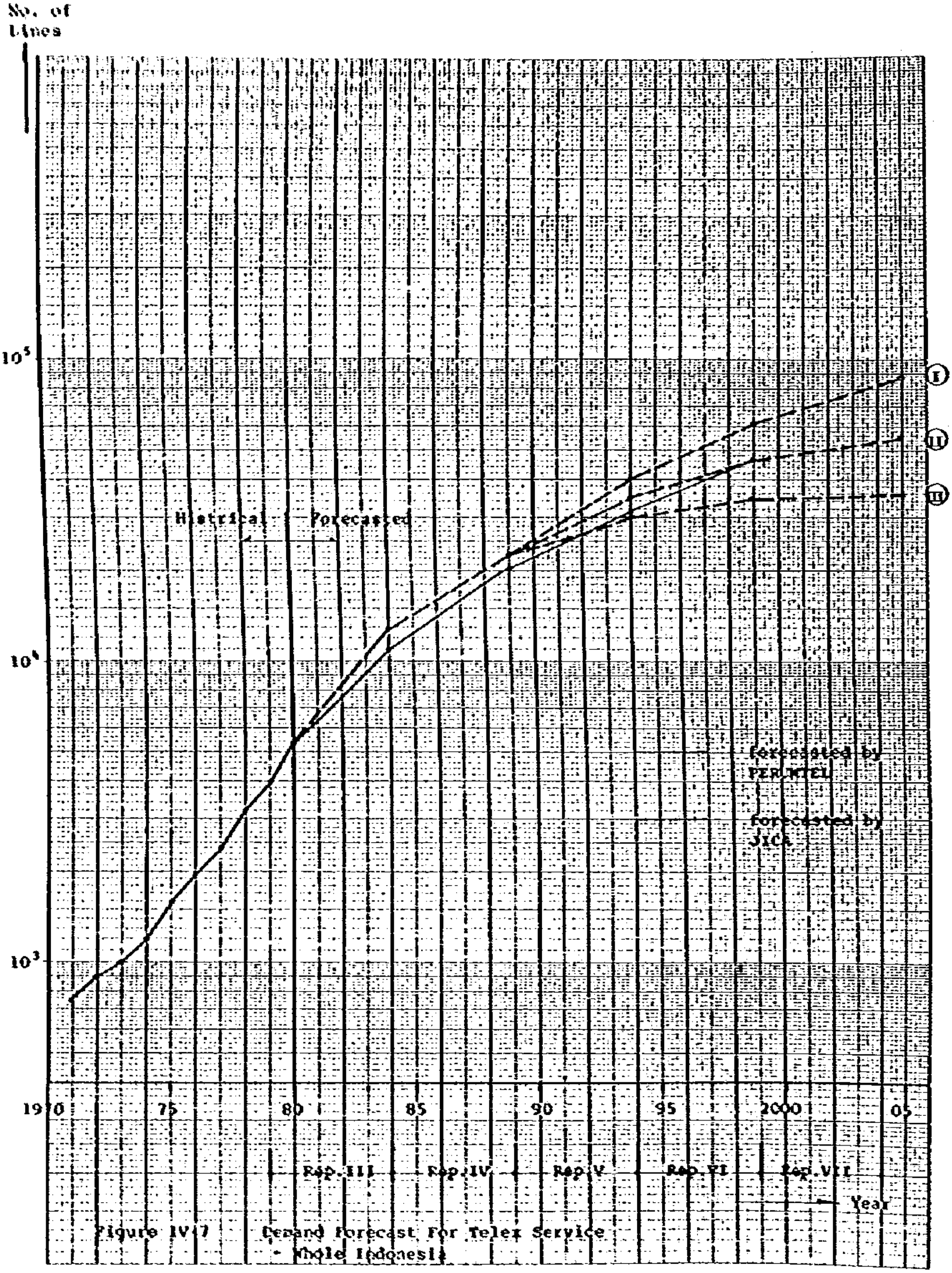


Figure IV-7 Demand Forecast For Telex Service
- Whole Indonesia

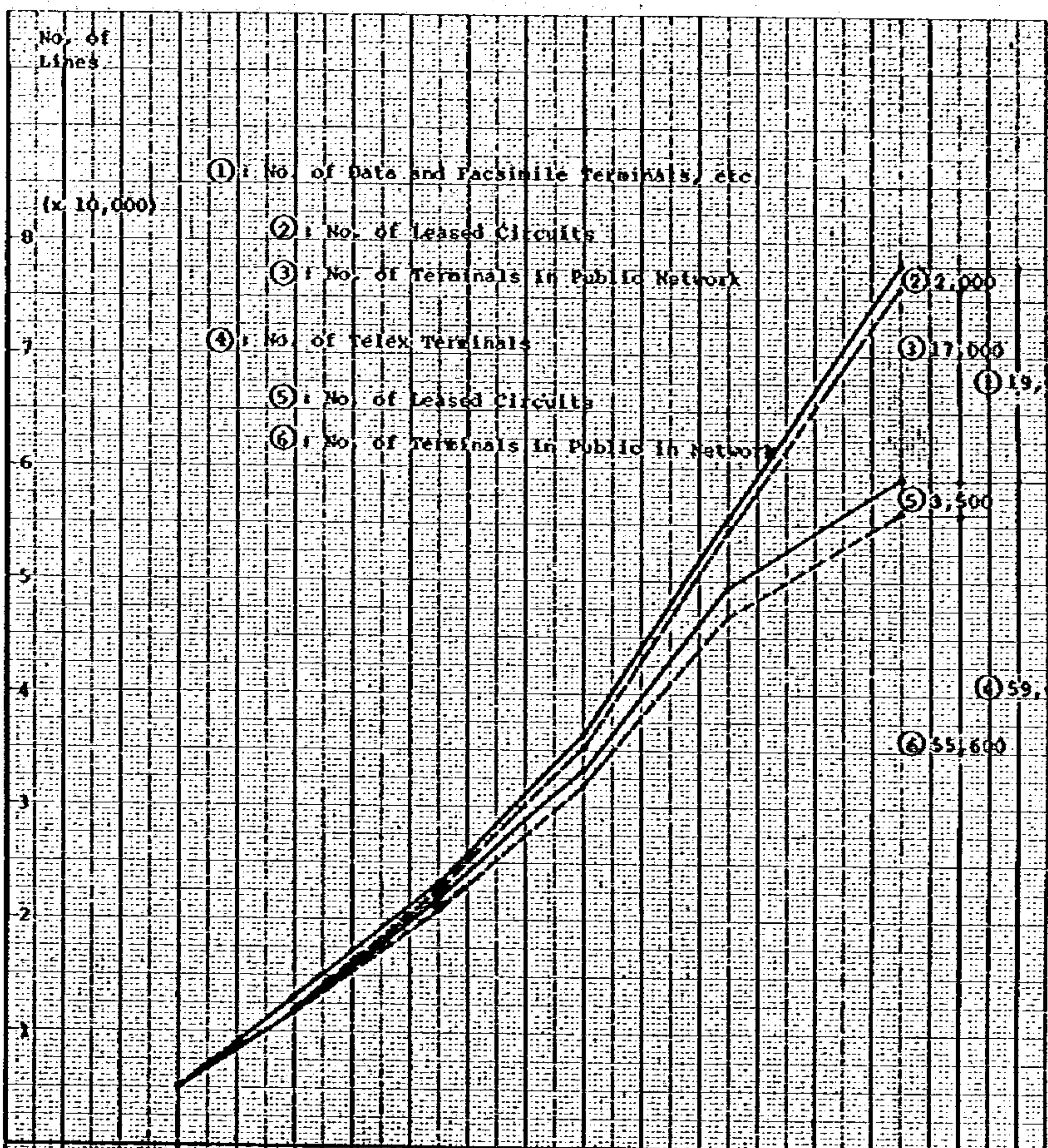


Figure IV-8 Demand Forecast for Non-Voice Telecommunication Services — Whole Indonesia

5. Proposed Network Configuration

5.1 Telephone Network

(1) Network Configuration Philosophy

For the telephone network configuration philosophy, PERUMTEL's "Fundamental Plan 1981 for the Telephone Network in Indonesia" can apply.

(2) Network Formation Strategy

a) Tertiary Centers will be interconnected by mesh network.

b) For the purpose of network cost reduction, high usage link will be established between Secondary Centers in the same Tertiary Center area and, where necessary, extending to Secondary Centers in other Tertiary Center area.

c) Between Secondary Center and Primary Center, high usage link will not be established, in principle.

5.2 Non-Telephone Network

(1) Network Configuration Philosophy

a) In Jakarta, Surabaya, Medan and Ujung Pandang, tandem exchanges will be established. In other principal cities, auxiliary tandem exchanges will be established as the case may be.

b) At the exchange lower than tandem exchanges in hierarchy, subscriber line multiplexer (to transform original signal into 64 Kbit/s PCM-coded signals) or line concentrator (to convert 64 Kbit/s PCM-coded signals into 2 Mbit/s bit stream) will be installed.

(2) Network Formation Strategy

a) Tandem exchanges will be interconnected by mesh network.

b) Outgoing/incoming circuits from/to the exchanges lower in hierarchy than tandem or auxiliary tandem exchanges will be established only in the tandem exchange to which each such exchange belongs.

5.3 Traffic Distribution between Satellite and Terrestrial Transmission Routes

Traffic should be distributed proportionately to satellite and terrestrial transmission routes. In this study, however, traffic distribution was made by the following principles since this study is dedicated to necessary investigations and examinations for introducing a terrestrial transmission network in the whole objective areas as far as topographically and technically possible.

(1) On both telephone and non-telephone networks, trunk traffic will be via terrestrial transmission route, in principle.

(2) In the objective area of this investigation, and before the completion of terrestrial transmission route, trunk traffic will be via domestic satellite system. In the areas, regardless of whether the objective area of this investigation or otherwise, where the terrestrial transmission system construction is infeasible due to topographic difficulty, trunk traffic will be via domestic satellite system.

(3) The final route for traffic by way of domestic satellite will be directed to the Demand Assignment (DA). DA and Tertiary Centers will be interconnected by mesh network.

6. Traffic Forecast

6.1 District-wise Trunk Telephone Traffic Forecast

6.1.1 Traffic Variations

(1) Traffic Variation Factors

Factors to affect trunk telephone traffic are:

(a) Brisking of economic activities of commercial enterprises as the result of the growth of economy as a whole.

(b) Upgrading of trunk telephone service, e.g., replacement of manual switching service with subscriber trunk dialling (STD) service.

(c) Growth of trunk telephone service utility following the expansion of STD network.

(d) The tariff system modification may either increase or decrease trunk telephone traffic.

(2) Calling Rate Variation Factors

Besides the foregoing factors, it must be noted that the calling rate generally tends to decrease in accordance with the diffusion of telephone service.

(3) Traffic Variations by Service Quality Improvement

The general estimate is that, in the event of manual delayed call service replaced with automatic service, the number of calls will more than double and the holding time will improve to 0.7 - 0.8 times. In other words, traffic will increase by about 1.5 times.

6.1.2 Trunk Traffic Growth Model

According to CCITT Manual, "Economic Studies at the National Level in the Field of Telecommunications," the growth rate of long distance trunk traffic is intimately related to the annual growth rate of GDP as indicated in the following formula:

$$C_p = 0.027 + 2.05 X_p$$

where

C_p : Annual growth rate of long distance toll traffic

X_p : Growth rate of GDP per annum

For instance, should the growth rate of GDP per annum in Indonesia continue by 6% to 7%, the number of long distance toll calls will grow annually by 12% through 14%.

6.1.3 Status Quo of Trunk Traffic

(1) Analysis of SLDD Traffic

The result of analysis of SLDD (Subscriber Long Distance Dialling) traffic data of Tertiary Centers, Secondary Centers and Primary Centers in Jawa and Sumatra areas, collected during the field surveys, is given in Table IV-17. This table indicates the following:

- Originating SLDD traffic from Tertiary Center and Secondary Center areas is distributed in the range of 0.004 - 0.006 Erlangs.

- Originating SLDD traffic from Primary Center areas is also distributed in 0.004 - 0.006 Erlangs range; however, the mean value is at a slightly lower level than in the preceding case.

(2) Analysis of Manual Switched Traffic

Monthly paid-minutes data of manual trunk exchanges in the objective area of this investigation are converted into Erlangs by the following formula:

$$A = C_1 \cdot C_2 \cdot C_3 \cdot 1/D \cdot T_m \quad \text{(Erlangs)}$$

where

- A : Mean busy hour traffic (in Erlangs)
- C_1 : Busy hour concentration factor (= 1/6)
- C_2 : Paid-minutes data converted to busy hour traffic (= 1/60)
- C_3 : Incremental traffic by ineffective calls (= 1.15)
- D : Monthly average working days (= 25)
- T_m : Monthly paid-minutes

The result of analysis appears in Table IV-18. It indicates that the calling rate from all exchanges in the objective area of this investigation is much lower than the aforementioned calling rate of all exchanges in Jawa and Sumatra areas. Meanwhile, this result of analysis must be distinguished from the earlier mentioned result of SLDD traffic analysis, because the monthly paid-minutes data include both long distance and suburban calls.

6.1.4 Calling Rate

Traffic variation factors identified in Paragraph 6.1.1 are mutually related and exert multilateral influences on the calling rate growth, so that long-term traffic forecast is not easy. Nevertheless, for the objective area of this investigation, the following estimates are considered to be legitimate:

- For some time to come, the demand for telephones from high calling rate subscribers, such as commercial institutions and governmental offices, is expected to rise;

- Usefulness of trunk telephone service will be enhanced by the expansion of SLDD network.

Thus, in the objective area of this investigation, the calling rate growth will be fast enough to be approximated to that in Jawa and Sumatra areas while in the latter areas the growth rate remains limited.

Table IV-19 presents the calling rate growth estimates.

6.1.5 Calculation of Forecast Values

(1) Mean busy-hour long-distance outgoing traffic from a Tertiary Center or a Secondary Center (A_{LD}) can be forecasted as follows:

$$A_{LD} = N_i \times CR_i \times 0.9 \quad \text{(Erlangs)}$$

where

N_i : Total line capacity of exchanges in Tertiary or Secondary Center Area i.

CR_i : Mean value of long-distance calling rate in Tertiary or Secondary Center Area i (Erlang)

A_{LD} is given in Table IV-20.

(2) Mean busy-hour long-distance and suburban trunk outgoing traffic from each Primary Center (A_T) can be obtained by the following formula:

$$A_T = N_j \times CR_j \times 0.9 \quad \text{(Erlangs)}$$

where

A_T : Combined long distance and suburban trunk outgoing traffic

N_j : Total line capacity of exchanges in Primary Center Area j.

CR_j : Mean value of combined long-distance and suburban trunk calling rate in Primary Center Area A_j.

Calculated A_T is in Table IV-21.

(3) Parenthesized in Tables IV-20 and IV-21 are the data of traffic via satellite, distinguished from traffic via terrestrial transmission route.

6.2 Forecast of Trunk Telephone Traffic between Trunk Centers

6.2.1 Basic Forecast Formula

The value of trunk telephone traffic between trunk centers is related to the size of traffic and the social/economic distance between the trunk centers. It can be obtained by the following formula:

$$A = K \cdot \frac{S_1 \cdot S_2}{d^{\alpha}} \quad \text{(Erlang)}$$

where

- A : Size of traffic between both trunk centers
- S_1, S_2 : Number of subscribers accommodated in each trunk center
- d : Linear distance between both trunk centers
- α : Coefficient by which to convert linear distance between both trunk centers into social/economic distance
- K : Coefficient for conversion to Erlang

6.2.2 Trunk Traffic Distribution

To obtain the social/economic distance between trunk centers, it is necessary to know the inter-trunk center traffic distribution as it presently is. Such trunk traffic distribution in the objective area of this investigation, obtained by the analysis of data collected by the field survey, appears in Table IV-22.

(a) Ujung Pandang

Traffic to/from Ujung Pandang is mostly to/from Jakarta, Surabaya, Manado and Pare Pare in the order mentioned.

The traffic distribution to/from these cities accounts for approximately 80% of the total. Relationships in terms of traffic with Sumatra, Kalimantan and Maluku/Irian Jaya are presumed to be limited.

(b) East Irian Jaya (including Maluku and Wamena)

Traffic to/from Jayapura, itself located in East Irian Jaya, is the greatest in size. Next to this is the traffic to/from Jakarta, Ujung Pandang and Surabaya, respectively, in the order mentioned, and all these are outside East Irian Jaya. Analysis of data indicates that the most part of traffic is to/from these cities. Traffic to/from other areas, i.e., Sumatra and Kalimantan, is presumed to be extremely limited.

(c) West Irian Jaya (including Sorong)

The traffic distribution resembles the long distance trunk traffic trend in East Irian Jaya. The ratio of originating calls to Jayapura is smaller.

(d) Ambon

As far as the analysis of manual traffic data shows, the traffic distribution is practically the same as the trends in cities in Irian Jaya.

(e) Kupang

Judging from the result of analysis of manual traffic data only, the most part of long distance trunk traffic is presumed to be the originating calls to Jakarta, Surabaya, Denpasar and Nusa Tenggara.

As seen in the foregoing description, long distance trunk traffic in the objective area of this investigation is distributed mainly on two routes. One is the route that originates in Irian Jaya and, extending by way of Maluku, Sulawesi and Surabaya, terminates in Jakarta. The other is from Nusa Tenggara Timur to Jakarta via Denpasar and Surabaya. Traffic to/from areas not located on these two routes is extremely limited. This fact presents an outstanding features of traffic distribution in the objective area of this investigation.

6.2.3 Inter-Trunk Center Traffic (Mean Busy-Hour Traffic) Forecast Models

(1) Primary Center - Secondary Center

The assumption is that the high usage circuit will not be established from the Primary Center. Therefore, all originating traffic from Primary Centers shown in Table IV-21 is carried to their respective parent Secondary Centers (or the Satellite).

(2) Tertiary Center - Tertiary Center
Secondary Center - Secondary Center
Tertiary Center - Secondary Center

In the case of network shown in Figure IV-9, the inter-trunk center traffic is calculated by the methods identified below.

(a) Long distance trunk outgoing traffic in Tertiary Center area I, A_{LD} (ti), is obtained by the following formula:

$$A_{LD}\ (ti) = \sum_{k=1}^{m} A_{LD}\ (sk) \quad \text{(Erlang)}$$

where

A_{LD} (sk) : Long distance trunk outgoing traffic (in Earlng) from each Secondary Center in Tertiary Center area I.

Note : Long distance trunk outgoing traffic from each Secondary Center is the sum of long distance trunk outgoing traffic from each Primary Center in the area.

(b) Long distance trunk traffic between Tertiary Center area I and Tertiary Center area J, A_{LD} (ti → tj), is obtained by the following formula:

A_{LD} (ti → tj) = A_{LD} (ti) x Interest Factor between Tertiary Center areas I and J : R [ti → tj]

$$R\ [ti \rightarrow tj] = \frac{\dfrac{A_{LD}\ (tj)}{(dij)^{\alpha}}}{\sum_{j=1}^{n} \dfrac{A_{LD}\ (tj)}{(dij)^{\alpha}}}$$

where

$A_{LD\ (tj)}$: Long distance trunk outgoing traffic in Tertiary Center area J.

dij : Crow-flight distance between Tetiary Center areas I and J.

α : Coefficient by which to convert crow-flight distance between Tertiary Center areas I and J into social/economic distance.

(c) Long distance trunk traffic between Secondary Center area K and Secondary Center area L, $A_{LD\ (sk \to sl)}$, is obtained by the following formula:

$A_{LD\ (sk \to sl)}$ = $A_{LD\ (ti)}$ x Interest Factor within Tertiary Center area I : R [ti → tj] x Interest Factor between Secondary Center areas K and L : R [sk → sl]

$$R\ [sk \to sl] = \frac{\dfrac{A_{LD\ (sl)}}{(\alpha kl)^{\beta}}}{\sum_{l=1}^{m} \dfrac{A_{LD\ (sl)}}{(\alpha kl)^{\beta}}}$$

where

$A_{LD\ (sl)}$: Long distance trunk outgoing traffic in Secondary Center area L

dkl : Crow-flight distance between Secondary Center areas K and L

β : Coefficient by which to convert crow-flight distance between Secondary Center areas K and L into social/economic distance

(d) Long distance trunk traffic from Tertiary Center area I to Secondary Center area Y, $A_{LD\ (ti \rightarrow sy)}$, is obtained by the following formula:

$$A_{LD\ (ti \rightarrow sy)} = A_{LD\ (ti)} \times \text{Interest Factor between Tertiary Center areas I and J} : R\ [ti \rightarrow tj] \times A_{LD\ (sy)} / A_{LD\ (tj)}$$

6.2.4 Calculation of Inter-Trunk Center Traffic Forecast Value

(a) According to CCITT recommendation, busy-hour traffic to be used in the calculation of the required number of equipment or circuits should preferably be the mean value for 35 days when the busy-hour traffic during the year reaches the maximum. In this study, the following correction is made to the mean busy-hour traffic so as to compensate for seasonal traffic variations and, by this means, the traffic forecast value is calculated:

A = K x (Average busy-hour traffic between trunk centers)

Provided:

For route where traffic is over 30 Erlangs, K = 1.15

For route where traffic is below 30 Erlangs, K = 1.20

(b) The result of calculation for the traffic forecast value appears in Table 23.

6.3 Non-Telephone Traffic Forecast

6.3.1 Busy-Hour Originating Traffic

(1) Telegram traffic, Atg, calculation is by the following formula:

Atg = (Annual total of outgoing telegrams x 1/12)
x (1/25 : 1/Average monthly working days)
x (1/8 : Busy-hour concentration factor)
x (125 : Average handling time of messages in second)
x 1/3,600 : erlang

(2) Telex traffic, Atx, calculation is by the following fourmula:

Atx = (Number of demand) x 0.05 : erlang

Provided that the originating calling rate per subscriber is 0.05 Erlang.

(3) New service traffic, Adt, calculation is by the following formula:

Adt = (Number of demand) x 0.1 : erlang

Provided that the originating calling rate per subscriber is 0.1 Erlang.

The volume of originating traffic per local area, calculated by the foregoing formula, is given in Table IV-24.

6.3.2 Inter-Tandem Exchange Traffic

The traffic distribution from Ujung Pandang tandem exchange to Jakarta, Surabaya and Medan tandem exchanges and international exchanges is given in Table IV-25. The traffic distribution ratio to each tandem exchange is determined, using field survey data for reference.

Table IV-17 (1/2) Present SLDD Traffic Analysis

(Tertiary and Secondary Centers)

Tertiary and Secondary Center	SLDD Traffic		No. of Lines	SLDD Traffic per Line	
	Outgoing (erl.)	Incoming (erl.)		Outgoing (10^{-3} erl.)	Incoming (10^{-3} erl.)
Bandung	109.0	133.3	24,399	4.50	4.60
Cirebon	17.98	19.25	3,765	4.80	5.10
Yogyakarta	21.08	32.48	3,321	6.30	9.80
Solo	22.03	20.94	5,434	4.10	5.50
Semarang	57.03	59.88	16,624	3.40	3.60
Purwokerto	7.74	8.28	1,725	4.50	4.80
Surabaya	216.49	181.33	35,399	6.10	5.10
Medan	88.75	78.70	16,682	5.30	4.70
Palembang	38.90	30.50	4,979	7.80	6.10
Denpasar	23.90	19.55	4,418	5.40	4.40
Padan	26.13	33.76	4,929	5.30	6.80
Tj.Karang	23.70	20.40	4,255	5.60	4.80
Total	652.73	627.37	125,930	$\bar{X}$ = 5.18 σ = 1.10	$\bar{X}$ = 4.98
Jakarta	520.6	462.0	125,116	4.16	3.69

Table IV-17 (2/2) Present SLDD Traffic Analysis

(Primary Centers)

Primary Center	SLDD Traffic		No. of Lines	SLDD Traffic per Line	
	Outgoing (erl.)	Incoming (erl.)		Outgoing (10^{-3} erl.)	Incoming (10^{-3} erl.)
Serang	5.6	4.4	906	6.2	4.9
Bogor	25.8	33.1	5,307	4.9	6.2
Cilacap	3.0	4.0	640	4.7	6.3
Tegal	7.0	5.7	1,771	4.0	4.9
Kediri	6.5	6.6	1,338	4.9	4.9
Mataram	7.5	6.5	2,239	3.3	2.9
Bukittingi	4.5	4.5	1,168	3.9	3.9
Kisaran	3.0	2.5	400	7.5	6.3
Total	62.9	63.3	13,769	$\overline{X}$ = 4.6 σ = 1.27	4.60

Table IV-18 Conversion of Manual Traffic Data to Erlang Value

Semi-auto. or Manual Service Exchange	No. of Lines (A)	Monthly paid Minutes (B)	(B) ÷ (A) = (C)	Erlang value; (C) × $\frac{1}{25}$ × $\frac{1}{6}$ × $\frac{1}{60}$ × 1.15: (10^{-3} erl.)
Ende	304	6,570	21.61	2.76
Bima	576	22,471	39.01	4.98
Gorontalo	1,160	12,210	10.43	1.33
Poso	559	1,348	2.41	0.31
Luwuk	591	4,402	7.45	1.00
Biak	635	16,076	25.32	3.24
Manokwari	394	6,567	16.67	2.13
Sorong	728	17,798	24.45	3.12
Fakfak	280	7,943	28.37	3.63
Merauke	343	10,061	29.33	3.75
Ternate	635	26,240	41.32	5.28
Total	6,205	131,686	21.22	$\overline{X}$ = 2.71

Table IV-19 Mean Busy-hour Long-distance Telephone Traffic Forecast per Line (Outgoing) (1/2)

Area	Trunk Center	1989	1994	1999	2005	Remark
JAKARTA	Jakarta	4.96	4.99	5.01	5.03	
	Bandung	6.18	6.22	6.24	6.26	
	Cirebon	6.18	6.22	6.24	6.26	
	Semarang	4.87	4.91	4.91	4.92	
	Solo	6.18	6.22	6.24	6.26	
	Purwokerto	4.87	4.91	4.91	4.92	
SURABAYA	Surabaya	7.49	7.54	7.56	7.58	
	Jember	4.87	4.91	4.91	4.92	
	Malang	4.87	4.91	4.91	4.92	
	Madiun	4.87	4.91	4.91	4.92	
	Denpasar	6.18	6.22	6.24	6.26	
	Sunbawa Besar	4.87	4.91	4.91	4.92	
	Ende	3.28	3.62	4.00	4.50	
	Kupang	3.28	3.62	4.00	4.50	
	Bima	4.80	4.89	4.97	5.03	
UJUNG PANDANG	Ujung Pandang	6.18	6.22	6.24	6.26	
	Pare-Pare	4.87	4.91	4.91	4.92	
	Manado	6.18	6.22	6.24	6.26	
	Palu	3.28	3.62	4.00	4.50	
	Kendari	3.28	3.62	4.00	4.50	
BANJARMASIN	Banjarmasin	6.18	6.22	6.24	6.26	
	Sampit	4.87	4.91	4.91	4.92	
	Samarinda	6.18	6.22	6.24	6.26	

(unit: 10^{-3} erlang)

Table IV-19 Mean Busy-hour Long-distance Telephone Traffic Forecast per Line (Outgoing) (2/2)

Area	Trunk Center	1989	1994	1999	2005	Remark
BANJARMASIN	Tarakan	4.87	4.91	4.91	4.92	
	Pontianak	4.87	4.91	4.91	4.92	
MEDAN	Medan	6.18	6.22	6.24	6.26	
	Sibolga	4.87	4.91	4.91	4.92	
	Langsa	4.87	4.91	4.91	4.92	
	Banda Ache	4.87	4.91	4.91	4.92	
PALEMBANG	Palembang	7.49	7.54	7.56	7.58	
	Jambi	4.87	4.91	4.91	4.92	
	Lahat	4.87	4.91	4.91	4.92	
	Tanjung Karang	6.18	6.22	6.24	6.26	
	Pakanbaru	4.87	4.91	4.91	4.92	
	Tanjung Pinang	4.87	4.91	4.91	4.92	
	Padang	6.18	6.22	6.24	6.26	
AMBON	Ambon	4.89	5.14	5.40	5.73	
	Ternate	6.05	6.17	6.26	6.34	
	Jayapura	4.89	5.14	5.40	5.73	
	Merauke	3.72	4.11	4.54	5.11	
	Sorong	3.72	4.11	4.54	5.11	

(unit: 10^{-3} erlang)

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (1/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
JAKARTA	JAKARTA		1,973.95	3,182.94	5,111.82	7,700.76
	BANDUNG		433.48	700.28	1,131.24	1,706.43
	CIREBON		52.58	87.01	137.82	207.60
	SEMARANG		(0.53) 216.88	(0.81) 350.93	(0.82) 562.41	(1.39) 848.56
	SOLO		131.93	210.10	342.77	518.07
	PURWOKERTO		100.68	162.85	267.02	404.14
	(Total - JAKARTA)		(0.53) 2,909.50	(0.81) 4,694.11	(0.82) 7,553.08	(1.39) 11,385.56
SURABAYA	SURABAYA		(0.81) 614.71	(1.62) 996.93	(2.46) 1,595.13	(4.170) 2,400.31
	JEMBER		74.12	117.94	191.97	290.53
	MALANG		171.68	279.48	453.24	682.89
	MADIUN		85.46	138.25	220.33	333.11
	DENPASAR		114.79	182.75	300.17	452.69
	SUMBAWA BESAR		12.62	21.35	35.16	53.21

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (2/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
SURABAYA	ENDE	Ende	5.02	9.12	16.20	27.54
		Maumere	2.12	2.70	4.39	6.67
		Larantuka	0.53	1.08	1.65	2.50
		Bajawa	1.06	1.62	2.20	3.34
		Ruteng	2.39	4.05	6.59	10.01
		Waingapu	0.53	1.08	1.65	2.50
		Waikabubak	0.53	1.08	1.65	2.50
		(Total - ENDE)	12.18	20.73	34.33	55.06
	KUPANG	Kupang	11.81	19.55	36.00	60.75
		Soe	0.53	1.08	1.65	2.50
		Kefamenau	0.53	1.08	1.65	2.50
		Atambua	1.59	2.70	4.39	6.67
		Baa	0.27	0.54	0.82	1.39

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (3/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
SURABAYA	KUPANG	Seba	(0.27)	(0.27)	(0.55)	(0.83)
		Kalabahi	1.06	1.62	2.20	3.34
		Ilwaki	(0.27)	(0.27)	(0.55)	(0.83)
		Baukau	1.06	1.62	2.75	4.17
		Dili	3.98	6.75	10.98	16.69
		(Total - KUPANG)	(0.54) 20.83	(0.54) 34.94	(1.10) 60.44	(1.66) 98.01
	(Total - SURABAYA)		(1.35) 1,106.39	(2.16) 1,792.37	(3.56) 2,890.77	(5.83) 4,365.81
UJUNG PANDANG	UJUNG PANDANG	Ujung Pandang	127.93	209.93	333.96	507.06
		Watampone	1.59	2.16	2.75	4.17
		Bantaeng	3.98	6.48	9.88	15.02
		Benteng	1.59	2.70	4.39	6.67
		Tanajampea	0.27	0.27	0.55	0.83
		(Total - UP)	135.36	221.54	354.53	553.75

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (4/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
UJUNG PANDANG	PARE-PARE	Pare-Pare	21.92	35.35	57.45	86.35
		Majene	(1.06)	1.89	3.02	4.73
		Rantepao	0.80	1.35	2.20	3.34
		Palopo	1.33	1.35	1.65	2.50
		Seng Kang	1.06	1.62	2.20	3.34
		Mamuju	(0.80)	1.35	2.20	3.34
		Masamba	0.27	0.54	0.82	1.39
		Malili	0.27	0.54	0.82	1.39
		Karosa	(0.27)	0.54	0.82	1.39
		(Total - PARE PARE)	(2.13) 25.65	44.53	71.18	107.77
	MANADO	Manado	61.18	95.17	157.25	236.63
		Tahuna	(1.06)	(1.62)	(2.20)	(3.34)
		Beo	(0.27)	(0.27)	(0.55)	(0.83)

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (5/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
UJUNG PANDANG	MANADO	Kotamobagu	1.59	2.16	3.02	4.73
		Gorontalo	7.97	13.50	21.96	33.37
		Tilamuta	0.27	0.54	0.82	1.39
		Paleleh	(0.27)	(0.54)	(0.82)	(1.39)
		(Total - MANADO)	(1.60) 71.01	(2.43) 111.37	(3.57) 183.05	(5.56) 276.12
	PALU	Palu	11.22	19.55	35.28	59.54
		Poso	3.72	6.21	9.88	15.02
		Toli-toli	2.66	4.32	6.86	10.57
		Tojo	(0.27)	0.27	0.55	0.83
		Kolonedale	(0.27)	0.27	0.55	0.83
		Bungku	(0.27)	0.27	0.55	0.83
		Katupa	(0.27)	0.27	0.55	0.83
		Luwuk	(3.98)	5.67	8.51	13.07

(   ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (6/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
UJUNG PANDANG	PALU	Banggai	(0.27)	0.27	0.55	0.83
		(Total - PALU)	(5.33) 17.60	37.10	63.28	102.35
	KENDARI	Kendari	(4.72)	8.15	14.40	24.30
		Baubau	(0.53)	1.08	1.65	2.50
		Raha	0.27	0.27	0.55	0.83
		Papalia	(0.27)	(0.27)	(0.55)	(0.83)
		Kolaka	0.53	1.08	1.65	2.50
		Malamala	0.27	0.27	0.55	0.83
		Wawotobi	0.27	0.27	0.55	0.83
		(Total - UJUNG PANDANG)	(5.52) 1.34	(0.27) 11.12	(0.55) 19.35	(0.83) 31.79
	(Total - UJUNG PANDANG)		(14.58) 250.96	(0.27) 425.66	(4.12) 691.39	(6.39) 1,051.78

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (7/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
BANJARMASIN	BANJARMASIN		(7.14) 59.88	(11.54) 96.59	(18.20) 151.65	(27.94) 228.80
	SAMPIT		(8.92) 0	(14.90) 0	(23.38) 0	(36.57) 0
	SAMARINDA		(1.08) 45.41	(2.16) 73.62	(3.28) 120.51	(5.56) 182.15
	TARAKAN		(5.46) 0	(9.23) 0	(14.33) 0	(22.39) 0
	PONTIANAK		(1.07) 21.44	(1.89) 35.70	(3.01) 55.47	(5.00) 84.13
	(Total - BANJARMASIN)		(23.67) 126.73	(39.72) 205.91	(62.20) 327.63	(97.46) 495.08
MEDAN	MEDAN		(4.52) 404.91	(6.75) 648.23	(10.44) 1,042.04	(15.85) 1,570.04
	SIBOLGA		(1.07) 18.74	(1.89) 31.55	(3.02) 50.43	(4.73) 76.77
	LANGSA		(1.86) 14.44	(2.70) 22.66	(3.57) 35.80	(5.56) 54.10

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (8/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
MEDAN	BANDA ACEH		(1.33) 30.96	(1.62) 49.93	(2.19) 75.53	(3.16) 114.91
	(Total - MEDAN)		(8.78) 469.05	(12.96) 752.37	(19.22) 1,203.80	(29.30) 1,815.82
PALEMBANG	PALEMBANG		(12.53) (104.85	(21.47) 162.29	(34.76) 254.82	(53.08) 383.69
	TANJUNG KARANG		103.28	159.52	258.73	390.10
	LAHAT		(0.27) 30.82	(0.54) 49.44	(0.82) 79.74	(1.39) 121.36
	JAMBI		(2.66) 30.84	(4.32) 52.02	(6.86) 83.04	(10.57) 125.74
	PADANG		(1.33) 86.97	(2.16) 136.67	(3.01) 219.69	(5.00) 331.58
	PAKANBARU		37.47	62.01	98.96	149.66
	TANJUNG PINANG		(1.35) 8.34	(2.70) 13.21	(4.10) 21.25	(6.95) 32.13
	(Total - PALEMBANG)		(18.14) 402.57	(31.19) 635.16	(49.55) 1,016.23	(76.99) 1,534.26

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (9/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
AMBON	AMBON	Ambon	(26.41)	41.63	68.04	108.30
		Piru	(0.27)	0.54	0.82	1.39
		Namlea	(0.53)	0.81	1.37	2.22
		Masohi	(0.53)	0.81	1.37	2.22
		Bula	(0.27)	0.54	0.82	1.39
		Tual	(2.66)	(4.32)	(6.86)	(10.57)
		Dobo	(0.80)	(1.35)	(2.20)	(3.34)
		Saumlaki	(0.27)	(0.54)	(0.82)	(1.39)
		Tepa	(0.27)	(0.54)	(0.82)	(1.39)
		Bandanaera	(0.27)	(0.54)	(0.82)	(1.39)
		(Total - AMBON)	(32.28) 0	(7.29) 44.33	(11.52) 72.42	(18.08) 115.52
	TERNATE	Ternate	(9.80)	16.66	28.17	42.80
		Jailolo	(0.27)	0.54	0.82	1.39

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (10/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
AMBON	TERNATE	Daruba	(0.27)	0.54	0.82	1.39
		Tobelo	(0.80)	1.35	2.20	3.34
		Weda	(0.27)	0.54	0.82	1.39
		Umera	(0.27)	(0.54)	(0.82)	(1.39)
		Labuha	(0.27)	0.54	0.82	1.39
		Laiwui	(0.27)	0.54	0.82	1.39
		Sanana	(0.27)	(0.54)	(0.82)	(1.39)
		(Total - TERNATE)	(12.49)	(1.08) (20.71	(1.64) 34.47	(2.78) 53.09
	SORONG	Sorong	(7.70)	(13.32)	23.70	40.01
		Samate	(0.27)	(0.54)	0.82	1.39
		Atkri	(0.27)	(0.54)	(0.82)	(1.39)
		Inanwatan	(0.27)	(0.54)	0.82	1.39
		Baho	(0.27)	(0.54)	(0.82)	(1.39)

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (11/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
AMBON	SORONG	Fakfak	(3.69)	(6.58)	(11.40)	(19.44)
		Kaimana	(0.53)	(0.81)	(1.37)	(2.22)
		Mimika	(0.27)	(0.54)	(0.82)	(1.39)
		(Total - SORONG)	(13.27)	(23.41)	(15.23) 25.34	(25.83) 42.79
	JAYAPURA	Biak	(4.03)	(6.98)	12.31	20.79
		Manokwari	(4.25)	(6.75)	(10.98)	(16.69)
		Serui	(1.59)	(2.70)	4.39	6.67
		Nabire	(0.80)	(1.35)	(2.20)	(3.34)
		Waren	(0.27)	(0.54)	0.82	1.39
		Sarmi	(0.27)	(0.54)	0.82	1.39
		Jayapura	(22.01)	(37.01)	58.32	92.83
		Beoga	(0.27)	(0.54)	(0.82)	(1.39)
		Wamena	(0.80)	(1.35)	(2.20)	(3.34)

( ) ; via Satellite

Table IV-20 Mean Busy-hour Long-distance Telephone Traffic Forecast, Outgoing from Each Trunk Center Area (12/12)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
AMBON	JAYAPURA	Kive	(0.27)	(0.54)	0.82	1.39
		(Total - JAYAPURA)	(34.56)	(58.30)	(16.20) 77.48	(24.76) 124.46
	MERAUKE	Merauke	(6.70)	(12.58)	22.47	38.17
		Okaba	(0.27)	(0.54)	0.82	1.39
		Kiman	(0.27)	(0.54)	0.82	1.39
		Koba	(0.27)	(0.54)	(0.82)	(1.39)
		Tanah Merah	(0.27)	(0.54)	0.82	1.39
		Agats	(0.27)	(0.54)	(0.82)	(1.39)
		Cumbu yum	(0.27)	(0.54)	(0.82)	(1.39)
		Waropko	(0.53)	(0.81)	1.37	2.22
		(Total - MERAUKE)	(8.85)	(16.63)	(2.46) 26.30	(4.17) 44.56
	(Total - AMBON)		(101.45)	(106.71) 65.04	(47.05) 236.01	(75.62) 380.42

( ) ; via Satellite

Table IV-21 Mean Busy-hour Trunk (Long-distance and Suburban) Telephone Traffic Forecast, Outgoing from Each Primary Center in Eastern Part of Indonesia (1/5)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
SURABAYA	ENDE	Ende				
		Maumere	2.87	3.65	5.95	9.03
		Larantuka	0.72	1.46	2.23	3.39
		Bajawa	1.44	2.19	2.97	4.51
		Ruteng	3.22	5.48	8.92	13.54
		Waingapu	0.72	1.46	2.23	3.39
		Waikabubak	0.72	1.46	2.23	3.39
	KUPANG	Kupang				
		Soe	0.72	1.46	2.23	3.39
		Kefamenau	0.72	1.46	2.23	3.39
		Atambua	2.15	3.65	5.95	9.03
		Baa	0.36	0.73	1.12	1.88
		Seba	(0.36)	(0.37)	(0.74)	(1.13)
		Kalabahi	1.44	2.19	2.97	4.51
		Ilwaki	(0.36)	(0.37)	(0.74)	(1.13)
		Baukau	1.44	2.19	3.72	5.64
		Dili	5.39	9.14	14.87	22.57
UJUNG PANDANG	UJUNG PANDANG	Ujung Pandang				
		Watampone	2.15	2.92	3.72	5.64
		Bantaeng	5.39	8.77	13.38	20.31
		Benteng	2.15	3.65	5.95	9.03

( ) : via Satellite

Table IV-21 Mean Busy-hour Trunk (Long-distance and Suburban) Telephone Traffic Forecast, Outgoing from Each Primary Center in Eastern Part of Indonesia (2/5)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
UJUNG PANDANG	UJUNG PANDANG	Tanajampea	0.36	0.37	0.74	1.13
	PARE-PARE	Pare-Pare				
		Majene	(1.44)	2.56	4.09	6.40
		Rantepao	1.08	1.83	2.97	4.51
		Palopo	1.80	1.83	2.23	3.39
		Sengkang	1.44	2.19	2.97	4.51
		Mamuju	(1.08)	1.83	2.97	4.51
		Masamba	0.36	0.73	1.12	1.88
		Malili	0.36	0.73	1.12	1.88
		Karosa	(0.36)	0.73	1.12	1.88
	MANADO	Manado				
		Tahuna	(1.44)	(2.19)	(2.97)	(4.51)
		Beo	(0.36)	(0.37)	(0.74)	(1.13)
		Kotamobagu	2.15	2.92	4.09	6.40
		Gorontalo	10.77	18.27	29.74	45.14
		Tilamuta	0.36	0.73	1.12	1.88
		Paleleh	(0.36)	(0.73)	(1.12)	(1.88)
	PALU	Palu				
		Poso	5.03	8.40	13.38	20.31
		Toli-Toli	3.59	5.85	9.29	14.30
		Tojo	(0.36)	0.37	0.74	1.13

( ) : via Satellite

Table IV-21 Mean Busy-hour Trunk (Long-distance and Suburban) Telephone Traffic Forecast, Outgoing from Each Primary Center in Eastern Part of Indonesia (3/5)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
UJUNG PANDANG	PALU	Kolonedale	(0.36)	0.37	0.74	1.13
		Bungku	(0.36)	0.37	0.74	1.13
		Katupa	(0.36)	0.37	0.74	1.13
		Luwuk	(5.39)	7.67	11.52	17.68
		Banggai	(0.36)	0.37	0.74	1.13
	KENDARI	Kendari				
		Baubau	(0.72)	1.46	2.23	3.39
		Raha	0.36	0.37	0.74	1.13
		Papalia	(0.36)	(0.37)	(0.74)	(1.13)
		Kolaka	0.72	1.46	2.23	3.39
		Malamala	0.36	0.37	0.74	1.13
		Wawotobi	0.36	0.37	0.74	1.13
AMBON	AMBON	Ambon				
		Piru	(0.36)	0.73	1.12	1.88
		Namlea	(0.72)	1.10	1.86	3.01
		Masohi	(0.72)	1.10	1.86	3.01
		Bula	(0.36)	0.73	1.12	1.88
		Tual	(3.59)	(5.85)	(9.29)	(14.30)
		Dobo	(1.08)	(1.83)	(2.97)	(4.51)
		Saumlaki	(0.36)	(0.73)	(1.12)	(1.88)

( ) : via Satellite

Table IV-21 Mean Busy-hour Trunk (Long-distance and Suburban) Telephone Traffic Forecast, Outgoing from Each Primary Center in Eastern Part of Indonesia (4/5)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
AMBON	AMBON	Tepa	(0.36)	(0.73)	(1.12)	(1.88)
		Bandanaera	(0.36)	(0.73)	(1.12)	(1.88)
	TERNATE	Ternate				
		Jailolo	(0.36)	0.73	1.12	1.88
		Daruba	(0.36)	0.73	1.12	1.88
		Tobelo	(1.08)	1.83	2.97	4.51
		Weda	(0.36)	0.73	1.12	1.88
		Umera	(0.36)	(0.73)	(1.12)	(1.88)
		Labuha	(0.36)	0.73	1.12	1.88
		Laiwui	(0.36)	0.73	1.12	1.88
		Sanana	(0.36)	(0.73)	(1.12)	(1.88)
	SORONG	Sorong				
		Samate	(0.36)	(0.73)	1.12	1.88
		Atkri	(0.36)	(0.73)	(1.12)	(1.88)
		Inanwatan	(0.36)	(0.73)	1.12	1.88
		Baho	(0.36)	(0.73)	(1.12)	(1.88)
		Fakfak	(5.05)	(9.02)	(15.65)	(26.64)
		Kaimana	(0.72)	(1.10)	(1.86)	(3.01)
		Mimika	(0.36)	(0.73)	(1.12)	(1.88)
	JAYAPURA	Biak	(5.53)	(9.56)	16.88	28.51

(   ) : via Satellite

Table IV-21 Mean Busy-hour Trunk (Long-distance and Suburban) Telephone Traffic Forecast, Outgoing from Each Primary Center in Eastern Part of Indonesia (5/5)

(Unit: Erlang)

Area			1989	1994	1999	2005
Tertiary	Secondary	Primary				
AMBON	JAYAPURA	Manokwari	(5.75)	(9.14)	(14.87)	(22.57)
		Serui	(2.15)	(3.65)	5.95	9.03
		Nabire	(1.08)	(1.83)	(2.97)	(4.51)
		Waren	(0.36)	(0.73)	1.12	1.88
		Sarmi	(0.36)	(0.73)	1.12	1.88
		Jayapura				
		Beoga	(0.36)	(0.73)	(1.12)	(1.88)
		Wamena	(1.08)	(1.83)	(2.97)	(4.51)
		Kive	(0.36)	(0.73)	1.12	1.88
	MERAUKE	Merauke				
		Okaba	(0.36)	(0.73)	1.12	1.88
		Kiman	(0.36)	(0.73)	1.12	1.88
		Koba	(0.36)	(0.73)	(1.12)	(1.88)
		Tanah Merah	(0.36)	(0.73)	1.12	1.88
		Agats	(0.36)	(0.73)	(1.12)	(1.88)
		Cumbu yum	(0.36)	(0.73)	(1.12)	(1.88)
		Waropko	(0.72)	(1.10)	1.86	3.01

( ) : via Satellite

Table IV-22 Distribution of Present Long-distance Telephone Traffic from Eastern Part of Indonesia

(Percentages)

Route / Origin of Traffic	Ujung Pandang		Kupang		Merauke		Sorong		Wamena		Ambon	
	Auto.	Manual	Auto.	Manual	Auto.	Manual	Auto.	Manual	Auto.	Manual	Auto.	Manual
Medan		0.5		1		0.4		0.4		0		1
Palembang	50	0.4	Data not in detail	1	0	0.2	0	0.8	0	0	Data not in detail	2
Jakarta		10		35		18		39		14		26
Surabaya	30	5		58	(SLDD not available)	7	(SLDD not available)	8	(SLDD not available)	2		14
Banjarmasin	-	2		0		0.2		0.3		0		1
Ujung Pandang	20	74		2		20		16		4		23
Ambon Jayapura	-	6		3		52		33		72		32
(Indistinct)	0	2.1		0		2.2		2.5		8		1
Total	100	100	-	100	0	100	0	100	0	100		100

Table IV-23 (1/4)

Terrestrial Long-distance Telephone Traffic Forecast from/to Secondary and Tertiary Centers in Eastern Part of Indonesia (1989)

(Erl)

Tertiary Area	From \ To	Objective Area (Eastern Part of Indonesia): ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL OUTGOING	Outside Objective Area: JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR-MASIN	MEDAN	PALEMBANG			TOTAL
SURABAYA	ENDE																											
	KUPANG																											
	(SURABAYA)					56		14									70											
UJUNG PANDANG	UJUNG PANDANG				55	-	28	42	20	2							147	92 / 84	12 / 14				8 / 8	7 / 10	5 / 5			114 / 121
	PARE-PARE					31											31											
	MANADO				14	40											52	26 / 28										26 / 28
	PALU					21											21											
	KENDARI					2											2											
AMBON	AMBON																											
	TERNATE																											
	SORONG																											
	JAYAPURA																											
	MERAUKE																											
TOTAL - INCOMING					69	150	28	56	20	2																		

(Note) ▱ ; Upper: Outgoing from Objective Area ; Lower: Incoming to Objective Area

Table IV-23 (2/4)

Terrestrial Long-distance Telephone Traffic Forecast from/to Secondary and Tertiary Centers in Eastern Part of Indonesia (1994)

(Erl)

Tertiary Area	To / From	Objective Area (Eastern Part of Indonesia) ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL OUTGOING	Outside Objective Area JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
SURABAYA	ENDE				25												25											
	KUPANG				40												40											
	(SURABAYA)	24	39			82		24				11					180											
UJUNG PANDANG	UJUNG PANDANG				82	-	50	65	42	13		15					267	136 / 143	23 / 24		12 / 13		13 / 13	10 / 16	9 / 9			203 / 218
	PARE-PARE					51											51											
	MANADO				23	70											93	44 / 46										44 / 46
	PALU					43											43											
	KENDARI					13											13											
AMBON	AMBON				13	13						-	25				51	37 / 26					2 / 2	2 / 3	2 / 2			33 / 33
	TERNATE											25					25											
	SORONG																											
	JAYAPURA																											
	MERAUKE																											
TOTAL - INCOMING		24	39		183	272	50	89	42	13		51	25															

(Note) ▱ ; Upper: Outgoing from Objective Area
; Lower: Incoming to Objective Area

Table IV-23 (3/4)

Terrestrial Long-distance Telephone Traffic Forecast from/to Secondary and Tertiary Centers in Eastern Part of Indonesia (1999)

(Erl)

Tertiary Area	From \ To	Objective Area (Eastern Part of Indonesia)																Outside Objective Area										
		ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL OUTGOING	JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
SURABAYA	ENDE				39												39											
	KUPANG				70												70											
	(SURABAYA)	39	68			113		42				39					301											
UJUNG PANDANG	UJUNG PANDANG				113	-	83	97	74	22		31			11		431	213/225	40/43		23/23	14/14	21/21	17/26	14/14			344/366
	PARE-PARE					82											82											
	MANADO				41	95						14					150	78/80										75/80
	PALU					73											73											
	KENDARI					23											23											
AMBON	AMBON				30	30		10				-	40	23	54	23	212	64/65					3/6	8/11	6/7			80/89
	TERNATE											40					40											
	SORONG											25			4		29											
	JAYAPURA					10						51		6		6	73	23/21										23/21
	MERAUKE											26			4		30											
TOTAL - INCOMING		39	68		293	426	83	149	74	22		226	40	29	73	31												

(Note) Diagonal cell: Upper: Outgoing from Objective Area; Lower: Incoming to Objective Area

Table IV-23 (4/4)

Terrestrial Long-distance Telephone Traffic Forecast from/to Secondary and Tertiary Centers in Eastern Part of Indonesia (2005)

(Erl)

Tertiary Area	From \ To	Objective Area (Eastern Part of Indonesia)																Outside Objective Area										
		ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL - OUTGOING	JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
SURABAYA	ENDE																63											
	KUPANG																114											
	(SURABAYA)	62	111			167		66				48			15		469											
UJUNG PANDANG	UJUNG PANDANG				165	-	126	117	119	37		41			21		626	317 / 337	64 / 68		36 / 37	23 / 24	31 / 31	25 / 39	21 / 21			517 / 557
	PARE-PARE				-	124											124											
	MANADO				65	114						24					203	116 / 120										116 / 123
	PALU					118											118											
	KENDARI					37											37											
AMBON	AMBON				53	39		17				-	62	38	70	40	319	91 / 84	15 / 10				8 / 9	13 / 17	9 / 12			136 / 140
	TERNATE											61					61											
	SORONG											44			8		52											
	JAYAPURA				17	18						54		13		12	114	39 / 37										39 / 37
	MERAUKE											45			6		51											
TOTAL - INCOMING		62	111		477	617	126	200	119	37		317	62	51	120	52												

(Note) ▱ ; Upper: Outgoing from Objective Area ; Lower: Incoming to Objective Area

Table IV-24

Originating Traffic in Non-Telephone Network (Year 2005)

Unit; Erlangs

Area \ Service	Telegram	Telex	New Services	Total - Area
Ujung Pandang	18	44.5	27	89.5
Kendari	3	3.5	2	8.5
Palu	7	16.5	10	33.5
Manado	12	27.5	16	55.5
Ambon	15	21	14	50.5
Jayapura, Meranke	7.5	19	12	38.5
Sorong	4	8	4.5	16.5
Total - Ujung Pandang	66.5	140	85.5	292.0
Kupang	9	7	4.5	20.5

Table IV-25

Distribution of Non-Telephone Traffic (Year 2005)
from Ujung Pandang Tandem Area

Unit; Erlangs

Tandem Area \ Service	Telegram	Telex	New Services	Total - Area
Ujung Pandang	12	21	13	46
Jakarta	24	70	51.5	145.5
Surabaya	18	14	8.5	40.5
Medan	6	7	4	17
Oversea	6.5	28	8.5	43
Total - Service	66.5	140	85.5	

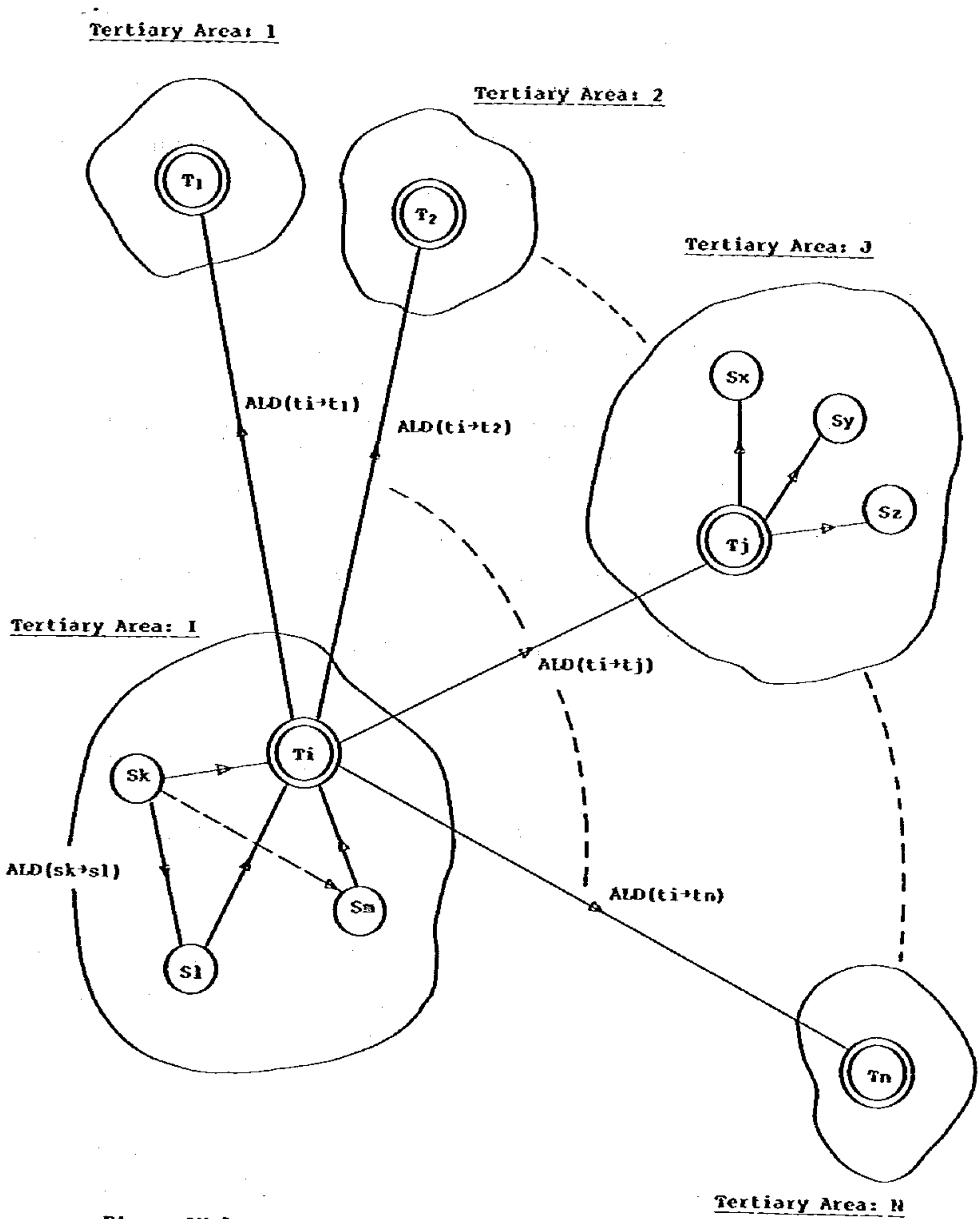


Figure IV·9

Typical Traffic Flow between Trunk Zones

7. Circuit Calculation

7.1 Calculation Methods

The methods by which to calculate the required number of circuits in telephone and non-telephone networks are as follows:

(1) Final Circuit

(a) For the section where the forecasted traffic is 30 Erlangs or less, the required number of circuits is given by means of Erlang's Loss Formula (B = 0.01)

(b) For the section where the forecasted traffic is more than 30 Erlangs, the calculation be made by

N (number of circuits) = 1.2 E + 5

where

E : Forecasted traffic in the section.

This is to avoid the traffic overload.

(2) Direct Circuit

(a) The Direct circit be established in the section where the sum of incoming and outgoing trunk circuits is greater than PCM primary group (30 circuits).

(b) the number of direct circuits be determined under the condition where the following formula holds true:

$$LTC > \frac{ATC}{K}$$

where

LTC : Calls to be carried by the last trunk circuit of the direct circuit group.

ATC : Traffic increment in the final circuit group per additional circuit.

K : Final circuit to direct circuit cost ratio.

7.2 Number of Circuits Required

(1) Telephone Network

(a) The number of trunk circuits (in the years 1989, 1994, 1999 and 2005) between Primary Center and Secondary Center in the objective area of this investigation is given in Table IV-26.

(b) The number of trunk circuits (in the years 1989, 1994, 1999 and 2005) from/to Secondary Center and Tertiary Center in the objective area of this investigation is given in Table IV-27.

(2) Non-Telephone Network

(a) The number of inter-tandem exchange circuits and junction circuits from/to Ujung Pandang is given in Table IV-28.

(b) The number of junction circuits from/to Kupang is given in Table IV-29.

Table IV-26 (1/4) Number of Telephone Trunk Circuits between Primary and Secondary Centers in Eastern Part of Indonesia

Tertiary Area (T1)	Secondary Area (S1)	Primary Area		1989					1994					1999					2005				
		Area Code	Area Name	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Circuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Circuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Circuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Circuits
Surabaya (T2)	Ende (S07)	381	ENDE																				
		382	Maumere	800	3.99	3.4	S	18	1000	4.06	4.4		20	1600	4.13	7.1		28	2400	4.18	10.8		38
		383	Larantuka	200	3.99	0.9	S	10	400	4.06	1.8		12	600	4.13	2.7		16	900	4.18	4.1		20
		384	Bajawa	400	3.99	1.7	S	12	600	4.06	2.6		16	800	4.13	3.6		18	1200	4.18	5.4		24
		385	Ruteng	900	3.99	3.9	S	20	1500	4.06	6.6		26	2400	4.13	10.7		38	3600	4.18	16.3		52
		386	Waingapu	200	3.99	0.9	S	10	400	4.06	1.8		12	600	4.13	2.7		16	900	4.18	4.1		20
		387	Waikabubak	200	3.99	0.9	S	10	400	4.06	1.8		12	600	4.13	2.7		16	900	4.18	4.1		20
	Kupang (S08)	391	KUPANG																				
		392	Soe	200	3.99	0.9	S	10	400	4.06	1.8		12	600	4.13	2.7		16	900	4.18	4.1		20
		393	Kefamenanu	200	3.99	0.9	S	10	400	4.06	1.8		12	600	4.13	2.7		16	900	4.18	4.1		20
		394	Atambua	600	3.99	2.6	S	16	1000	4.06	4.4		20	1600	4.13	7.1		28	2400	4.18	10.8		38
		395	Baa	100	3.99	0.4	S	8	200	4.06	0.9		10	300	4.13	1.3		10	500	4.18	2.3		14
		396	Seba	100	3.99	0.4	S	8	100	4.06	0.4	S	8	200	4.13	0.9	S	10	300	4.18	1.4	S	12
		397	Kalabahi	400	3.99	1.7	S	12	600	4.06	2.6		16	800	4.13	3.6		18	1200	4.18	5.4		24
		398	Ilwaki	100	3.99	0.4	S	8	100	4.06	0.4	S	8	200	4.13	0.9	S	10	300	4.18	1.4	S	12
		399	Baukau	400	3.99	1.7	S	12	600	4.06	2.6		16	1000	4.13	4.5		20	1500	4.18	6.8		28
		390	Dili	1500	3.99	6.5	S	26	2500	4.06	11.0		38	4000	4.13	17.8		54	6000	4.18	27.1		76
Ujung Pandang (T3)	Ujung Pandang (S01)	411	UJUNG PANDANG																				
		412	Watampone	600	3.99	2.6		16	800	4.06	3.5		18	1000	4.13	4.5		20	1500	4.18	6.8		28
		413	Bantaeng	1500	3.99	6.5		26	2400	4.06	10.5		38	3600	4.13	16.1		50	5400	4.18	24.4		70
		414	Benteng	600	3.99	2.6		16	1000	4.06	4.4		20	1600	4.13	7.1		28	2400	4.18	10.8		38
		415	Tanajampea	100	3.99	0.4		8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12

(Note 1) S: via Satellite
(Note 2) Traffic per Line (m Erl) and Traffic (Erl) are of one way: outgoing

Table IV-26 (2/4) Number of Telephone Trunk Circuits between Primary and Secondary Centers in Eastern Part of Indonesia

Tertiary Area (Ti)	Secondary Area (Si)	Primary Area		1989					1994					1999					2005				
		Area Code	Area Name	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits
Ujung Pandang (T3)	Pare-pare (S02)	421	PARE-PARE																				
		422	Majene	400	3.99	1.7	S	12	700	4.06	3.1		16	1100	4.13	4.9		22	1700	4.18	7.7		30
		423	Rantepao	300	3.99	1.3		10	500	4.06	2.2		14	800	4.13	3.6		18	1200	4.18	5.4		24
		424	Palopo	500	3.99	2.2		14	500	4.06	2.2		14	600	4.13	2.7		16	900	4.18	4.1		20
		425	Sengkang	400	3.99	1.7		12	600	4.06	2.6		16	800	4.13	3.6		18	1200	4.18	5.4		24
		426	Mamuju	300	3.99	1.3	S	10	500	4.06	2.2		14	800	4.13	3.6		18	1200	4.18	5.4		24
		427	Masamba	100	3.99	0.4		8	200	4.06	0.9		10	300	4.13	1.3		10	500	4.18	2.3		14
		428	Malili	100	3.99	0.4		8	200	4.06	0.9		10	300	4.13	1.3		10	500	4.18	2.3		14
		429	Karosa	100	3.99	0.4	S	8	200	4.06	0.9		10	300	4.13	1.3		10	500	4.18	2.3		14
	Manado (S03)	431	MANADO																				
		432	Tahuna	400	3.99	1.7	S	12	600	4.06	2.6	S	16	800	4.13	3.6	S	18	1200	4.18	5.4	S	24
		433	Beo	100	3.99	0.4	S	8	100	4.06	0.4	S	8	200	4.13	0.9	S	10	300	4.18	1.4	S	12
		434	Kotamobagu	600	3.99	2.6		16	800	4.06	3.5		18	1100	4.13	4.9		22	1700	4.18	7.7		30
		435	Gorontalo	3000	3.99	12.9		44	5000	4.06	21.9		64	8000	4.13	35.7		96	12000	4.18	51.9		136
		436	Tilamuta	100	3.99	0.4		8	200	4.06	0.9		10	300	4.13	1.3		10	500	4.18	2.3		14
		437	Daleleh	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3	S	10	500	4.18	2.3	S	14

(Note 1) S: Satellite Route
(Note 2) Traffic per Line (m Erl) and Traffic (Erl) are of one way: outgoing

Table IV-26 (3/4) Number of Telephone Trunk Circuits between Primary and Secondary Centers in Eastern Part of Indonesia

Tertiary Area (Ti)	Secondary Area (Si)	Primary Area		1989					1994					1999					2005				
		Area Code	Area Name	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits
Ujung Pandang (T3)	Palu (S04)	451	PALU																				
		452	Poso	1400	3.99	6.0		26	2300	4.06	10.1		36	3600	4.13	16.1		36	5400	4.18	24.4		70
		453	Toli-toli	1000	3.99	4.3		20	1600	4.06	7.0		28	2500	4.13	11.1		38	3800	4.18	17.2		54
		454	Tojo	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
		455	Kolonedale	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
		456	Bungku	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
		457	Katuga	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
		458	Luwuk	1500	3.99	6.5	S	26	2100	4.06	9.2		34	3100	4.13	13.8		46	4700	4.18	21.2		64
		459	Banggai	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
	Kendari (S05)	401	KENDARI																				
		402	Danbau	200	3.99	0.9	S	10	400	4.06	1.6		12	600	4.13	2.7		16	900	4.18	4.1		20
		403	Raha	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
		404	Papalia	100	3.99	0.4	S	8	100	4.06	0.4	S	8	200	4.13	0.9	S	10	300	4.18	1.4	S	12
		405	Kolaka	200	3.99	0.9	S	10	400	4.06	1.6		12	600	4.13	2.7		16	900	4.18	4.1		20
		406	Malamala	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12
		407	Wawotobi	100	3.99	0.4	S	8	100	4.06	0.4		8	200	4.13	0.9		10	300	4.18	1.4		12

(Note 1) S: Satellite Route
(Note 2) Traffic per Line (m Erl) and Traffic (Erl) are of one way: outgoing

Table IV-26 (4/4) Number of Telephone Trunk Circuits between Primary and Secondary Centers in Eastern Part of Indonesia

Tertiary Area (Ti)	Secondary Area (Si)	Primary Area		1989					1994					1999					2005				
		Area Code	Area Name	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits	No. of Lines	Traffic Per Line (m Erl)	Traffic (Erl)	Route	No. of Cir-cuits
Ambon (T7)	Sorong (803)	956	Fakfak	1300	4.32	6.1	S	26	2100	4.77	10.8	S	38	3300	5.27	18.8	S	58	5000	5.92	31.5	S	86
		957	Kaimana	200	3.99	0.9	S	10	300	4.06	1.3	S	10	500	4.13	2.2	S	14	800	4.18	3.4	S	18
		958	Mimika	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3	S	10	500	4.18	2.3	S	14
	Jayapura (804)	961	Biak	1600	3.84	6.6	S	26	2500	4.25	11.5	S	40	4000	4.69	20.3		60	6000	5.28	34.2		94
		962	Manokwari	1600	3.99	6.9	S	28	2500	4.06	11.0	S	38	4000	4.13	17.8	S	54	6000	4.18	27.1	S	76
		963	Serui	600	3.99	2.6	S	16	1000	4.06	4.4	S	20	1600	4.13	7.1		28	2400	4.18	10.8		38
		964	Nabire	300	3.99	1.3	S	10	500	4.06	2.2	S	14	800	4.13	3.6	S	18	1200	4.18	5.4	S	24
		965	Waren	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3		10	500	4.18	2.3		14
		966	Sarmi	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3		10	500	4.18	2.3		14
		967	JAYAPURA																				
		968	Beoga	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3	S	10	500	4.18	2.3	S	14
		969	Wamena	300	3.99	1.3	S	10	500	4.06	2.2	S	14	800	4.13	3.6	S	18	1200	4.18	5.4	S	24
		960	Kiwe	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3		10	500	4.18	2.3		14
	Merauke (805)	971	MERAUKE																				
		972	Okaba	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3		10	500	4.18	2.3		14
		973	Kiman	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3		10	500	4.18	2.3		14
		974	Koba	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3	S	10	500	4.18	2.3	S	14
		975	Tanah Merah	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3		10	500	4.18	2.3		14
		976	Agats	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3	S	10	500	4.18	2.3	S	14
		977	Cumbuyum	100	3.99	0.4	S	8	200	4.06	0.9	S	10	300	4.13	1.3	S	10	500	4.18	2.3	S	14
		978	Waropko	200	3.99	0.9	S	10	300	4.06	1.3	S	10	500	4.13	2.2		14	800	4.18	3.6		18

(Note 1) S: Satellite Route
(Note 2) Traffic per Line (m Erl) and Traffic (Erl) are of one way: outgoing

Table IV-27 (1/4) Number of Telephone Trunk Circuits from/to Secondary and Tertiary Centers in Eastern part of Indonesia (1989)

Tertiary Area	From \ To	ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL - OUTGOING	JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
		Objective Area (Eastern Part of Indonesia)																Outside Objective Area										
SURABAYA	ENDE																											
	KUPANG																											
	(SURABAYA)					78		16									94											
UJUNG PANDANG	UJUNG PANDANG				76	-	40	56	30	7							209	111 / 114	14 / 16				15 / 16	14 / 10	11 / 11			145 / 175
	PARE-PARE					43											43											
	MANADO				16	63											79	29 / 31										29 / 31
	PALU					31											31											
	KENDARI					7											7											
AMBON	AMBON																											
	TERNATE																											
	SORONG																											
	JAYAPURA																											
	MERAUKE																											
TOTAL - INCOMING					92	222	40	72	30	7																		

(Note) Diagonal cell: Upper: Outgoing from Objective Area; Lower: Incoming to Objective Area

Table IV-27 (2/4) Number of Telephone Trunk Circuits from/to Secondary and Tertiary Centers in Eastern part of Indonesia (1994)

Tertiary Area	From \ To	ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL - OUTGOING	JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
		Objective Area (Eastern Part of Indonesia)																Outside Objective Area										
SURABAYA	ENDE				36												36											
	KUPANG				53												53											
	(SURABAYA)	35	52			112		26				19					244											
UJUNG PANDANG	UJUNG PANDANG				111	-	65	84	56	22		24					362	100 / 100	26 / 27		14 / 15		22 / 22	18 / 26	17 / 17			277 / 306
	PARE-PARE					67											67											
	MANADO				26	89											115	40 / 50										40 / 50
	PALU					57											57											
	KENDARI					22											22											
AMBON	AMBON				22	22						-	36				80	30 / 37					7 / 7	7 / 8	7 / 7			59 / 59
	TERNATE											36					36											
	SORONG																											
	JAYAPURA																											
	MERAUKE																											
TOTAL - INCOMING		35	52		248	369	65	110	56	22		79	36															

(Note) ; Upper: Outgoing from Objective Area
; Lower: Incoming to Objective Area

Table IV-27 (3/4) Number of Telephone Trunk Circuits from/to Secondary and Tertiary Centers in Eastern part of Indonesia (1999)

Tertiary Area	From \ To	Objective Area (Eastern Part of Indonesia)																Outside Objective Area										
		ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL - OUTGOING	JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
SURABAYA	ENDE				52												52											
	KUPANG				89												89											
	(SURABAYA)	52	87		-	151		46				52					388											
UJUNG PANDANG	UJUNG PANDANG				151	-	105	122	94	33		43			13		561	200 / 294	44 / 47		25 / 26	16 / 16	31 / 31	27 / 37	23 / 23			446 / 474
	PARE-PARE					104											104											
	MANADO				45	119						17					181	81 / 86										81 / 86
	PALU					93											93											
	KENDARI					34											34											
AMBON	AMBON				42	61		12				-	53	36	71	38	313	95 / 69					11 / 13	15 / 19	13 / 14			134 / 135
	TERNATE											53					53											
	SORONG											38			6		44											
	JAYAPURA					11						66		9		9	95	25 / 24										25 / 24
	MERAUKE											40			6		46											
TOTAL - INCOMING		52	87		379	573	105	180	94	33		309	53	45	96	47												

(Note) ⧄ ; Upper: Outgoing from Objective Area
; Lower: Incoming to Objective Area

Table IV-27 (4/4) Number of Telephone Trunk Circuits from/to Secondary and Tertiary Centers in Eastern part of Indonesia (2005)

Tertiary Area	From \ To	ENDE	KUPANG		(SURABAYA)	UJUNG PANDANG	PARE-PARE	MANADO	PALU	KENDARI		AMBON	TERNATE	SORONG	JAYAPURA	MERAUKE	TOTAL - OUTGOING	JAKARTA	BANDUNG		MALANG	DENPASAR	BANJAR - MASIN	MEDAN	PALEMBANG			TOTAL
		Objective Area (Eastern Part of Indonesia)																Outside Objective Area										
SURABAYA	ENDE				81												81											
	KUPANG				142												142											
	(SURABAYA)	80	139			220		70		-		68			17		594								-			
UJUNG PANDANG	UJUNG PANDANG				218	-	157	155	148	50		58			23		809	413/438	68/73		40/41	25/26	43/43	36/52	31/31			656/704
	PARE-PARE					154											154											
	MANADO				69	152						28					249	123/130										123/130
	PALU					147											147											
	KENDARI					50											50											
AMBON	AMBON				74	56		20				-	80	55	89	57	431	123/114	17/20				15/17	22/27	17/21			194/199
	TERNATE											79					79											
	SORONG											59			12		71											
	JAYAPURA				19	20						71		18		17	145	42/40										42/40
	MERAUKE											64			9		73											
TOTAL - INCOMING		80	139		603	799	157	245	148	50		427	80	73	150	74												

(Note) ; Upper: Outgoing from Objective Area
; Lower: Incoming to Objective Area

Table 28 Non-Telephone Circuits (Year 2005) between Ujung Pandang and Main Offices

Main Offices	No. of Circuits (OG + IC)
Jakarta	412
Surabaya	122
Medan	62
Overseas	130
Kendari	36
Palu	104
Manado	164
Ambon	148
Jayapura	118
Sorong	58
Total	1,354

Table 29 Non-Telephone Circuits (Year 2005) between Kupang and Surabaya/Denpasar

Tandem Exchange	No. of Circuit (OG + IC)
Surabaya/Denpasar	60

V SELECTION OF TERRESTRIAL TRANSMISSION ROUTE AND TRANSMISSION SYSTEM

V. Selection of Terrestrial Transmission Route and Transmission System

What are the optimum transmission route and transmission system from the viewpoint of most effective constitution of toll telephone circuits connecting major cities in the eastern region of Indonesia and of non-voice circuits, such as data communication and facsimile circuits, in that region, based on the demand forecast made in the preceding Chapter? Study about the selection of such transmission route and transmission system is the subject of this and succeeding chapters.

The transmission route and transmission system selected for the objective areas of study are illustrated en bloc in Figure V-1. This chapter deals with the selection of transmission route and system for the overland section. About the selection of transmission route and system for the submarine section that connect one island to another, a detailed description will be made in the next chapter.

1. Selection of Terrestrial Transmission Route

1.1 Basic Conditions of Selection

Main points to be considered in the selection of terrestrial transmission route are as follows:

(1) Generally, the transmission system construction cost increases in proportion to the transmission distance, so that the transmission route should be as short as possible. Especially in the case of digital transmission system, the terminal system cost can be reduced to less than one-severalth of the cost required in the case of analog system, but the repeater system cost increases to several times as

much. Hence the need for selection of the shortest possible transmission route, i.e., the route where the number of repeater station can be reduced to the minimum.

(2) From the viewpoint of construction cost curtailment, as well as the ease of maintenance and operation, repeater sites should be selected near the public road as far as the situation permits. Selection of repeater sites at such places that are located far from the public road so that access roads must be newly built or such places that require land readjustment at high cost should be avoided.

(3) The transmission route to be selected must of course be such that will connect all cities covered by the study. The transmission route must also be such that branching/insertion to/from small local cities outside the objective cities of the study, which may be required in the future, is easy.

(4) For the transmission route, the areas of adverse geographic conditions, such as volcanic zone, frequent flood zone and moist zone, should be avoided. In the case of terrestrial radio transmission route, the paddy field zone and the sea section should be avoided to the utmost because they exert an ill influence on radio propagation characteristics.

In the actual selection of transmission route, several other conditions than those basic conditions must also be studied in full depth.

1.2 Existing Status of Roads and Road Construction Plans in Objective Areas of Study

Most important out of the foregoing basic conditions of terrestrial transmission route selection is the status of road network. Therefore, the study as to whether the roads are already well developed or will henceforward be newly constructed in the objective areas of study has also vitally to do with the selection of transmission route.

Study findings from the foregoing viewpoint are summarized and graphically presented in Figures V-2, V-3, V-4 and V-5. Descriptions by regions follow:

(1) Sulawesi Region

(Refer to Figure V2.)
Both backbone and branch road networks have already been constructed except in a few sections. Even in those sections, the road construction/improvement is scheduled to be completed in the near future.

(2) Nusa Tenggara Timur and Timor Timur Regions

(Refer to Figure V-3.)
As in Sulawesi region, both backbone and branch networks are complete except in a few sections where the construction/improvement work is now underway.

(3) Maluku Region

(Refer to Figure V-4.)
Almost all roads are in the planning stage.
According to the Government of Indonesia authorities in charge of road administration, the completion of those planned roads is expected in the closing period of REPELITA IV, or, more precisely, in 1990.

(4) Irian Jaya Region

(Refer to Figure V-5).
The road improvement work in this region is lagging far behind, compared with other regions. Authorities concerned initially scheduled the completion of Jayapura - Merauke and Nabire - Wamena roads at the end of 1981, but the construction has not yet been completed. Road construction in other sections belongs to the master plan formulated as part of regional transmigration program, scheduled to be completed by the year 2000. Both the commencement and completion periods for these road construction works, as well as other construction work details, are not yet to be determined.

In Sulawesi and Nusa Tenggara Timur/Timor Timur regions, the road construction/improvement is practically complete so that no serious trouble is foreseen in the introduction of terrestrial transmission network. However, in Maluku and Irian Jaya regions, where the road development/improvement work is delayed, the introduction of terrestrial transmission network is difficult for the time being. Hence, for the planning of transmission network introduction in these regions, an in-depth study of the progress of road development work is prerequisite.

This study assumes that all the illustrated road development plans have been completed according to the schedule and, on such assumption, formulates the master plan for the projected terrestrial transmission network.

1.3 Transmission Route Plan

Based on the aforementioned basic conditions of transmission route selection and the road constructon/improvement plans, the transmission route plan, inclusive of the alternate route plan, covering the whole target areas of study has been formulated. The plan appears in Figure V-1.

The transmission route plan has been selected as a realizable route. The selection followed the general study of radio propagation path outlines on the topographical maps of the scale of 1:500,000 and, for part of the areas, 1:1,000,000. Therefore, each section distance indicated in the illustration is not the point-to-point linear distance but in the radio transmission route distance that extends by way of through repeater sites scheduled to be established.

The transmission route plan, however, is a schematic route plan formulated by on-the-table design only. Therefore, at the time of project implementation, the plan must of course be modified where necessary, based on the findings in more detailed investigations and studies including field surveys.

1.4 In-depth Study of Transmission Route Plan

(1) Areas where terrestrial transmission route network formation is impossible and relief measure for those areas

Cities in part of the objective areas of investigation cannot be covered by the terrestrial transmission network.
The reasons are as follows:

a. The public road construction plan does not exist. Nor can the road improvement be expected in the foreseeable future. (Refer to Paragraph 1.2 of this Chapter.)

b. Being located in scattered remote islands. In the digital radio system, the maximum no-repeater section length for oversea propagation is about 110 km. For the longer section than this, the network formation is technically impossible.

The number of cities that cannot be covered by the terrestrial transmission network for the reasons mentioned above is tabulated below.

Region	No. of City That Cannot be covered	No. of All Objective Cities
Sulawesi Selatan	0	14
Sulawesi Utara	3	7
Sulawesi Tengah	0	9
Sulawesi Tenggara	1	7
Maluku	7	19
Irian Jaya	12	26
Nusa Tenggara Timur	2	15
Timor Timur	0	2
Total	25	99

The sole relief measure presently available for those cities that cannot be covered by the terrestrial tarnsmission network is by the domestic satellite communication system. Therefore, the relief measure issue is excluded from the scope of study.

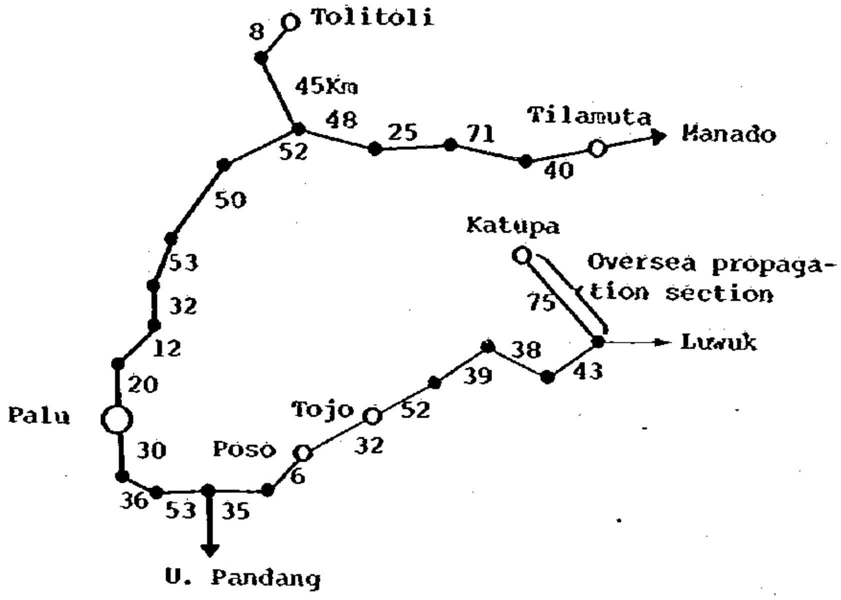
(2) Study of Alternate Route Plan

For Palu - Tilamuta and Ende - Kupang sections, the alternate route plans can be considered. Each alternate route plan for each section has its merits and demerits.

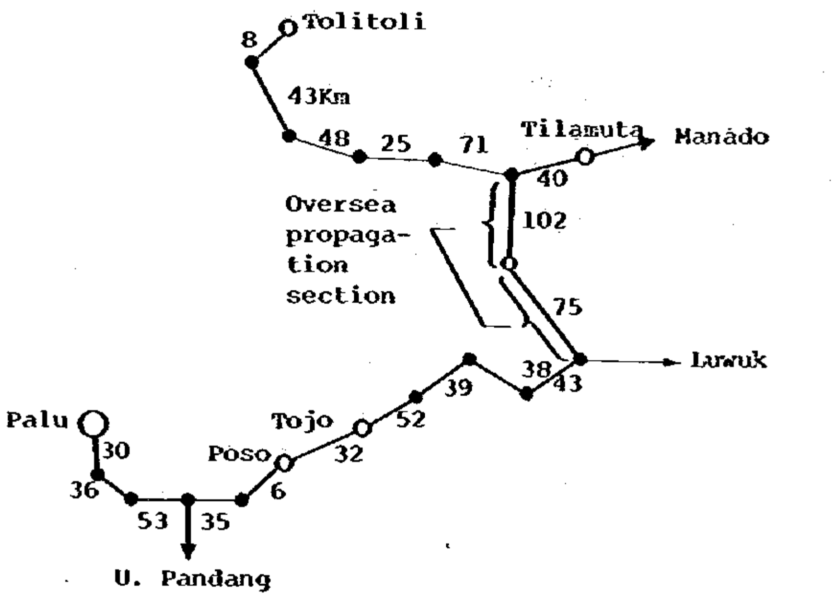
a. Palu - Tilamuta Section

Two alternate route plans, A and B, which are illustrated below, can be taken up for comparison.

- Alternate Route Plan A



- Alternate Route Plan B



Comparison between the above two alternate route plans follows:

o Route Distance

Plan A route is 893 km long (repeaters: 18) and Plan B route 776 km long (repeaters: 13). Plan B route commands greater advantage.

o Propagation Conditions

Plan A route includes one oversea propagation section on the spur route whereas Plan B route comprises two oversea propagation sections on the main route. In these oversea propagation sections, the adoption of space diversity system and automatic equalizer is necessary in order to keep transmission performance at the required level. For this reason, the system cost in the oversea propagation section becomes about 1.5 times the system cost in the overland propagation section.

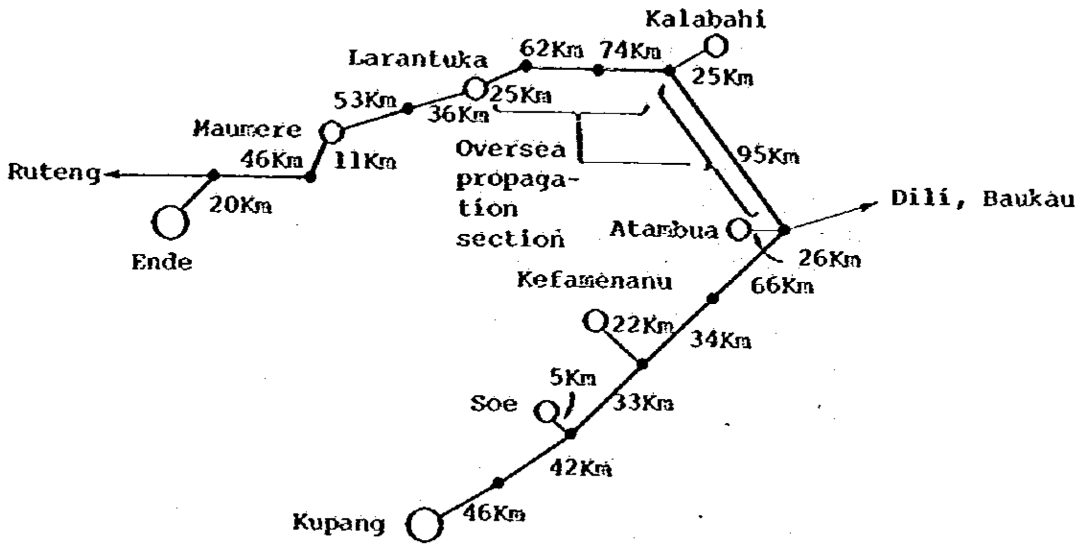
o Relief of Local Cities

In Palu - Tolitoli section on Plan A route are scattered local cities including Tobali, Ampebado and Sigenti. When the system branching to those local cities becomes necessary in the future, Plan A route can attain such purpose with advantage.

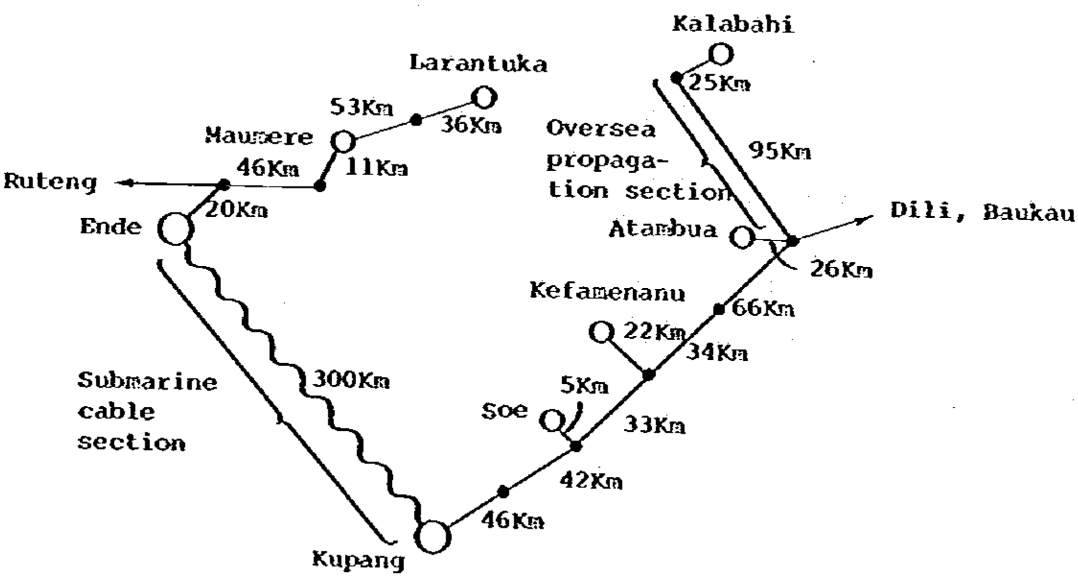
b. Ende - Kupang Section

For this section, two alternate route plans, A and B, illustrated below, can be considered.

- Alternate Route Plan A



- Alternate Route Plan B



Comparison between the above two alternate route plans follows:

o Route Distance

Plan A route is 721 km long (repeaters: 11). Plan B route consists of 560 km long overland route (repeaters: 9) and about 300 km long submarine route. Plan A route commands greater advantage.

o Propagation Conditions

Plan A route includes four oversea propagation sections but Plan B route comprises only one oversea propagation section.

o Topography

Larantuke - Kalabahi section on Plan A route belongs to the active volcanic zone. Furthermore, this section extends via two islands, and the repeater station must be established on each island. Therefore, Plan A route involves greater disadvantages than Plan B route in terms of construction, maintenance and operation.

o Network Formation

Both Ende and Kupang are the Secondary Centers. Maumere and Larantuka are the Primary Centers in the Ende area. Other cities are the Primary Centers in the Kupang area. From the viewpoint of network formation, the optimum choice is to connect the two Secondary Centers, i.e., Ende and Kupang, by the shortest distance.

From the economic viewpoint only, Plan B route is preferable for Palu - Tilamute section and Plan A route is advantageous for Ende - Kupang section. However, since there are other factors to be considered, it will be hasty to draw a conclusion by economic considerations only.

Decision as to which route plan to adopt depends upon the result of detailed comparative study of all route plans at the time of project implementation.

1.5 Circuit Distribution on Selected Transmission Route

When the inter-city circuit requirements forecasted in Chapter IV are distributed on the transmission routes selected in the preceding Paragraph, the results are as shown in Figures V-6, V-7, V-8, V-9, V-10, V-11, V-12, V-13 and V-14. These route by route circuit distribution charts include the submarine cable sections. (See Figure V-14.) The selection of submarine cable sections is based on the study which is made in the next chapter.

The inter-city circuit requirements in the illustrations are given in the 110% value of the forecasted telephone circuit demand as of 2005, the final year of the plan, this time. The figure in parentheses is the number of basic primary groups required when the above circuit requirements are calculated in terms of basic primary group of 30 channels. The reason why the inter-city circuit requirements are indicated in the 110% value of telephone ciruit demand is this: As is stated in Appendix V-1, no-voice circuit, such as data communication and facsimile, circuit requirements are calculated in terms of telephone circuits, i.e., at the same transmission bit rate of 64 Kbit/s as in telephone circuits, and, as the result, no-voice circuit requirements between cities are estimated uniformly at 10% of telephone circuit requirements.

The circuit distribution summary by transmission routes follows:

(1) Between Secondary Center and Primary Center: On all routes except two, the circuit distribution comprises 180 channels (30 channels x 6) or less. The two exceptions are Kupang - Soe route with 300 channels (30 channels x 10) distributed and Soe - Atambua route with 270 channels (30 channels x 9) distributed. Both these routes are Plan B routes.

(2) Between Tertiary Center and Secondary Center and between Secondary Centers: On each route, the number of circuits distributed is not uniform as shown below.

Route	Circuit Distribution Minimum		Maximum
Ujung Pandang - Manado	900 ch	-	1,770 ch
Malili (Ujung Pandang) - Kendari	120 ch	-	180 ch
Ende - Kupang (Plan A route)	330 ch	-	630 ch
Jayapura - Merauke	210 ch	-	270 ch

(3) Submarine cable route: The number of circuits distributed varies from route to route as shown below.

Route	Circuit Distribution
Ujung Pandang - Ambon	1,290 ch
Ambon - Ternate	210 ch
Ambon - Sorong	810 ch
Sorong - Biak	660 ch
Biak - Jayapura	960 ch
Ende - Kupang	330 ch

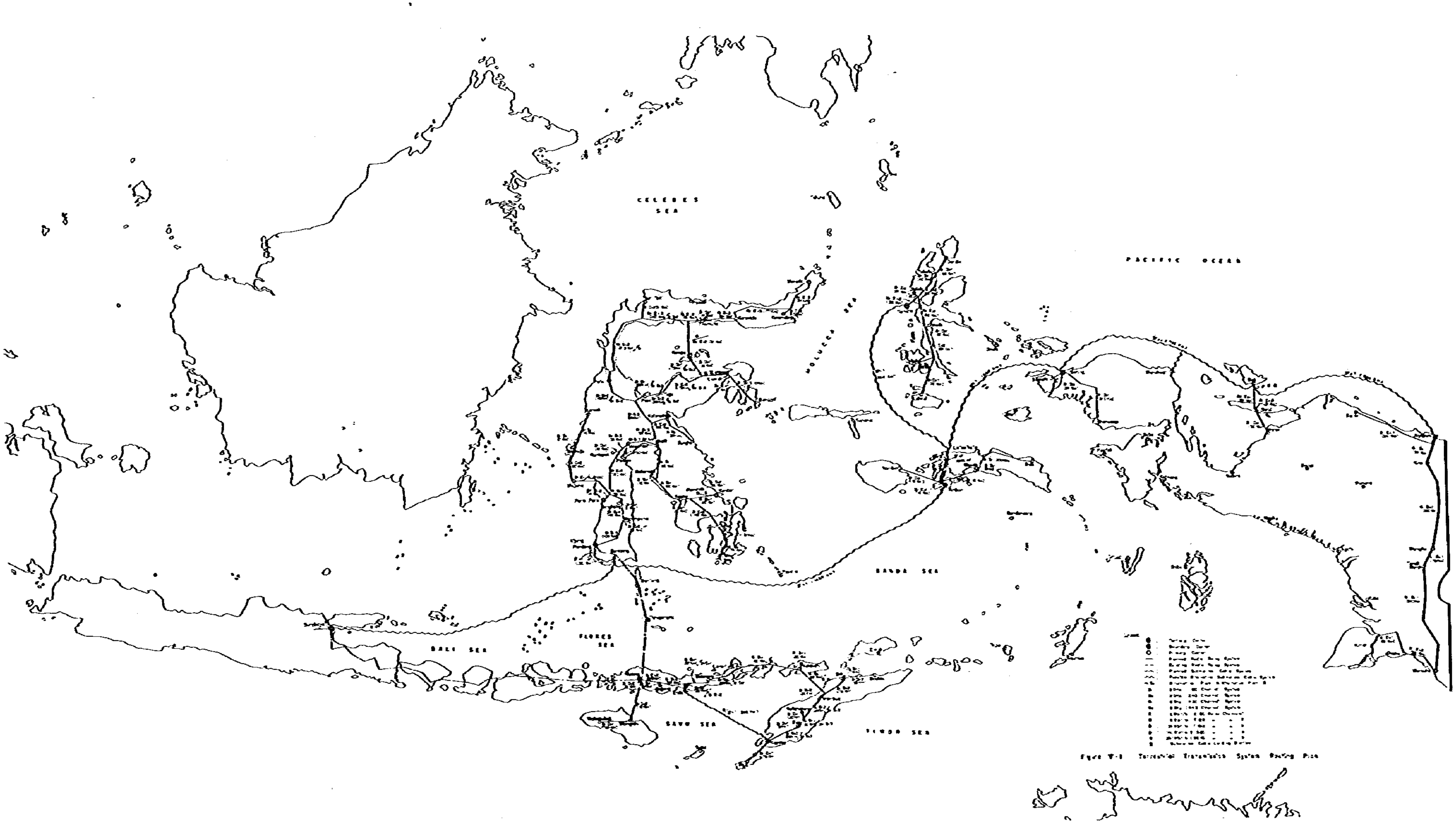


Figure V-1 Terrestrial Transmission System Routing Plan

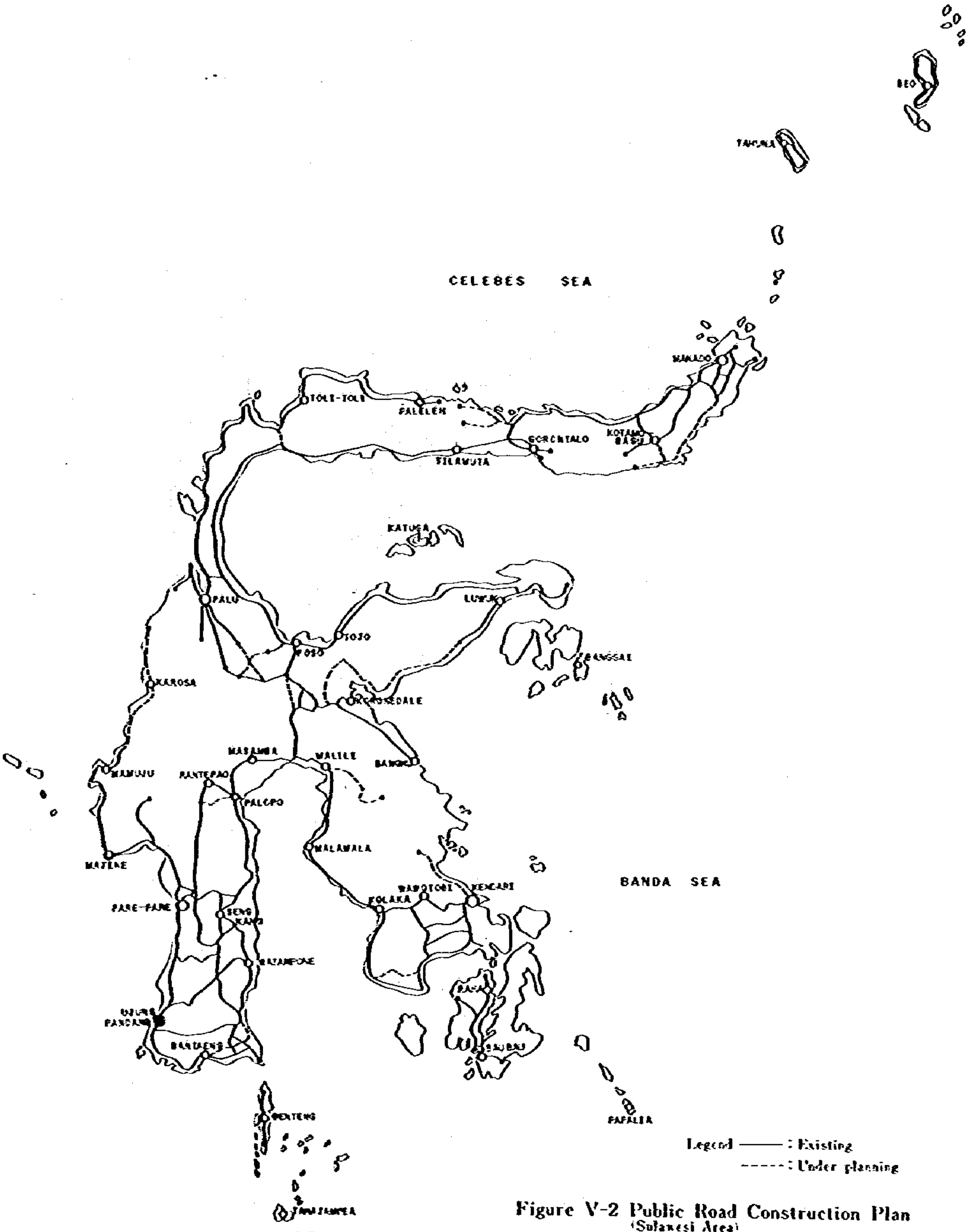


Figure V-2 Public Road Construction Plan
(Sulawesi Area)

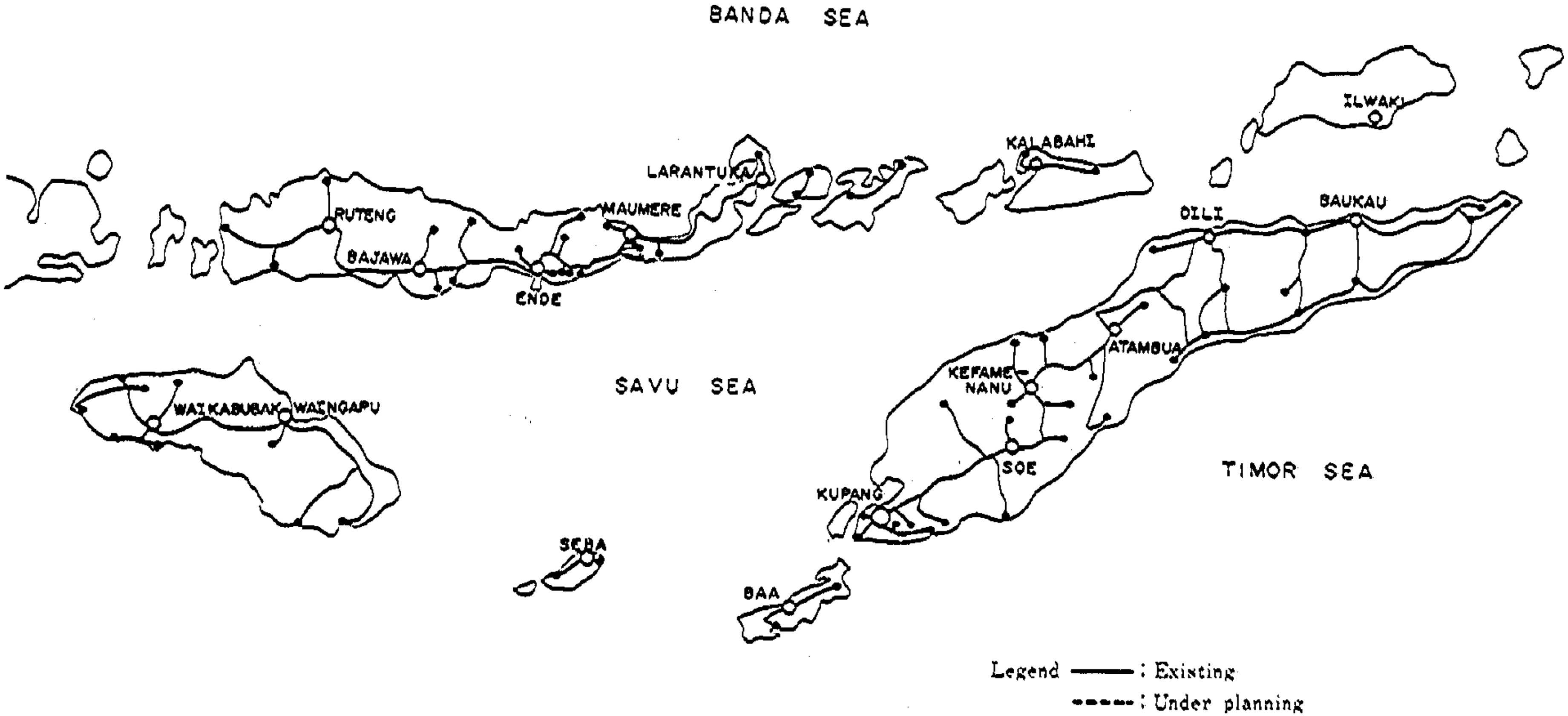


Figure V-3 Public Road Construction Plan
(Nusa Tenggara Timur and Timor Timur Areas)

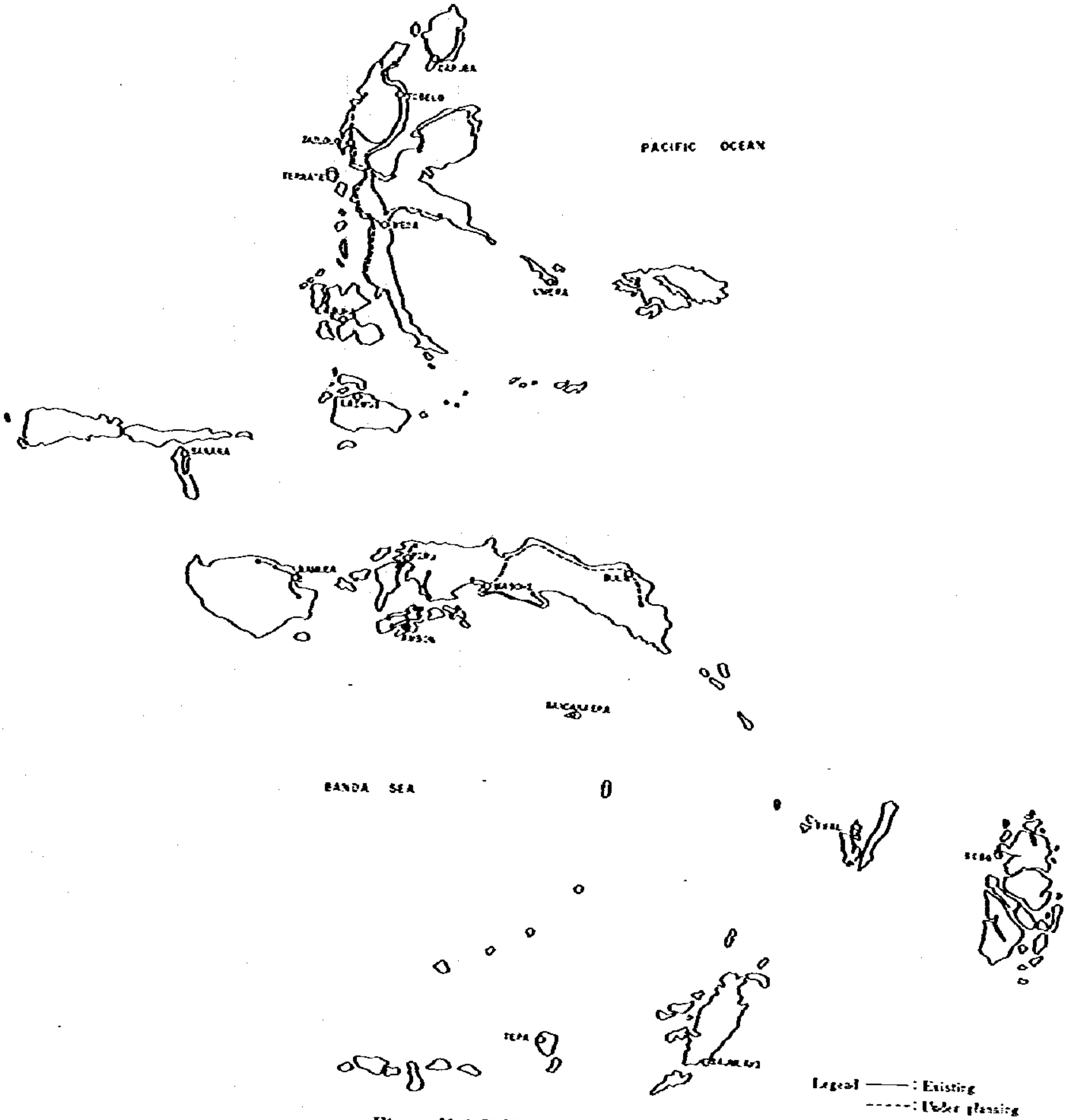


Figure V-4 Public Road Construction Plan
(Maluku Area)

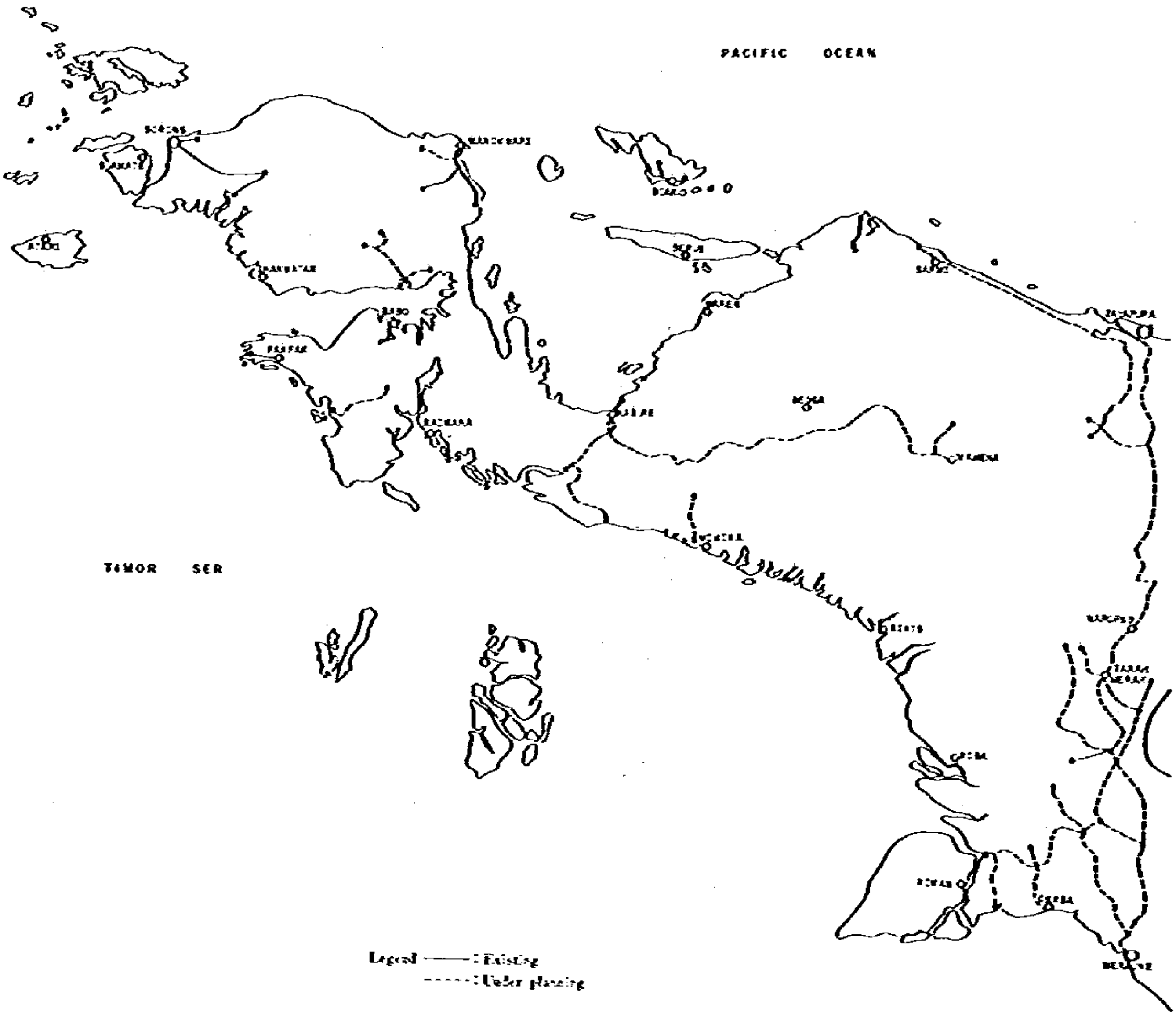


Figure V-5 Public Road Construction Plan
Irian Jaya Area

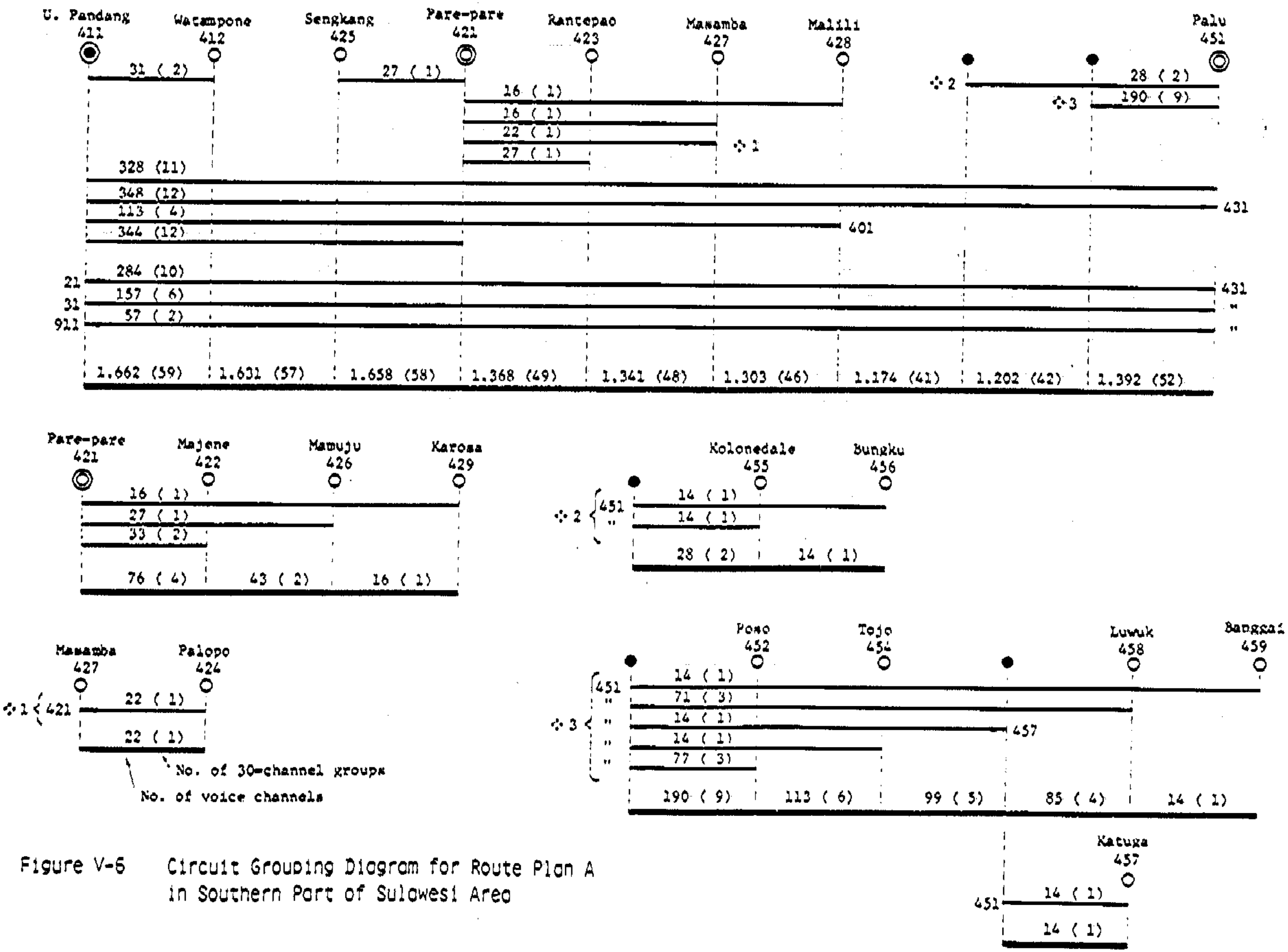
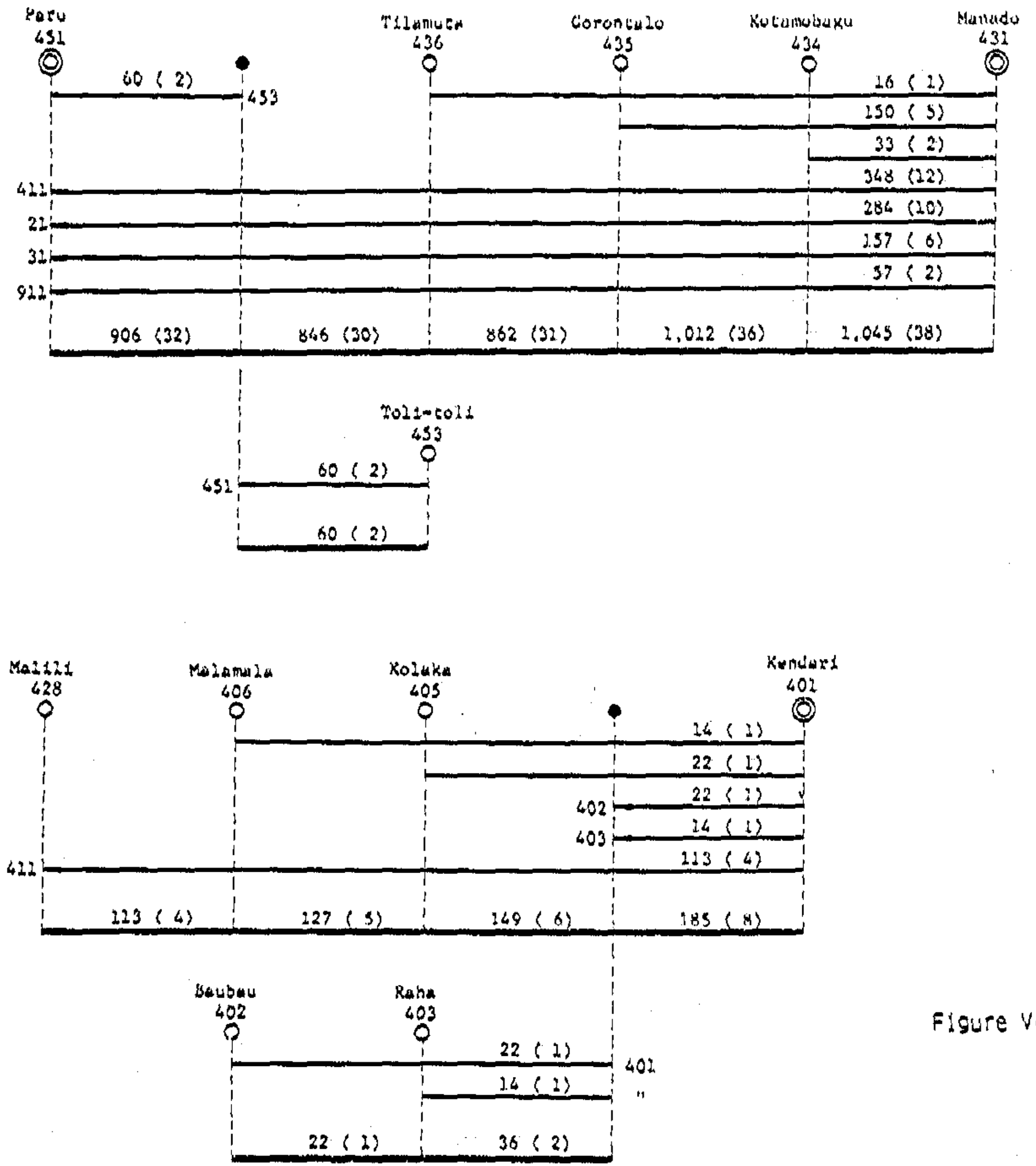


Figure V-6 Circuit Grouping Diagram for Route Plan A in Southern Part of Sulowesi Area



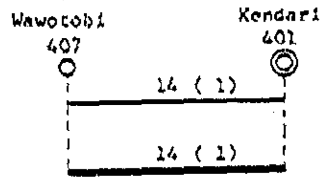
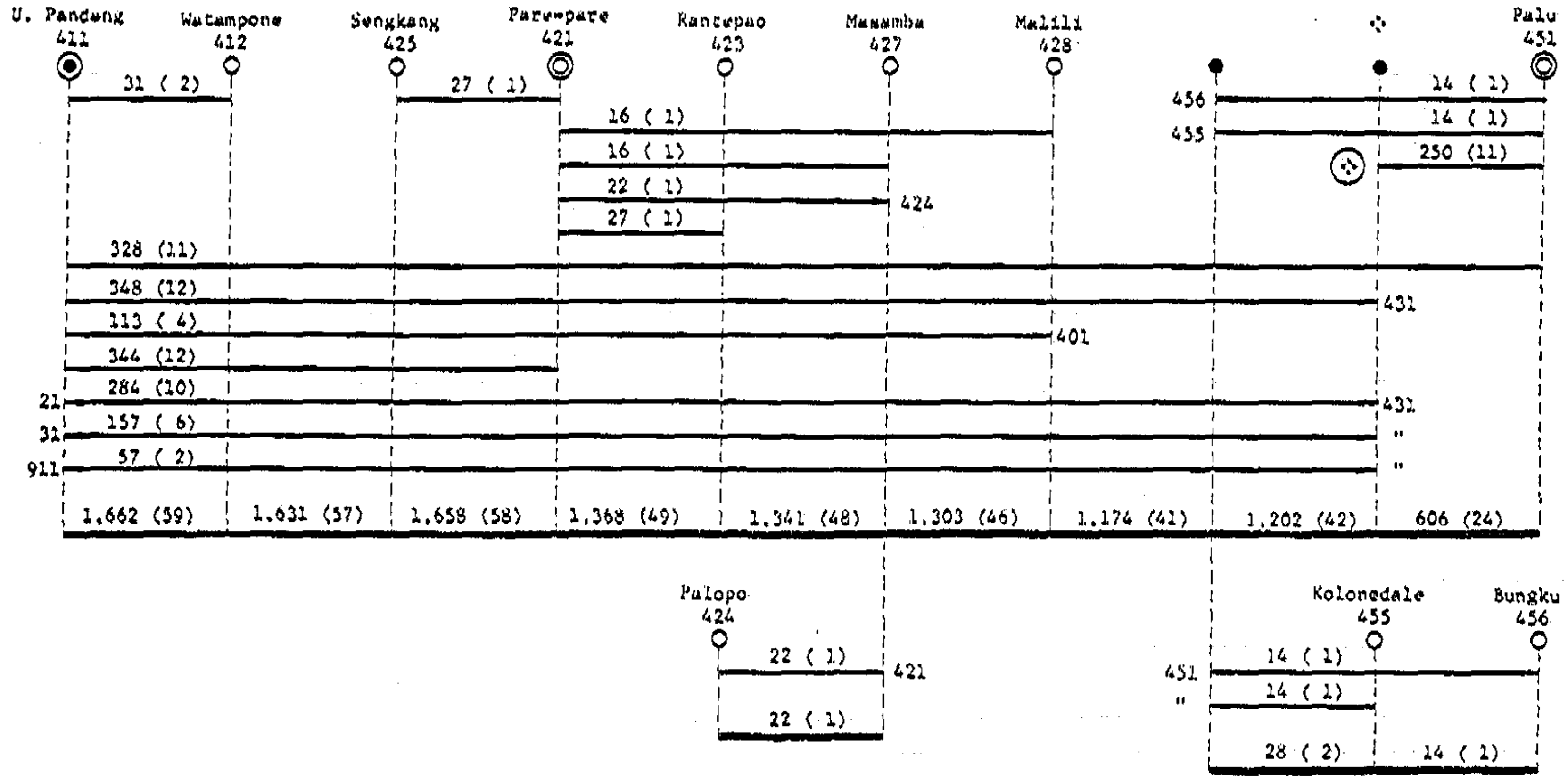


Figure V-7 Circuit Grouping Diagram for Route Plan A in Northern Part of Sulawesi Area



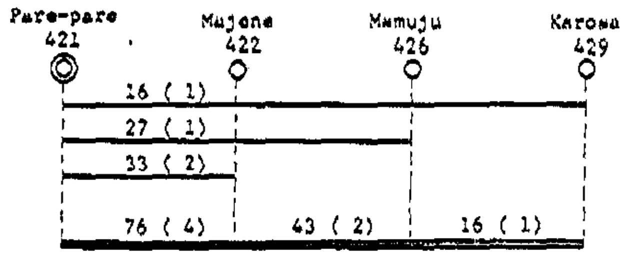


Figure V-8 Circuit Grouping Diagram for Route Plan B in Southern Part of Sulawesi Area

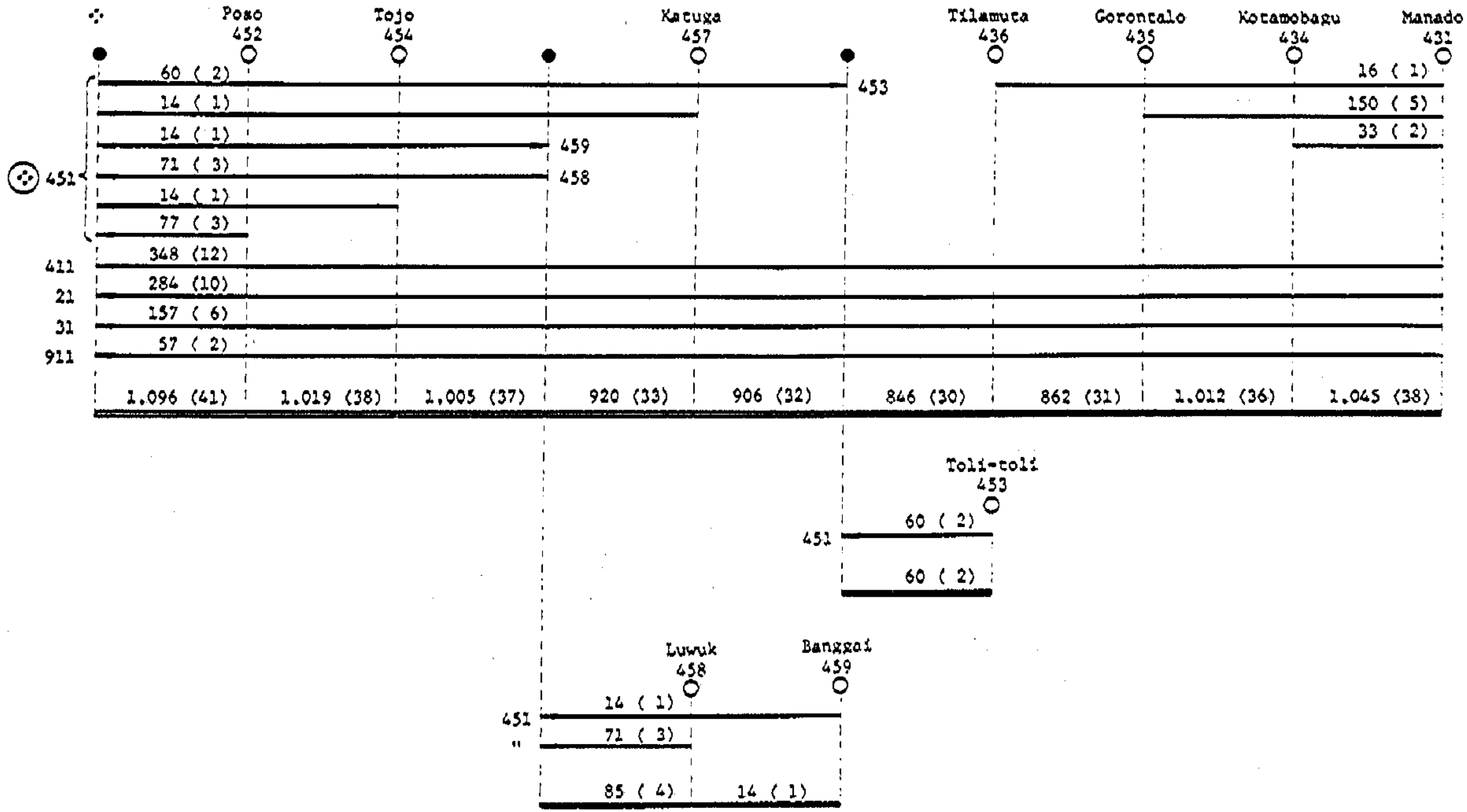


Figure V-9 Circuit Grouping Diagram for Route Plan B in Northern Part of Sulawesi Area

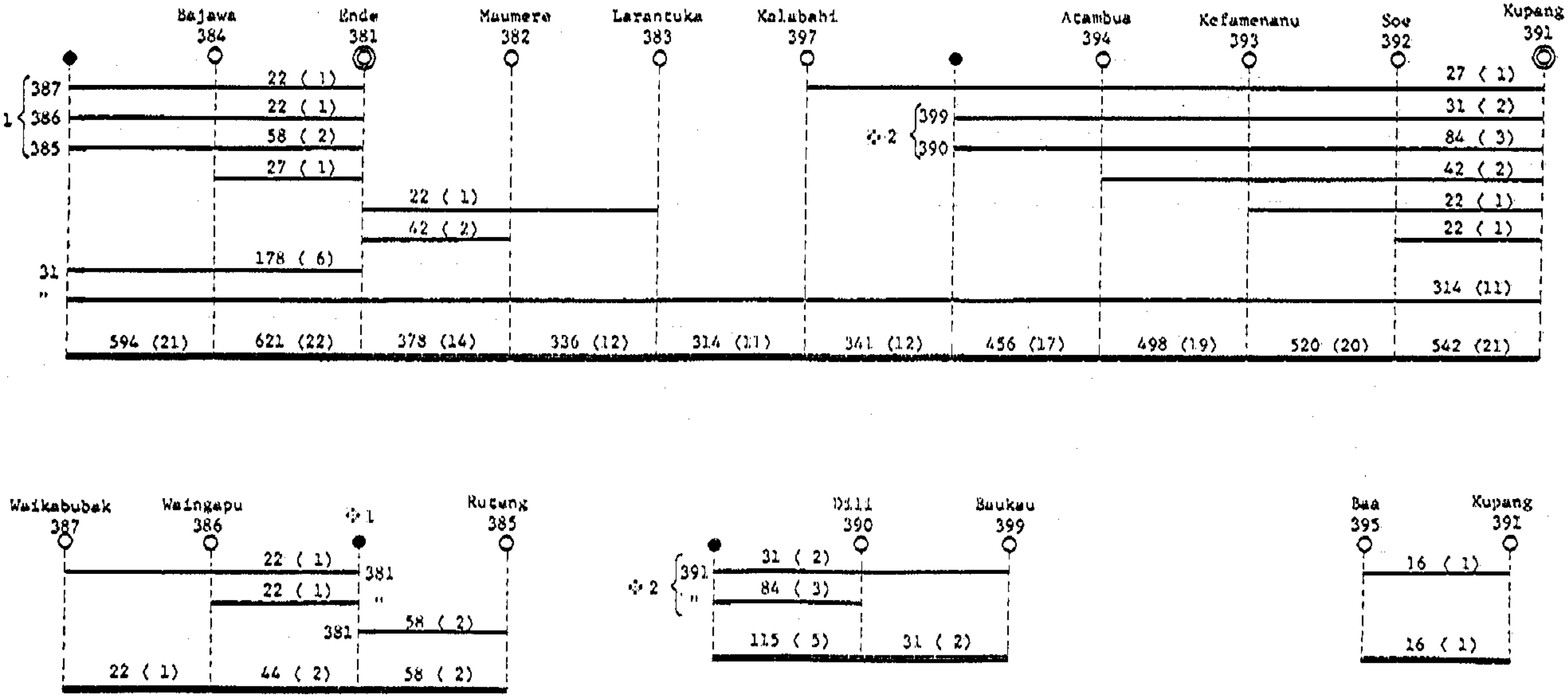


Figure V-10 Circuit Grouping Diagram for Route Plan A in Nusa Tenggara Timur and Timor Timur Areas

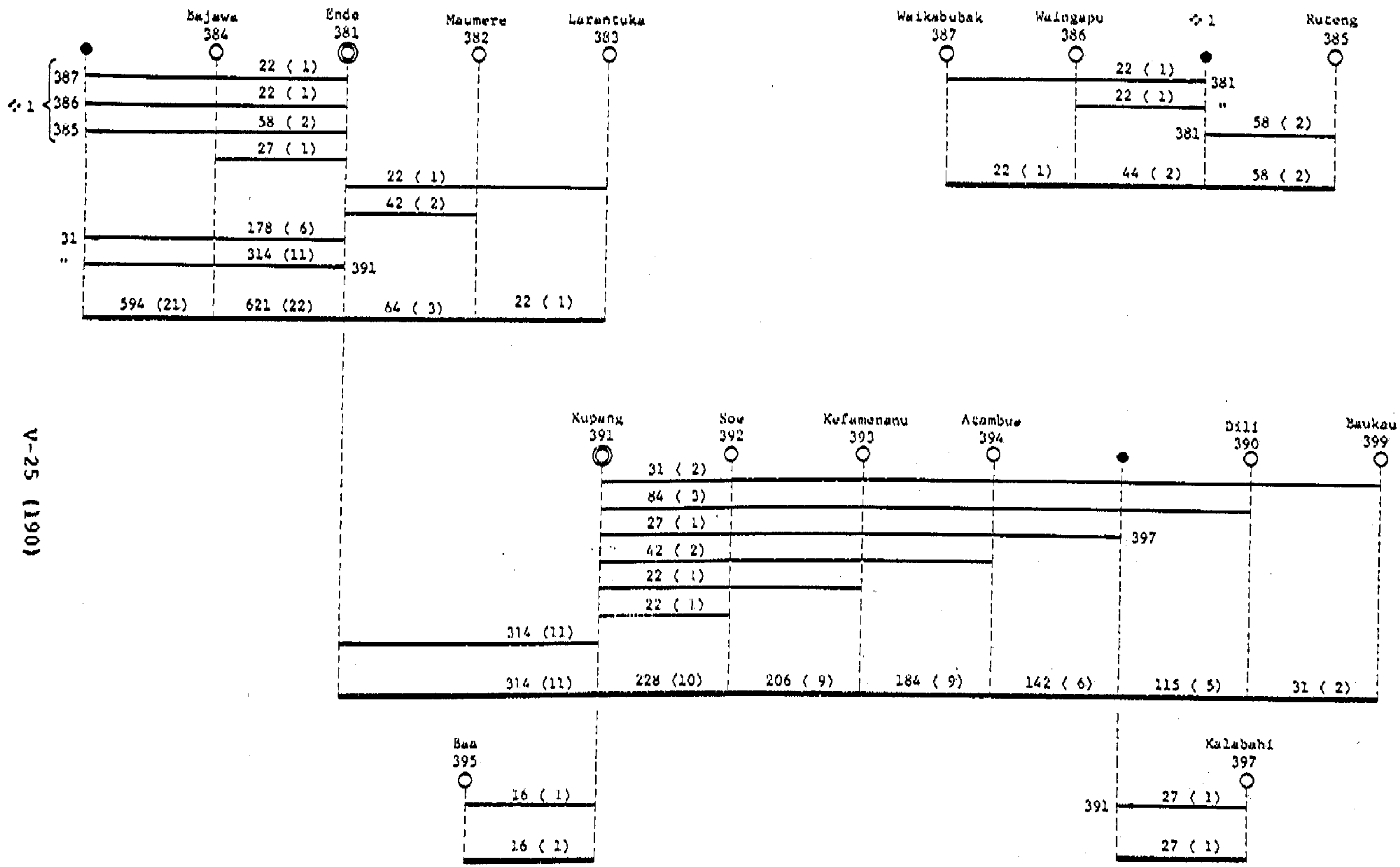


Figure V-11 Circuit Grouping Diagram for Route Plan B in Nusa Tenggara Timur and Timor Timur Areas

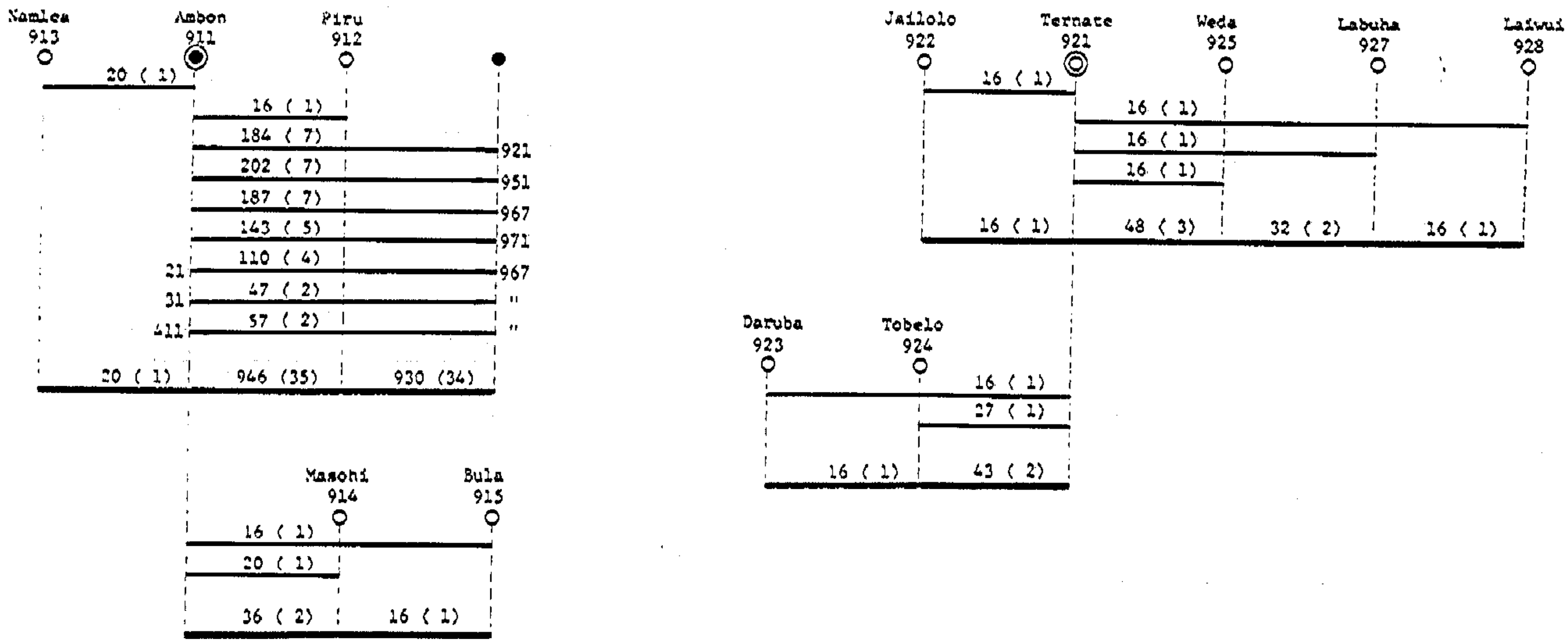


Figure V-12   Circuit Grouping Diagram in Maluku Area

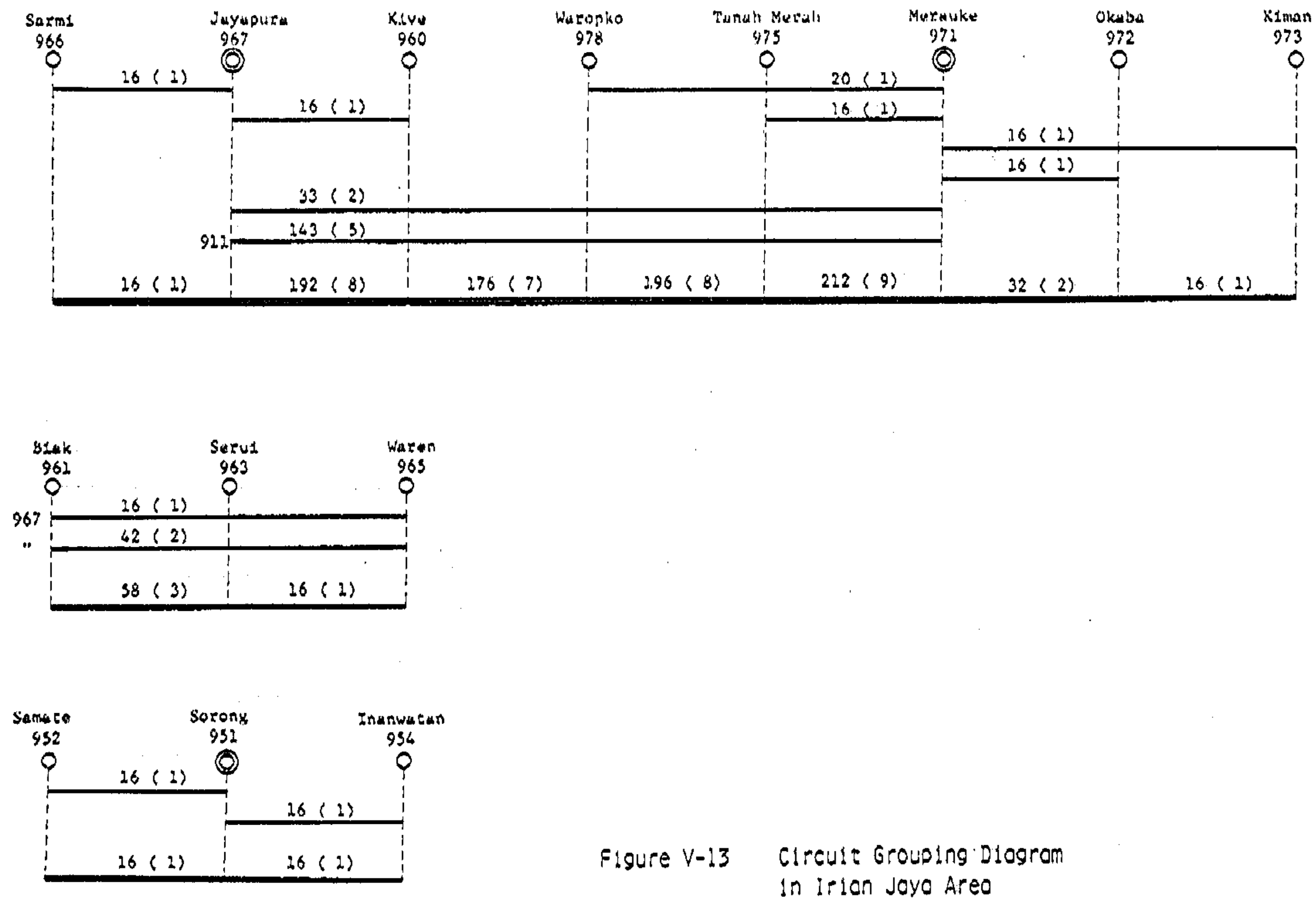


Figure V-13 Circuit Grouping Diagram in Irian Jaya Area

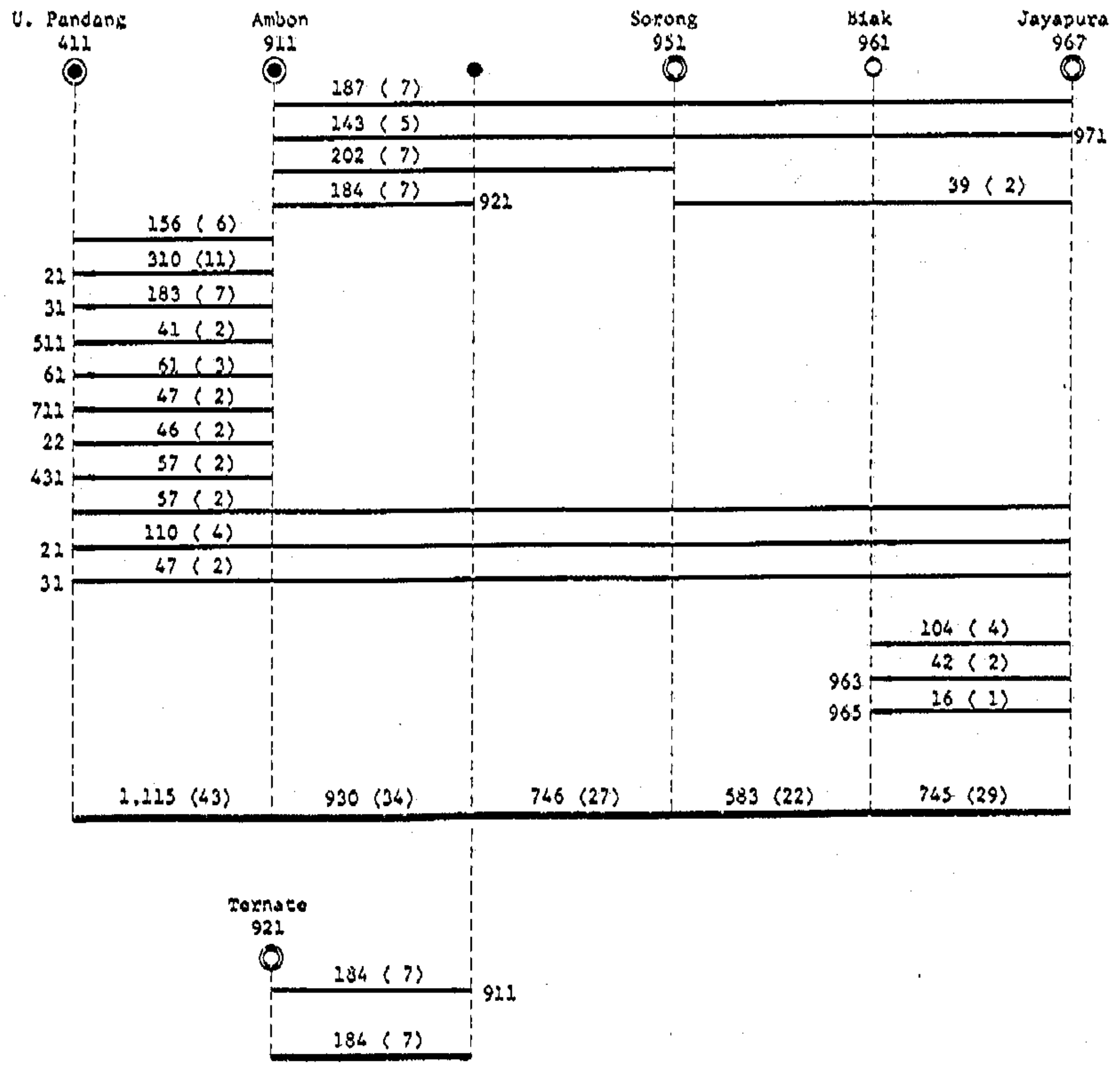


Figure V-14 Circuit Grouping Diagram on Submarine Cable Route

2. Selection of Terrestiral Transmission System

In this study, for the transmision system to be adopted in the terrestiral section, the line-of-sight UHF and SHF radio systems of digital configuration will be taken up for consideration. (Refer to chapter III Basic Philosophy and Preconditions of Study.)

This Paragraph is dedicated to the study of digital radio systems of all kinds so far developed in UHF and SHF frequency bands. The 2 GHz system for UHF band and the 6 GHz (upper band) system for SHF band have been selected as optimum systems. The reasons of this selection are described below.

2.1 Selection of Optimum Frequency Band

(1) Selection of 2 GHz Band

The frequency band commonly used for multiplex telephone repeating in UHF band is from 800 MHz to 2 GHz. Here, the selection is made for 2 GHz band. The reasons are:

a. In the circuit formation, it is generally the case that the equipment cost increases proportionally as a higher frequency is adopted. Contrarily, the antenna directivity deteriorates, or, when space diversity is employed, a large antenna spacing is required as a lower frequency is used. Therefore, depending upon the section, the system cost is bound to increase unproportionally as a lower frequency is used.