b. The 800 MHz freqeuncy band is for mobile radio communication and, as such, is being developed and put to practical use in many other countries. (Refer to Radio Regulation No. 701.) In Indonesia also, the 800 MHz frequency band should be preserved for use in mobile radio communication. The radio system of this frequency band is being developed and applied to medium/small capacity, short section communications, so that it should be utilized for local/rural system, such as radio link betwen Primary Center and Local Exchange.

c. With regard to the 2 GHz frequency allocation, CCIR recommendation (Rec. 283-3) is already available. Therefore, the practicing and diffusion of the 2 GHz system are expected to be earlier than for other systems.

(2) Selection of 6 GHz Band (Upper Band)

Frequency bands to be taken up for study in SHF bandwidth are 4 GHz to 10 GHz bands and higher than 10 GHz bands. Out of these frequency bands, the selection is made for 6 GHz band (upper band). The reasons are:

a. Higher than 10 GHz band frequencies suffer great attenuation due to rainfall. This fact imposes not a few constraints on system formation, such as necessity for reducing repeater spacing. Those constraints are especially serious in Indonesia that belongs to the tropical zone. Therefore, any frequency of higher than 10 GHz band is not fit for use in long distance transmission.

b. In Indonesia, the 4 GHz and 6 GHz (lower band) bands are presently allocated to the PALAPA system (domestic satellite communication system). In view of radio interference, the application of those two frequency bands to any other system should be avoided.

c. The 7 GHz band is allocated to the PALAPA system's approach link so that this frequency band also should not be used in other systems. (In the objective areas of this study, the 7 GHz band is now used at Ambon, Jayapura, Kendari, Kupang and Ujung Pandang.)

d. The remaining frequency bands available are the 5 GHz, 6 GHz (upper band) and 8 GHz bands. Out of these, the 6 GHz band digital system will be earliest developed and practiced and most rapidly diffused. This judgment can be reached from the development trend of the traditional analog system.

2.2 Selection of Optimum System

The digital radio system is presently in the initial stage of practical applications. Although various prototype systems are being developed in many other countries, the worldwide standard system has not yet been established. For the 2 GHz and 6 GHz band digital radio systems selected in the preceding Paragraph also, one system after another is being developed. The 2 GHz and 6 GHz band digital radio systems developed in Japan and other countries are listed below, classified by transmission capacity and modulation system.

o 2 GHz System

Transmission Capacity: Transmission Bit Rate	Transmission Capacity: No. of Circuits in Terms of Telephone Circuits	Modulation System
2 Mbit/s	30	2 PSK
2 Mbit/s x 2	60	4 PSK
8 Mbit/s	120	2 PSK
8 Mbit/s x 2	240	4 PSK
*34 Mbit/s	480	2 or 4 PSK
*34 Mbit/s x 2	960	4 PSK

Note: Marked with * is the wide band system only.

o 6 GHz System

Transmission Capacity: Transmission Bit Rate	Transmission Capacity: No. of Circuits in Terms of Telephone Circuits	Modulation System
34 Mbit/s	480	2 or 4 PSK
34 Mbit/s x 2	960	4 PSK
34 Mbit/s x 3	1,440	8 PSK
34 Mbit/s x 4 or 140 Mbit/s	1,920	16 QAM

After the study of all the foregoing systems, the selection is made for the undermentioned systems as being fit for use in the objective areas of this study.

o 2 GHz System

Transmission Capacity: Transmission Bit Rate	Transmission Capacity: No. of Circuits in Terms of Telephone Circuits	Modulation System
2 Mbit/s	60	4 PSK
8 Mbit/s x 2	240	4 PSK

o 6 GHz System

Transmission Capacity		Modulation System
Transmission Bit Rate	No. of Circuits in Terms of Telephone Circuits	
34 Mbit/s	480	4 PSK
34 Mbit/s x 3	1,440	8 PSK

In the above system selection, the results of earlier made route by route circuit distribution are of course taken into consideration. The following facts are also considered:

(1) From the viewpoint of system maintenance and operation, the transmission bit rate and modulation system should be standardized as much as possible. Meanwhile, the system of 2 PSK modulation type is becoming less and less used.

(2) The 2 GHz system comprises the narrow band system and wide band system, classified by the frequency allocation method. As far as the effective use of frequency spectrum is concered, the narrow band system serves the purpose better.

(3) The 6 GHz system of 16 QAM modulation type must have space diversity and automatic equalization functions established in each repeater section, so that the system characteristics can be fully maintained. Hence higher construction cost than other modulation type systems.

2.3 Section Where to Apply Selected Transmission System

By means of comparison between the transmission capacities of 2 GHz and 6 GHz systems selected in the preceding Paragraph, on one hand, and the results of route by route circuit distribution, on the other, the section where to apply the 2 GHz or 6 GHz system have been established. Those sections as plotted in the whole objective areas of this study are shown en bloc in Figure V-1 that appears at the beginning of this Chapter. In this illustration, the transmission capacity of each system in each section and the number of circuits in each section estimated as of the year 2005 are also indicated.

Following are the guidelines for standardizing the sections where to apply either 2 GHz or 6 GHz system:

(1) To apply the 2 GHz system in all Primary Center - Secondary Center routes.

Note: According to the route by route circuit distribution charts, all routes except Kupang - Soe - Atambua route (Plan B route) are with 240 channels or less each, so that they can be standardized as 2 GHz system routes. For Kupang - Soe - Atambua route also, the 2 GHz system can be used provided that the number of radio bearers be increased.

(2) To constitute Secondary Center to Secondary Center routes and Secondary Center to Tertiary Center routes in such a way that television signals can be transmitted via standby system. By this means, all these routes can be standardized as 6 GHz system routes.

Note: According to the route by route circuit distribution charts, Malili (Ujung Pandang) - Kendari and Jayapura - Merauke routes are small capacity routes, each with less than 480 channels.

Although both routes can have the 2 GHz system applied to meet the demand, decision is made to use the 6 GHz, 480 channels system in both those routes, based on the aforementioned standardization guidelines. Both routes are considered to operate as backbone routes, so that the system for them should be designed to have sufficient transmission capacity to meet unexpected demand growth in the future and to allow television signal transmission by standby system.

2.4 Main System Parameters

Main system parameters of the selected UHF and SHF systems are as follows:

Frequency band	UHF System 2 GHz		SHF System 6 GHz (upper band)	
Transmission capacity per system				
Bit rate (Mbit/s)	2.0x2	8.4x2	34.4x1	34.4x3
No. of channels in terms of voice channels	60	120	480	1,440
No. of systems (working + standby)	2+1	2+1	2+1	2+1
Modulation system	4PSK	4PSK	4PSK	8PSK
Standard repeater separation	50 km	50 km	50 km	50 km
Repeating system	Regenerative or Heterodyne		Same as at left	
Power supply system				
Primary power	Commercial power, engine generator output, solar energy		Same as at left	
Secondary power	Battery floating		Same as at left	

The reasons for establishment of these system parameters and the points wherein to exercise care when applying these parameters are stated below. For frequency band, transmission capacity and modulation system, the statement was already made elsewhere.

(1) Number of Systems

The result of circuit distribution to each transmission route shows that in almost all sections, i.e., barring few exceptions, the total number of distributed circuits falls short of the transmission capacity per system of the system applied to the section concerned. (Refer to Paragraph 1.5 of this Chapter.) Therefore, in those sections, it is possible to use one working system, keeping a spare set of each main equipment for standby purpose. However, in consideration of the undermentioned facts, decision has been made to use two working systems plus one standby system, or the so-called (2 + 1) system, for both UHF and SHF systems.

a. The standby scheme that uses the counterpart system is a little more advantageous economically than the standby system that uses spare equipment sets.

b. From the viewpoint of effective use of frequency spectrum, the standby system that uses spare equipment sets is preferable to the standby scheme that uses the counterpart system. However, considering that the maximum number of systems available within the frequency bands allocated to both UHF and SHF systems is six systems in the case of 2 GHz band and eight systems in the case of 6 GHz band, the system constitution of (2 + 1) type, i.e., of three systems, does not pose a serious problem in the way of effective use of frequency spectrum.

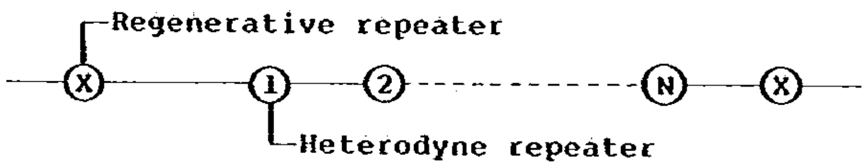
c. The system constitution of (2 + 1) type makes it possible to cope with an unexpected circuit demand growth or to cater for needs for non-telephonic wide band services.

(2) Repeater Span

The standard repeater span is set at 50 km and the maximum repeater span at 110 km. Needless to mention, the repeater span depends upon the radio propagation path condition, so that, when actually determining the repeater span, the route by route investigation and study of propagation path condition are necessary.

(3) Repeating System

Both the regenerative repeater and the heterodyne repeater will be used. Whichever type that fits the propagation path condition will be chosen. The application standards for both types vary according to the path conditions. Usually, both types are used as illustrated below.



N is 2 - 3 in the case of 4PSK modulation system and 1 - 2 in the case of 8PSK modulation system.

(4) Power Supply

At the repeater station where the power consumption is 300 W or less, the utilization of solar energy as primary power is considered to be possible. (For the study result on this subject, see Appendix V-2.)

VI SUBMARINE CABLE ROUTE SELECTION AND SYSTEM SELECTION

VI. Submarine Cable Route Selection and System Selection

1. Cable Route Selection

1.1 Route Study

For the submarine cable system route to interconnect main cities in Sulawesi, Maluku and Irian Jaya areas, the following alternate routes can be considered:

- o Ujung Pandang - Ambon
- o Kendari - Ambon
- o Manado - Ternate
- o Ambon - Ternate
- o Ambon - Sorong
- o Ambon - Merauke
- o Weda - Sorong
- o Sorong - Biak
- o Biak - Jayapura
- o Bula - Fak Fak
- o Ende - Kupang (Alternate for terrestrial transmission route. Refer to Chapter V.)

Ambon - Merauke route is the longest in distance. About half the route length traverses Arafura Sea at a depth of 50 - 100 m so that shallow water cable requires protection. Hence, economically, this route is not an advantageous route. Furthermore, between Jayapura and Merauke, a terrestrial transmission route can be established. For such reasons, this route (Ambon - Merauke) has been eliminated from the scope of study.

Bula - Fak Fak route is of no significance in the network configuration because a terrestrial transmission route from Fak Fak to Jayapura, Merauke, etc., cannot be realized, as stated in the preceding chapter. Therefore, this route (Bula - Fak Fak) has been removed from the target of study.

The submarine cable route that interconnects the three areas - Sulawesi, Maluku and Irian Jaya - constitutes a key transmission route. It further constitutes the backbone route of Indonesia's countrywide communication network, to be extended to Jakarta by way of Surabaya. From the viewpoint of network configuration, it is desired that, in this key transmission route, the district network centers, i.e., Ujung Pandang, Ambon and Jayapura, be linked together in the shortest distance. Further, in view of the required network characteristics, it is also desired that the number of branchings and insertions on the transmission route be limited to the possible minimum.

In consideration of all the foregoing, the following submarine cables have been selected for study:
(Refer to Figure IV-1.)

Main Route: Ujung Pandang - Ambon - Sorong - Biak - Jayapura
Spur Route: Ambon - Ternate
Alternate for terrestrial route: Ende - Kupang

1.2 Route Selection Requirements

In the submarine cable route selection, the landing point and route requirements must be duly considered. They are:

(1) Route length between cable landing points must be as short as possible. Especially so in the shallow water section (depth: 500 m or less) where fishery operations and anchorages are expected and in the extremely deep sea section (depth: 6,000 m or more) where cable repair work is difficult.

(2) Construction of transmission route between the cable landing point and the exchange station must be easy.

(3) Fishery, anchorage and/or mining must not be on-going in the sea area in front of the cable landing point.

(4) Topography of cable landing point must be such that cable landing work is easy. That is to say, the seashore must be sandy and easy of access for the cable work ship.

(5) Places where cable is apt to be damaged must be avoided for cable route. Such places include area where explosives are disposed of, area for anchorage, port entrance, vicinity of submarine volcano, and estuary.

(6) Sea bottom is desired to be sandy or muddy; sea bottom with rocks and coral reefs must be avoided. Flat sea bottom is preferred. Cable route across the accidented sea bottom where the angle of inclination is more than 20 degrees or across the sloping sea bottom must be avoided.

(7) Where cable burying is necessary, sea bottom must be the soft ground so that cable burying is easy.

(8) Where another cable laying is expected in the future, consideration must be made to leave sufficient space for that cable laying.

Based on the foregoing requirements, preliminary study has been made about the proposed submarine cable routes, using available charts, and placing emphasis on the selection of tentative cable routes. Study results are described in the succeeding paragraph.

About Surabaya - Ujung Pandang submarine cable route also, study has been made. As stated in Chapter VII, this cable route is considered to provide an optimum route when the terrestrial digital transmission network in the eastern region of Indonesia is extended to Jakarta in the future.

1.3 Cable Route Study

(1) Ujung Pandang - Ambon

For the cable landing point at Ujung Pandang side, the seashore near the urban district of Ujung Pandang is advantageous economically because the tie line with the exchange station can be short. However, in the shallow water section west of Ujung Pandang, coral reefs lie from north to south about 25 nautical miles (47 km) offshore. This fact necessitates complicated cable laying work and, hence, is not delectable from the viewpoint of cable protection. On the other hand, the shallow water area in the southern end of Sulawesi is of sandy ground so that this place is suitable for cable laying.

As for Ambon side, the flat land is scarce as the nearby mountains protrude to the seaboard, and steep slopes continue from the seaboard into the sea. And, on the land, roads are not complete. In view of all these, the cable landing point should be selected at a place near the city sector. However, Ambon is an important port city in Maluku area so that the seaborne traffic is brisk with ships of several thousand tons incoming and outgoing. Therefore, cable landing point must be selected such that the cable route keeps away from the area where those ships cast anchor.

For the selection of cable route between both landing points, the cable route be made as short as possible unless otherwise necessitated technically. For the selection of short cable route between Ujung Pandang and Ambon, cable laying by way of Salayar Strait southeast of Ujung Pandang is necessary. This strait is relatively narrow as its width measures 3.6 nautical miles (approx. 7 km). It is located at the boundary of shallow Java Sea and deep Flores Sea. The eastern slope of the strait forms a large angle of inclination and the strait itself is narrow, and therefore tidal current is predicted, so that, the cable route must be so selected that it will be at right angles to the sea bottom slope as far as possible.

In Flores Sea (7° 47' S, 123° 36' E) and Banda Sea (6° 38' S, 126° 40' E), volcanic islands are reported to exist. Generally, in the neighborhood of an active volcanic island, cable damage possibilities are large because of volcanic heat and accidented or rocky sea bottom. Therefore, from the viewpoint of cable protection, the cable route must be selected 10 km or more distant from the volcanic island.

An approximate route length of Ujung Pandang - Ambon submarine cable is 570 nautical miles (1,060 km).

(2) Ambon - Sorong

To make Ambon side cable landing point common to both Ambon - Sorong and Ujung Pandang - Ambon cables is not desirable because of the facts mentioned below. Hence, for Ambon - Sorong cable, selection is made for the cable that it lands at Ceram Island seashore facing Ceram Sea, traverses the island southward and then enters into the sea, and lands again on Ambon Island.

- o Cable route that passes Manipa Strait on the way from Ambon Island to Sorong is not desirable. Reason: The strait bottom topography is steeply inclined in part and the rapid surface current in this strait is also reported.

- o To avoid Manipa Strait, cable route must detour by the western side of Buru Island. This detour makes cable route too long. Hence disadvantageous economically.

Sorong is said to be the gateway to/from Irian Jaya. It constitutes the shipping center of the region including Maluku area. In the nearby sea are the shipping route and anchorage ground for large sized tankers and freighters. Therefore, to be remote from these sea facilities, the cable landing point is selected at seashore on the northern side of Sorong.

In the sea area in front of this cable landing point, the sea bottom slope is mild, and neither rocks nor coral reefs exist. Hence no problem.

The problem arises in the sea area north of Batanta Island, west of Sorong. This area abounds in coral reefs so that the cable laying work by a large sized cable ship faces danger.

For the cable route that passes Sagewin Strait between Batanta Island and Salawasi Island, a careful ocean survey is necessary. For, the strait is narrow, posing difficulty to good cable route making and cable laying work itself requires utmost care. For the tentative cable route, this Sagewin Strait route is selected.

The approximate route length of Ambon - Sorong cable is 250 nautical miles (460 km).

(3) Sorong - Biak - Jayapura

No problem is involved in the shared use of Sorong side cable landing point for both Sorong - Biak - Jayapura and Ambon - Sorong cables.

For cable landing at Biak, the following points must be duly considered:

a) In the shallow sea area northeast of Biak Island, coral reefs spread. This place is not desirable for the cable landing point. Reasons are the same as in the case of the shallow sea west of Ujung Pandang.

b) In the offing east of Biak Island is reported to exist the ammunition dumping area. The cable route must evade this area.

c) The use of common landing point for both Sorong - Biak and Biak - Jayapura submarine cables is preferred.

Therefore, the cable landing point is to be selected in the western or southern part of Biak Island.

In Jayapura coastal sea, neither coral reefs nor shallows exist, so that the sole requirement is to select the cable landing point at seashore detached from the sailing route. However, in the offing of Jayapura, the ammunition dumping area is reported to exist. No problem is in sight if the cable route is 3 nautical miles (approx. 6 km) away from that dumping area.

At Sorong and Jayapura, about 25 nautical miles (50 km) offshore, the sea bottom is flat and fit for submarine cable route. In the sea area west and south of Biak, the sea bottom topography is complicated but poses no specific problem relating to cable route selection.

An approximate route length is 350 nautical miles (650 km) for Sorong - Biak and 340 nautical miles (630 km) for Biak - Jayapura.

(4) Ambon - Ternate

The cable landing point on Ternate Island should be selected on the western side of the island that faces Molucca Sea. The coastal sea area is supposed to form an abrupt downward slope. For cable landing, the steep slope should be avoided.

Ambon side cable landing point may well be common to Ambon - Sorong cable.

The cable route passes the saddle section between Obi Major Island and Mangoli Island. The northern and southern sides of the saddle section form the relatively flat ground at a depth of some 4,400 m. There seems to be no problem for cable route selection.

In the neighborhood of 1° 10' S, 127° E and 2° 55' S, 127° 40' E, the tidal current is reported to be strong. Special investigation about the tidal current is necessary for the saddle section between Obi Major Island and Mangoli Island so as to avoid the strong tidal current section for cable route selection.

An approximate route length is 280 nautical miles (520 km).

(5) Ende - Kupang

At Ende, Flores Island mountains protrude into the sea so that the abrupt downward slope is suspected even in the coastal sea area. For cable landing, the sea area without such abrupt downward slope should be selected just outside Ende Port.

In Kupang Port area, there are shallows here and there so that the cable laying by ship is exposed to danger. Therefore, the cable landing point should be selected in the shallows-free sea area outside the port.

The sea area between both cable landing points is the deep sea surrounded by the subduction zone formed by the Indian Ocean plate and the Continent, and the volcanic island group of Sunda (refer to Appendix VI-1). This deep sea features, however, is no hindrance to cable routing. Even if the heavily accidented sea bottom is discovered along the cable route in an ocean survey, it will be possible to arrange cable route by partial detour to avoid such sea bottom accident.

Report says that the ammunition dumping area exists in the northwestern offing of Kupang Port. It goes without saying that the cable route should evade that area.

The cable route length is 160 nautical miles (300 km).

(6) Surabaya - Ujung Pandang

For cable route selection, the following facts must be taken into consideration:

- That the most part of Java Sea is less than 200 m deep;

- That the coral reefs and shallows exist in many parts of Java Sea;

- That trawl net fishery, a typical shallow sea fishery, may be practised in Java Sea.

For Surabaya - Ujung Pandang cable route, two alternatives can be considered. They are:

a) The route that proceeds from Surabaya to eastward through the central part of shallow Java Sea and through the coral reefs and shallows at the end of Continental shelf, enters into the deep sea that continues from Makassar Strait, and lands in the southern end of Sulawesi.

b) The route that proceeds from Surabaya to Madura Strait where the depth is 600 m or thereabouts, then goes through Bali Sea, and terminates at the southern end of Sulawesi.

For the route a), a full ocean survey is required for the purpose of safety operation of cable laying ship in the coral reef zone. Furthermore, as the most part of route is in the shallow sea, cable protection by means of burying at sea bottom and/or cable armoring becomes necessary.

For the route b), the length for cable protection by burying or armoring can be reduced because in Madura Strait the shallow water sections are short. In this respect, the selection of this route is economically preferable. Nevertheless, to cope with the other hazards, i.e., the intensity of seaborne traffic by large sized ships and the scale of fishery and its prospective expansion, a thorough investigation must be made.

For Surabaya side cable landing point, the port environs must be avoided because Surabaya is a big port city, and the cable, in turn, is to keep away from the congested sailing route. For the route a), the desirable cable landing point is in the vicinity of Ujung Pangkah that faces Java Sea or at the northern coast of Madura Island, and, for the route b), on Jawa Island coast facing Madura Strait or the coast in the middle eastern part of Madura Island.

At approach to Ujung Pandang, coral reefs lie from the coast to 30-50 km offshore as mentioned in item (1) of this chapter. This fact necessitates the use of specially armored cable for the approach section to Ujung Pandang. Further, depending upon the bottom topography, special arrangement must be made, such as digging an artificial trench in coral reefs so that the cable will not vibrate or move due to the tidal current. These require no small cost and are economically not desirable.

As a remedy, the cable landing point should be selected at the southern end of Sulawesi. This arrangement does not involve a large scale extension of cable route length from Surabaya. In addition, the cable landing point can be used for that of Ujung pandang - Ambon cable also.

The approximate cable route lengths for route a) and route b) are 475 nautical miles (880 km) and 440 nautical miles (810 km), respectively.

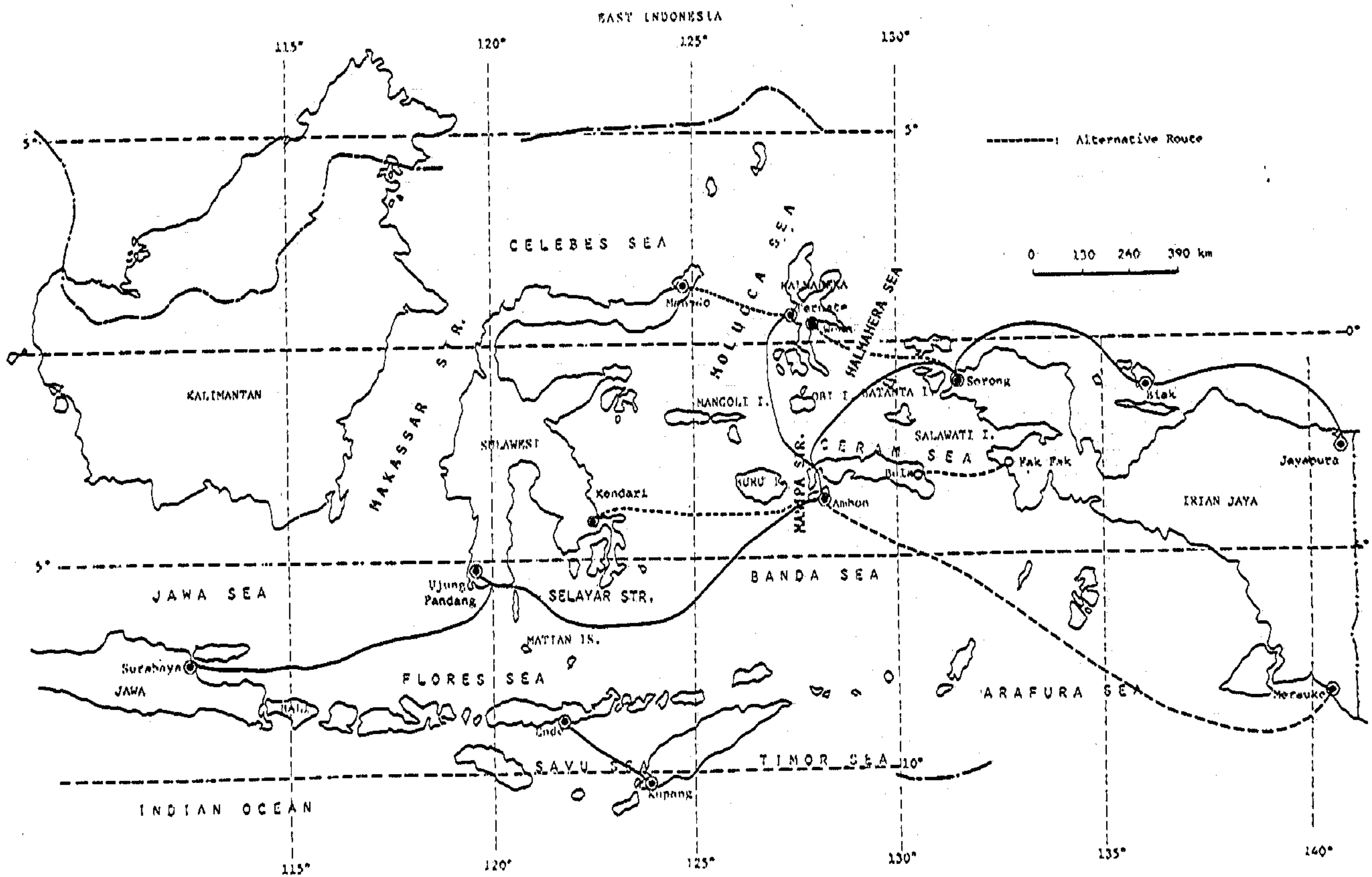


Fig. VI-1 Submarine Cable System Route Plan

2. Cable System Selection

2.1 Preconditions

The submarine cable system is a long life system that endures for 20 - 25 years. However, the system capacity expansion after the construction is not easy. Hence the need for determining the proper transmission capacity based on the long term communication demand forecast.

The communication demand as of the year 2005 in the proposed submarine cable system sections, when calculated by the primary group of 30 channels in CEPT digital hierarchy, is estimated at 7 - 43 groups (210 - 1,290 channels) (Refer to Table V-14 of Chapter V).

Assume that one backup circuit be established for TV signal transmission. Then it follows that an additional equivalent of 480 telephone channels (16 primary groups or one tertiary group) is required on the condition of TV band compression. In this case, the number of channels to be transmitted by the submarine cable system in the year 2005 turns out to be 690 - 1,770 in terms of telephone channels.

The number of channels that are transmitted varies considerably from one submarine cable section to another. For the systems applicable to those sections, the following three are worth consideration from the practical point of view:

a) To use in parallel 2 - 4 low bit rate, small capacity (e.g., 480 channels by 34 Mbit/s) subsystems.

b) To use the high bit rate, medium - large capacity (e.g., 1,920 channels by 140 Mbit/s or 3,840 channels by 280 Mbit/s) system now being developed in several countries.

c) To carry out multiplexing by special bit rate instead of applying the standard hierarchy, so as to meet up with the channel requirements of each section.

The system a) uses 2 - 4 subsystems so that it requires 2 - 4 pairs of optical fiber. This increases the number of repeater circuits to be mounted, and the cost of parts and components also. Therefore, this system is not the economy type.

The system b) requires only one pair of optical fibers. The number of repeater circuits to be mounted is also reduced to the minimum. Furthermore, the standard multiplexing can be adopted. Although the number of unoccupied, idle channels increases, the system itself is the economy type.

The system c) employs the non-standard multiplexing type, hence the order-made type, terminal equipment. Naturally, the cost of design and manufacture increases. The system cannot be the economy type.

This time, the system b) is to be adopted, and, for the bit rate, either 140 Mbit/s or 280 Mbit/s, whichever more economical in system operation, is to be selected. And the application of the same cable system to all submarine cable sections under study is considered to be advantageous.
The reasons are as follows:

a) Even in the section with the greatest channel requirement, the system leaves surplus capacity after filling such channel requirement.

b) The small capacity system fitted for small channel requirement cannot evade the parts and components cost increase. This leads to a broad increase of construction cost per channel.

c) Idle system capacity in the small channel requirement sections can be spare capacity to meet unpredictable demand variations in the future.

d) The system standardization is delectable for system maintenance, especially for the upkeeping of maintenance technique and the simplifying of staff training.

e) Spare plant, such as cables and repeaters necessary for repairs of the submarine cable system can be commonly used in all sections. Therefore, the stock of those spare plant can be in the necessary minimum.

The succeeding paragraphs present a result of preliminary study on the understanding that the system with a bit rate of 140 Mbit/s and capacity of 1,920 channels, i.e., the system, of which the construction cost can possibly be lower, is adopted. The channel requirement in each of the proposed submarine cable sections, together with the system applied, is given in Table VI-1.

Table VI-1 Channel Requirements in Proposed Submarine Cable Sections

Section	Telephone Transmission		TV Transmission	Channel Requirement		System Applied	
	(ch)	(Primary Group)	(Primary Group)	(Primary Group)	(ch)	(ch)	(Bit rate) Mbit/s
Ujung Pandang - Ambon	1,290	43	16	59	1,770	1,920	140
Ambon - Sorong	810	27	-	43	1,290	-	-
Sorong - Biak	660	22	-	38	1,140	-	-
Biak - Jayapura	960	32	-	48	1,440	-	-
Ambon - Ternate	210	7	-	23	690	-	-
Ende - Kupang	330	11	-	37	810	-	-

2.2 System Selection

The development of optical submarine cable system is presently being carried out by the world's major research organizations. The development objective is to introduce the middle and long distance, large capacity (4,000 - 15,000 telephone channels) system in the latter half or in the closing part of 1980s. (Refer to Appendix VI-2.)

However, for the 2,000 channels or so medium capacity optical submarine cable system, the world demand is considered to be limited. As a matter of fact, the medium capacity system is not the main target of development efforts. The medium capacity system was earlier dealt with in the U.K. and France as a preliminary step to the large capacity system development. Furthermore, the medium capacity system leaves no further technical elaboration. It is expected that the world's qualified communication system manufacturers will be able to supply the medium capacity system about the time the large capacity system development efforts come to a successful conclusion.

When the cable length of the system is short, the number of repeaters required is small. This fact makes it easy to achieve the required system reliability and will expedite its early development.

The key points of medium capacity system design are as follows:

a) The main system parameters be the same as those of the large capacity system. (Among such system parameters are optical fiber, wavelength to be used, light emitting and receiving units, and mechanical parts.)

b) For the submarine cable system terminal equipment, the overland digital transmission terminal technology be utilized, and the standard hierarchy be adopted as far as possible.

c) For cable laying, the conventional coaxial submarine cable technology be utilized to the best advantage.

d) To improve the system economy, the repeater spacing be as long as possible.

Main system parameters determined according to the above requirements are shown in Table VI-2.

Table VI-2 Main System Parameters (Example)

Bit rate *	Approx. 140 Mbit/s
Number of telephone channels	1,920
Number of subsystem	1
Number of optical fibers	2
Wavelength used	1.3 μm
Type of optical fiber used	Single mode fiber
Repeater spacing	50 km
Maximum applicable distance	1,500 km
Maximum applicable water depth	6,000 m
System life	25 years
MTBF (mean time between failures)	10 years

* Note: Bits for order wire, system supervisory signal, etc., are included.

2.3 System Applications

(1) Tie Line

The submarine cable is intrinsically the transmission line between one cable station established near the seashore and the other cable station across the sea. Therefore, to complete the network configuration, the tie line must be installed between the cable landing station and the telephone exchange station in the nearby city or town. For the tie line that must be well matched with the optical submarine cable, choice from among the following plans is recommended:

a) In case the tie line length is short, e.g., several tens of km or less, the submarine cable landing station is dispensed with. The submarine cable itself is extended, with the extension laid in the overland conduit or the like, directly to the telephone exchange station. The terminal equipment for optical submarine cable and the power feeding equipment to the cable are to be installed in the telephone exchange station.

b) In case the overland cable distance is longer than several tens of km but not longer than 100 km and it is difficult or improper to establish the cable landing station on the seashore, the cable landing station is despensed with. The submarine cable extension on land with repeater is laid up to the telephone exchange station. The terminal equipment for optical submarine cable and the power feeding equipment to the cable are to be installed in the telephone exchange station.

c) In case the overland cable distance is considerably long or it is preferable to establish the cable landing station and make channel distribution and so forth in this station, the cable station is established. For the tie line, either radio or wire system is selected, depending upon the overland route condition.

Following are the examples wherein either of the foregoing plans is applied to the tie line of each submarine cable section:

a) Ujung Pandang - Southern end of Sulawesi

Plan c) is applied.

In this section, not only Ujung Pandang - Ambon cable but also a new cable to Ujung Pandang from Surabaya as the substitute for Java - Sulawesi main route may possibly be established near Bantaeng on southern end of Sulawesi. Therefore, at the cable landing point, the cable station is to be established. And, to make channel connections between both cables in this cable station is reasonable from the viewpoint of network configuration. Furthermore, this cable station does not necessitate the greater tie line capacity than necessary. Hence economic advantage.

In South Sulawesi are many towns and roads that interconnect those towns are complete. There will be no problem as to establishing the cable landing station.

The tie line of about 130 km should be so designed that it can deal with large capacity traffic. It would be preferable to adopt the overland optical cable system, e.g., with bit rate of 280 Mbit/s, which is expected to be more economically advantageous in the future.

b) Ambon - Southern Coast of Ambon Island

Plan a) is applied.

The overland cable distance is not longer than some tens of km. Therefore, the submarine cable extension directly to the telephone exchange station is preferred.

c) Ambon - Northern Coast of Ceram Island

Plan c) is applied.

Several alternative plans are considered. An example is:

Between Ambon Island and Ceram Island, about 50 km distant, the submarine cable link is to be established. On both islands, overland optical cable (combined length: approx. 70 km) is to be laid. The bit rate of 140 Mbit/s will be adequate in view of traffic demands. Near the town of Laluhelu on the northern coast of Ceram Island, the cable landing station is to be established to make channel distribution to Sorong and Ternate.

d) Sorong, Biak, Jayapura, Ternate, Ende, Kupang

Plan a) is applied.

At these locations, the overland cable distance is 5 - 15 km. The submarine cable extension directly to the telephone exchange station is advantageous.

(2) Submarine Cable Applications

Applications of 140 Mbit/s submarine cable system for the proposed sections appear in Table VI-3. For the case where cable landing station is to be established, tie line between exchange station and the cable station is taken as one separate section.

Table VI-3 System Applications (Example)

Section	Tentative Route Length (km)		Number of Repeaters	Remarks
	overland tie line	submarine cable		
Ujung Pandang - Bantaeng	130	-	6	280 Mbit/s overland tie line
Bantaeng - Ambon	20	1,060	22	
Ambon - Laluhelu	70	50	2	140 Mbit/s overland and submarine tie line
Laluhelu - Sorong	10	460	9	
Laluhelu - Ternate	10	520	10	
Sorong - Biak	20	650	13	
Biak - Jayapura	20	630	13	
Ende - Kupang	30	300	6	

3. Future Investigation/Survey Items

In this study, the provisional cable route and cable system have been selected, based on sea chart studies. Hence, for the implementation of submarine cable project in the future, a detailed system design is necessary.

Serveys required for cable route selection include the following:

(a) Route Survey

- o Ocean survey
- o Shallow water survey

(b) Site Survey

- o Cable landing beach survey
- o Cable station site servey
  (In case the cable station is to be established.)

(c) Tie Line Survey

- o Tie line route survey
  (In case the land tie line is used.)
- o Microwave route survey
  (In case the radio tie line is used.)

Furthermore, for the purpose of safe installation and faultfree operation of submarine cable, there is need for inquiring the following items to the competent authorities and coordinating the cable route with the authorities.

- o Port/harbor construction/improvement plan
- o Oil field development plan
- o Pipeline construction plan
- o Ammunition dumping area
- o Industrial waste dumping area

o Anchorage area in the port
o Fishery activities

In this chapter, 140 Mbit/s submarine cable system using optical fiber is proposed to be adopted in the eastern part of Indonesia. However, in view of the rapid technical progress being made in the field of optical fiber system, it is important to make a full investigation about the system development being made in research organizations for the purpose of selecting the optimum system.

For the typical implementation flow relating to the submarine cable system construction project, refer to Appendix VI-3. For general information on maintenance concerning the submarine cable system, see Appendix VI-4.

VII REVIEW AND STUDY OF MASTER PLAN

VII. Project Size Summary, and Comment on Existing Analog Transmission Network Digitalization

1. Project Size summary

The project sizes formulated for the terrestrial radio transmission network and the submarine cable network in this master planning study are respectively summarized in Table VII-1 and Table VII-2.

In Table VII-1 are given Paru-Tilamuta and Ende-Kupang alternative route plans also. However, these alternative route plans leave room for further detailed studies including feasibility studies, in order that the optimum routes can be selected. This fact was already referred to in Chapter V.

For other sections than the aforementioned two also, further detailed studies may lead to the necessity for considering alternative routes or alternative systems. For example:

a) Adoption of microwave system instead of optical fiber cable system in Ujung Pandang-Bantaeng and Ambon-Laluhelu sections.

b) Intermediate landing of Sorong-Biak submarine cable at Manokwari so as to constitute Sorong-Manokwari-Biak submarine cable system.

For all alternative routes and alternative systems that can be considered, comparative studies will have to be made on concrete terms technically and economically, based on feasibility study findings and other related data to select the optimum route and optimum system.

Table VII-1 Project Size summary of Terrestrial Radio Transmission Network Plan

Item \ Region	Sulawesi		Nusa Tenggara Timur & Timor Timur		Maluku	Irian Jaya	Ground Total	
	A	B	A	B			A	B
1. Transmission Route Length (km)	3,256	3,139	1,345	1,184	1,079	1,673	7,353	7,075
a. 6G.1440 ch Sys.	1,486	1,547	-	-	-	-	1,486	1,547
b. 6G. 480 ch Sys.	335	300	785	163	-	826	1,946	1,289
c. 2G. 240 ch Sys.	397	186	85	362	152	85	719	785
d. 2G. 60 ch Sys.	1,308	1,106	475	659	927	762	3,202	3,454
2. No. of Radio Station *	98	93	38	36	24	32	192	183
a. 6G.1440 ch Sys.	39	39	-	-	-	-	39	39
Terminal St.	7	9	-	-	-	-	7	9
Repeater St.	29	27	-	-	-	-	29	27
b. 6G.480 ch Sys.	10	9	19	5	-	12	41	26
Terminal St.	3	2	4	1	-	5	12	8
Repeater St.	7	7	15	4	-	7	29	18
c. 2G.240 ch Sys.	13	7	3	12	6	2	24	25
Terminal St.	3	2	1	3	3	1	8	9
Repeater St.	10	5	2	9	3	1	16	16
d. 2G.60 ch Sys.	36	38	16	19	18	18	88	93
Terminal St.	19	19	10	11	9	8	46	47
Repeater St.	17	19	6	8	9	10	42	46
3. No. of Radio Hop	95	89	37	34	22	30	184	175
a. 6G.1440 ch Sys.	37	36	-	-	-	-	37	36
b. 6G. 480 ch Sys.	10	9	18	4	-	11	39	24
c. 2G. 240 ch Sys.	13	7	3	11	4	1	21	23
d. 2G. 60 ch Sys.	35	37	16	19	18	18	87	92

* Note: Radio station where radio systems of different transmission capacities coexist is handled as a station to which the system of the largest transmission capacity applies.

Table VII-2 Project Size Summary of Submarine Cable Network Plan

Item \ Section	U. Pandang ∿ Ambon	Ambon ∿ Laluhelu	Laluhelu ∿ Ternate	Laluhelu ∿ Sorong	Sorong ∿ Biak	Biak ∿ Jayapura	Ende ∿ Kupang	Total
1. Cable Length (km)	1,260	120	550	490	700	680	350	4,150
a. 3840 CH System (Land Section)	130	-	-	-	-	-	-	130
b. 1920 CH System (Under Sea Section)	1,110	50	540	480	680	660	320	3,840
c. 1920 CH System (Land Section)	*1 0+20	*1 30+40	*1 0+10	*1 0+10	*1 10+10	*1 10+10	*1 10+20	180
2. No. of Repeater	28	2	10	9	13	13	6	77
a. 3840 CH System (Land Section)	6	-	-	-	-	-	-	2
b. 1920 CH System (Under Sea Section)	22	-	10	9	13	13	6	73
c. 1920 CH System (Land Section)	-	2	-	-	-	-	-	2
3. No. of Station	3	1	1	1	1	1	2	10
Terminal Station	2	(1)	1	1	(1)+1	(1)+1	2	8
Cable Landing Station	1	1	(1)	(1)	-	-	-	2

Note *1 : (Cable length at upper side station) + (Cable length at lower side station)

( ) : Counted up in the other section

2. Comment on Existing Analog Transmission Network Digitalization

The terrestrial transmission network for the eastern region of Indonesia as formulated by this study is to be connected to the analog Eastern Microwave System at Ujung Pandang and Poco Ranakah (Flores Island).

For the interface between the digital and analog systems, TDM-FDM transmultiplexer, commonly known as T-MUX, can be introduced. By this means, the virtual or equivalent integrated digital network, where the existing analog transmission route is maintained, is regarded to have been completed.

However, the introduction of T-MUX is, after all, the provisional means up to the time the integrated digital network is realized in the future. Therefore, to elevate the network efficiency and to provide high quality, uniform service, the promotion of existing analog transmission route digitalization is required.

Following are the study results for digitalization of the existing transmission network from Ujung Pandang to Jakarta, which has directly to do with the terrestrial transmission network for the eastern region of Indonesia formulated by this study:

(1) Network Formation

By the realization of integrated digital network, the provision of not only telephone but also non-telephone services becomes possible. And the demand for these services generally arises in and around big cities. Therefore, in the transmission route digitalization, priority should be given to the digitalization of backbone transmission routes that interconnect big cities.

For the digitalization of transmission network from Jakarta eastward to Ujung Pandang, the existing analog transmission routes (Java - Bali and Eastern Microwave Systems) should not be the sole objective. Instead, the digital network formation to interconnect main cities located along the existing two microwave systems will be the major study subject.

(2) Bottleneck to Digitalization

The Eastern Microwave System between Denpasar and Ujung Pandang extends by way of Nusa Tenggara island group so that in many sections the repeater span is relatively long or the oversea radio propagation is unavoidable. For this reason, the digitalization of this transmission system is next to impossible technically and economically.

(3) Demand Behavior

The estimated demand as of the year 2005 for telephone circuits to interconnect principal cities (mainly Tertiary Centers) on Jakarta - Surabaya - Ujung Pandang route is in Table VII-3.

The existing analog transmission route cannot relieve such estimated demand. Hence the need for establishing additional new transmission route. And this additional route should of course be of digital system. However, as previously stated, it is extremely difficult to construct a new digital transmission route parallel to the existing Denpasar - Ujung Pandang route, so that another route must be selected for the additional new transmission circuit.

Assume that the inter-city unit circuits as per Table VII-3 be carried on the new route referred to above. Then, the circuits to be carried on the existing analog transmission route (Eastern Microwave System) are only the circuits that interconnect Denpasar, Sumbawa Besar, Ende, Kupand and other cities that belong to Surabaya Tertiary Center and the circuits that extend from Ujung Pandang to Benteng and Tana-Jampea.

According to the telephone circuit demand forecast for those sections as of the year 2005, even the maximum demand that is forecasted for Denpasar - Mataram section falls short 1,000 circuits. These circuits can be fully accommodated on the existing analog transmission route.

Considering the foregoing study results, the digitalization of Jakarta - Surabaya - Ujung Pandang transmission network should be carried out by the following principles:

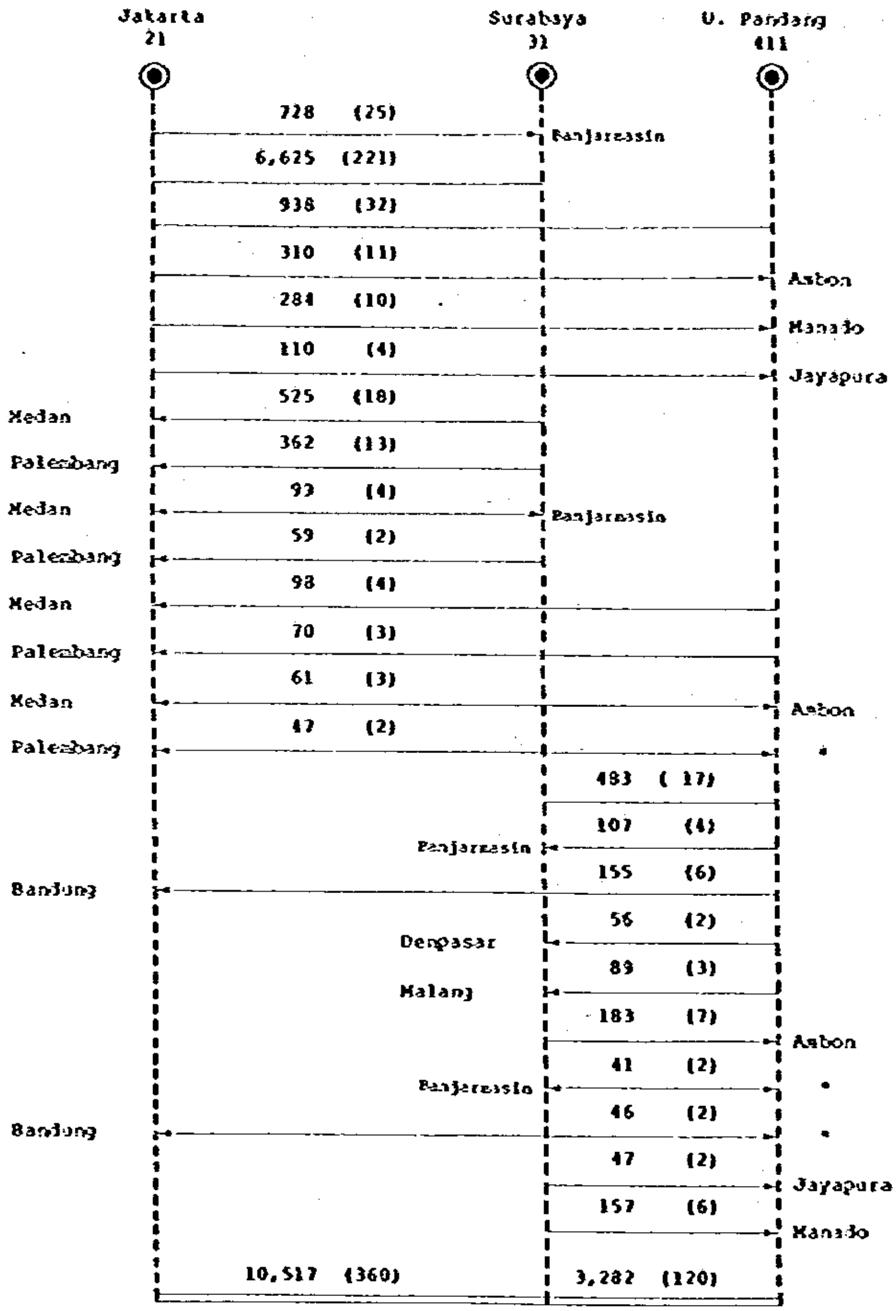
a. In Jakarta - Surabaya - Denpasar section, the second transmission route of digital system is to be introduced in addition to the existing analog transmission route.

b. In Surabaya - Ujung Pandang section, the optical submarine cable system is to be introduced.

c. The existing analog transmission route between Denpasar and Ujung Pandang (Eastern Microwave System) is not to be digitalized. After the completion of the above a. and b. transmission routes, this analog route is to operate as a local transmission route.

The period for introducing the above a. and b. digital transmission routes is to be determined in consideration of the digital communication network introduction plan covering the whole territories of Indonesia, so that it is outside the scope of this study. However, from the viewpoint of network formation, it is recommended that the plans be implemented at the time the digital transmission route is introduced in Sulawesi area or, at the latest, before the digital transmission route is introduced in Maluku area.

Table VII-3 Circuit Grouping Diagram



VIII FINANCIAL INVESTMENT ESTIMATES

VIII. Financial Investment Estimates

For the implementation of the terrestrial transmission network plan and the submarine cable network plan covering the eastern region of Indonesia, the required financial investments are estimated in Table VIII-1 and Table VIII-2.

In view of the nature of this study, both network plans are based on desk studies by use of all available data including topographical maps and sea charts. Therefore, the investment estimates herein presented are only to suggest gross financial requirements for the implementation of those plans. For accurate final estimates, re-calculations must be made, based on the implementation work procedures to be clarified through the feasibility study and related fact-finding surveys scheduled henceforward.

Preconditions used in the tentative financial investment estimates, this time, are as follows:

(1) General Common Items

a) Construction work is to be carried out by the contractor, based on detail designs and specifications made by the consultant and under his supervision.

b) All multiplex terminal equipments are to be installed in the telephone exchanges, and floor space required for these installations and power supply equipment are to be procured in advance at all telephone exchanges. Costs of these items are excluded from the investment estimates.

c) All switching equipments are to be the digital type. Signalling between multiplex terminal equipment and switching equipment is to be carried out by the basic primary group.

d) Of all submarine cable landing points, Bantaeng and Laluhelu are to have the cable landing stations newly built, where to install optical terminal equipment, power feeding equipment, supervisory order wire equipment and digital group conversion equipment. At other cable landing points, submarine and overland cables are to be directly connected, and optical terminal equipment, power feeding equipment, etc., along with multiplex terminal equipment, are to be installed in the telephone exchanges.

e) Investment estimates are calculated in Japanese yen, in principle. However, such cost categories as of land improvement at radio repeater sites, access road establishment to these facilities and civil works of submarine cable landing sites are to be covered by the domestic currency budget as much as possible. Therefore, these cost items are calculated in Indonesian Rupiahs.

(2) Terrestrial Radio System

a) System Composition: (2 + 1) system

b) Repeating System:

Standard repeating section:

Alternate repeating by heterodyne and regenerative repeating system

- Long-distance repeating section:

  In the 60 km or longer section, space diversity is applied except for the 1,440-channel 6 GHz system to which in the 45 km or longer section space diversity is applied.

  Oversea propagation section:

  For 6 GHz system, space diversity and automatic equalizer are added. For 2 GHz system, space diversity only is applied.

c) Antenna System:

2 GHz system:	3 mø parabolic antenna for both transmission and receiving
6 GHz system:	4 mø parabolic antenna for both transmission and receiving

d) Antenna Tower: 40 m high, self-supporting type in all cases

e) Power supply system at Repeater Station:

5 kVA engine generators ..... 2 sets
50 A rectifiers .... 2 sets
500 AH battery .... 1 pair

f) Repeater Station Building:

Shelter type in all cases

g) Access Road Length: 5 km/station

h) Repeater Station Site Area: (50 x 50) m^2/station

(3) Optical Submarine Cable System

a) Transmission System:

140 Mbit/s optical submarine cable system (1,920-channel, both-way. For main system parameters, refer to Chapter VI.)

b) *Cable Station Building:

Earthquake-proof, wind-resisting, fire-resisting.

c) *Cable Station Floor Area:

200 m^2 (communication equipment room only)

d) *Cable Station Site Area:

Approx. 18,000 m^2

e) *Power Supply Equipment:

Engine generators, rectifiers, batteries

f) *Access Road Length: 5 km

Note: * applies to Bantaeng and Laluhelu only.

(4) Terrestrial Optical Cable System

Transmission System:

*280 Mbit/s terrestrial optical cable system (3,840-channel, both-way)
140 Mbit/s terrestrial optical cable system (1,920-channel, both-way)

Note: * applies to Ujung Pandang - Bantaeng section.

Table VIII-1 Financial Investment Estimate for The Implementation of The Terrestrial Radio Transmission Network Plan

	Sulawesi		Nusa Tenggara Timur and Timor Timur		Maluka	Irian Jaya	Total	
	Plan A	Plan B	Plan A	Plan B			Plan A	Plan B
A. Foreign Currency Portion in Million Japanese Yen								
a. Radio & Multiplex	8,075	7,978	2,428	2,146	1,475	1,950	13,928	13,549
b. Power Supply System for Repeater St.	2,232	2,071	784	719	471	664	4,151	3,925
c. Antenna Tower	2,803	2,660	1,087	1,030	687	916	5,493	5,293
d. Shelter for Repeater St.	1,236	1,142	431	394	225	337	2,229	2,098
e. Spare, Tool & Test Equipment	2,118	2,065	663	593	414	549	3,744	3,621
f. Installation Materials & Fee	5,993	5,980	2,162	1,893	1,316	1,723	11,194	10,912
g. Engineering Consultancy	786	767	317	285	193	258	1,554	1,503
h. Total	23,243	22,663	7,782	7,060	4,781	6,397	42,293	40,901
B. Local Currency Portion in Million Rupiah								
a. Access Road, Site Levelling	20,460	18,910	7,130	6,510	3,720	5,580	36,890	34,720
b. Installation Materials & Fee	14,687	14,032	5,389	5,034	3,364	4,498	27,938	26,928
c. Engineering Consultancy	876	854	353	317	215	287	1,731	1,673
d. Total	36,023	33,796	12,872	11,861	7,299	10,365	66,559	63,321

Table VIII-2 Financial Investment Estimate for The Implementation of Submarine Cable Network Plan

Phase	II	III					IV				II ∿ IV
	Ende ∿ Kupang	U. Pandang ∿ Bantaeng	Bantaeng ∿ Ambon	Ambon ∿ Laluhelu	Laluhelu ∿ Ternate	Total	Laluhelu ∿ Sorong	Sorong ∿ Biak	Biak ∿ Jayapura	Total	Total
A. Foreign Currency Portion in Million Yen											
a. Submersible Plant and Terminal Equipment	2,369	1,283	6,068	867	3,246	11,464	3,048	3,625	3,708	10,381	24,214
b. Installation	383	197	721	313	466	1,697	426	528	524	1,478	3,558
c. Engineering (incl. training)	106	66	168	61	107	402	101	115	117	333	841
d. Consultancy	125	193				193	138			138	456
e. Total	2,983					13,756				12,330	29,069
B. Local Currency Portion in Million Rupiah											
a. Installation & Transportion	944	1,274	715	1,292	762	4,043	621	676	710	2,007	6,994
b. Survey	759	1,011				1,011	840			840	2,610
c. Consultancy	107	164				164	117			117	388
d. Total	1,810					5,218				2,964	9,992

IX PROJECT FORMATION AND PROJECT IMPLEMENTATION PLAN

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IX. Project Formation and Project Implementation Plan

This chapter is for study of project formation and project implementation plan for the purpose of gradual introduction of terrestrial transmission network, inclusive of submarine cable system, in the eastern region of Indonesia, based on the master plan.

The study here is to establish general guidelines for the terrestrial transmission network introduction. In-depth project formation and project implementation plan are to be formulated in the light of findings in the feasibility study to be conducted in sequel to this study.

1. Project Formation

In case the objective area is extensive and the implementation of plan for the whole area in one series requires huge financial investment, the alternative is to divide the objective area into several sub-areas and to realize the plan for one sub-area after another. In this case, there is need for establishing the order of priority for implementation work, based on the comparative study of degrees of local social development, as well as the degrees of infrastructure improvement, in all sub-areas. Also to be considered are the size of available investment budget and the national policy line.

In the case of telecommunications networks as important media of information transmission, the gradual improvement and expansion of one network after another are especially required. For, the isolated networks without means of interconnection cannot function as effectively as they ought.

Assume that, from the foregoing viewpoint, the eastern region of Indonesia be divided into unit areas and the terrestrial transmission network be introduced in each unit area in due order. Then, the order of priority for network introduction according to unit areas will be as follows:

1st priority:	Sulawesi Area
2nd priority:	Nusa Tenggara Timur and Timor Timur Areas, and Ende - Kupang submarine cable section (in case of Plan B route)
3rd priority:	Maluku Area, and Ujung Pandang - Ambon and Ambon - Ternate submarine cable sections
4th priority:	Irian Jaya Area, and Ambon - Sorong - Biak - Jayapura submarine cable section

The above division into unit areas is applicable to the objective area of the forthcoming feasibility study. At the stage of project implementation, each unit area may have to be subdivided in consideration of available investment budget. Such subdivisions depend to a great extent upon the feasibility study findings.

2. Project Implementation Plan

In order to carry out the feasibility study for each unit area according to the aforementioned order of priority and to implement the project in due order, the following work processes are necessary:

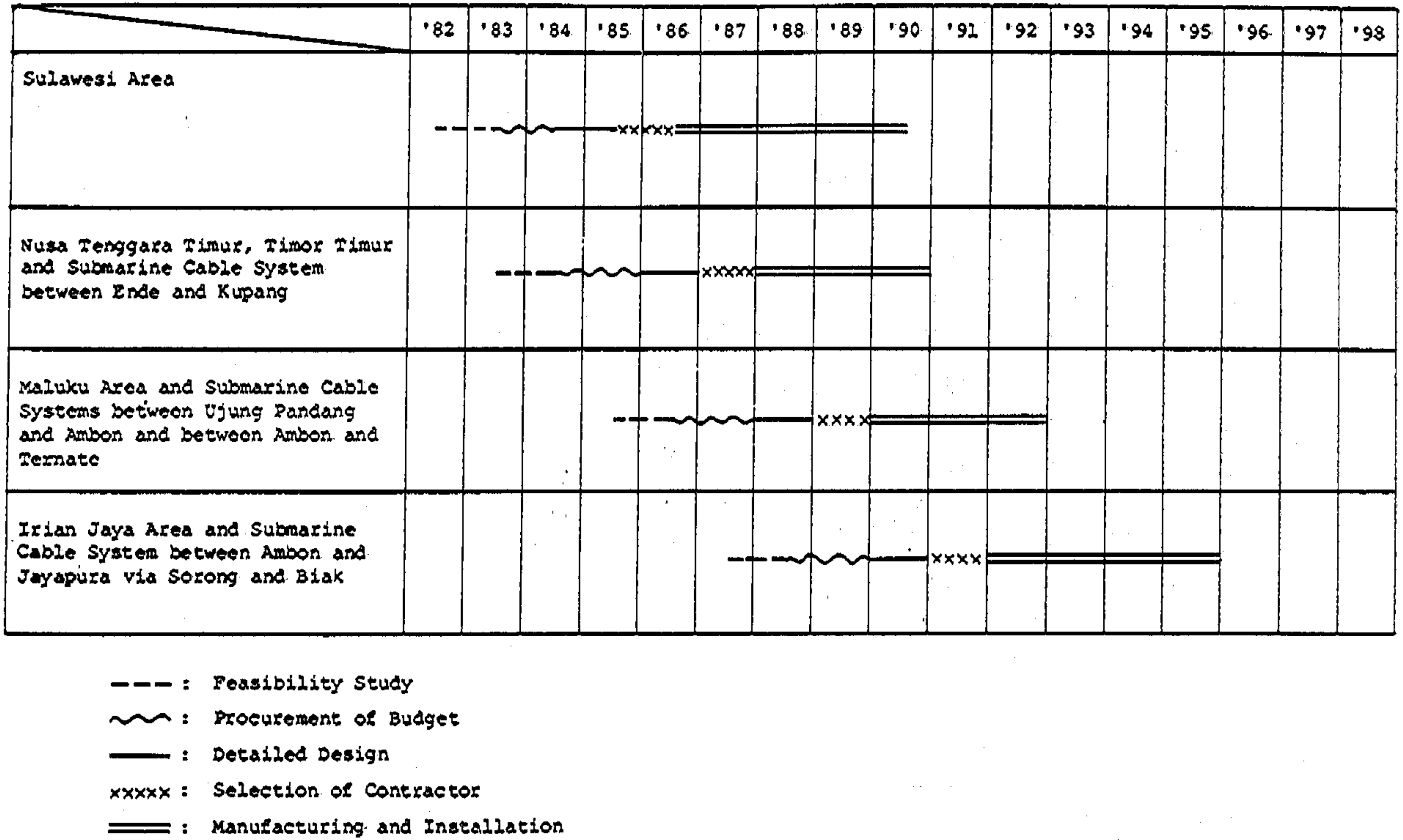
1st process:	To determine the project size, based on the feasibility study result.
2nd process:	To raise fund and organize the budget.
3rd process:	To make detail design of the project and prepare tender specifications.

4th process: To select equipment suppliers and project contractors (including constructors of buildings, access roads, etc.)

5th process: To have equipment manufactured and supplied, and execute the implementation work.

The project implementation flow chart based on the above work processes is drafted in Figure IX-1. Since the project implementation plan must be integral, covering not simply the study objective area but the whole of Indonesia also, the attached flow chart is for reference.

Figure IX-1 Project Implementation Schedule



APPENDIX

Appendix II-1 Outline of Transmigration Plan

For the Government of Indonesia, the transmigration planning constitutes an extremely important policy line. This planning is to move the resident population from overpopulated Jawa, Bali, Madura and Lombok islands to underpopulated Sumatra, Kalimantan, Sulawesi, Maluku and Irian Jaya islands. The objectives are (1) to decentralize the population, (2) to promote regional development, (3) to make effective use of natural resources and manpower, and (4) to develop and maintain the national unity and integrity.

The past records of Government-aided internal settlements or, more precisely, transmigrations appear in Table 1. During the period of Third Five-Year National Development (Repelita III) (1979 - 1984), a total of 500,000 families (2.5 million persons) are to be transmigrated. Table 2 presents the proposed Repelita III transmigration sites, as well as the scheduled number of settlers at each site, in the objective areas of this study. According to the plan, upwards of 100,000 families will be transmigrated to Sulawesi, Malku and Irian Jaya during the Repelita III period.

The Government of Indonesia is presently concetrating on the improvement of transportation to carry settler families, the procurement of machines for land formation at settlement sites, and the soil improvement of scheduled lands for cultivation. The preparatory work for transmigration will make progress at an accelerated pace from now on.

Figure 1 is the scheduled transmigration site map up to the year 2000 in Sulawesi, Maluku and Irina Jaya regions.

Table 1 Number of Families Settled

PERIOD	NUMBER OF FAMILIES	ANNUAL RATE OF SETTLEMENT (families)
1905 - 1950	31,510	700
1950 - 1968	97,452	5,414
1969 - 1974	46,268	9,254
1974 - 1979	55,083	11,017
1979 (Apr. - Dec.)	11,330	13,010
1980 (Jan. - Dec.)	62,339	62,339
1981 (Jan. - Apr.)	30,478	91,434

Source: Directorate General of Transmigration

Table 2 Location of Proposed Repelita III Transmigration Sites

Province	Location	Number of SKPs/a				
		Yr 1 1979/80	Yr 2 1980/81	Yr 3 1981/82	Yr 4 & 5 1982-84	Total 1979-84
North Sulawesi	Inobonto Barat	-	0.4	-	-	0.4
	Bongo	0.25	0.25	-	-	0.5
	Marisa	-	0.25	-	-	0.25
Central Sulawesi	Sausu	1	-	-	-	1
	Bunta	-	1	-	-	1
	Taopa Lambunu	-	1	-	2	3
	Mamo	-	-	-	1	1
	Kolenedale	-	-	2	1	3
	Toili	-	0.2	-	-	0.2
South Sulawesi	Kaluku/Budong	-	-	1	2	3
	Angkona	-	0.5	-	-	0.5
South East Sulawesi	Tinanggea	1.35	1.65	1	-	4
	Wonotobi (ADB)	-	0.75	-	-	0.75
	Lahumbuti	-	1	-	-	1
	Towari/Poleang	-	-	1	2	3
Maluku	Buru	0.65	1.35	-	-	2
	Dataran Kao	-	-	1	2	3
	Dataran Weda	-	-	1	-	1
	Pasahari	-	-	-	2	2
Irian Jaya	Aimas	0.15	1.35	1	2	4.5
	Prafi	-	0.3	1	2	3.3
	Grime	-	-	-	1	1
	Nabire	-	-	1	1	2
	Kupeh	-	-	-	4	4
	Kurik	0.15	0.05	2	4	6.2
	Nimbokrang	0.12	0.18	-	-	0.3
Sulawesi Total		2.60	7.00	5	8	22.60
Maluku Total		0.65	1.35	2	4	8.00
Irian Jaya Total		0.42	1.88	5	14	21.30
Sumatra Total		15.75	30.10	16	33	94.85
Kalimantan Total		4.45	11.35	12	58	85.80
Whole Indonesia (No. of families)		23.87 (48,000)	51.68 (103,000)	40	117	233.55

/a : SKP = Development Unit for 2,000 families

Source : Document of the World Bank Report No. 3170a-IND. Indonesia Transmigration Program Review

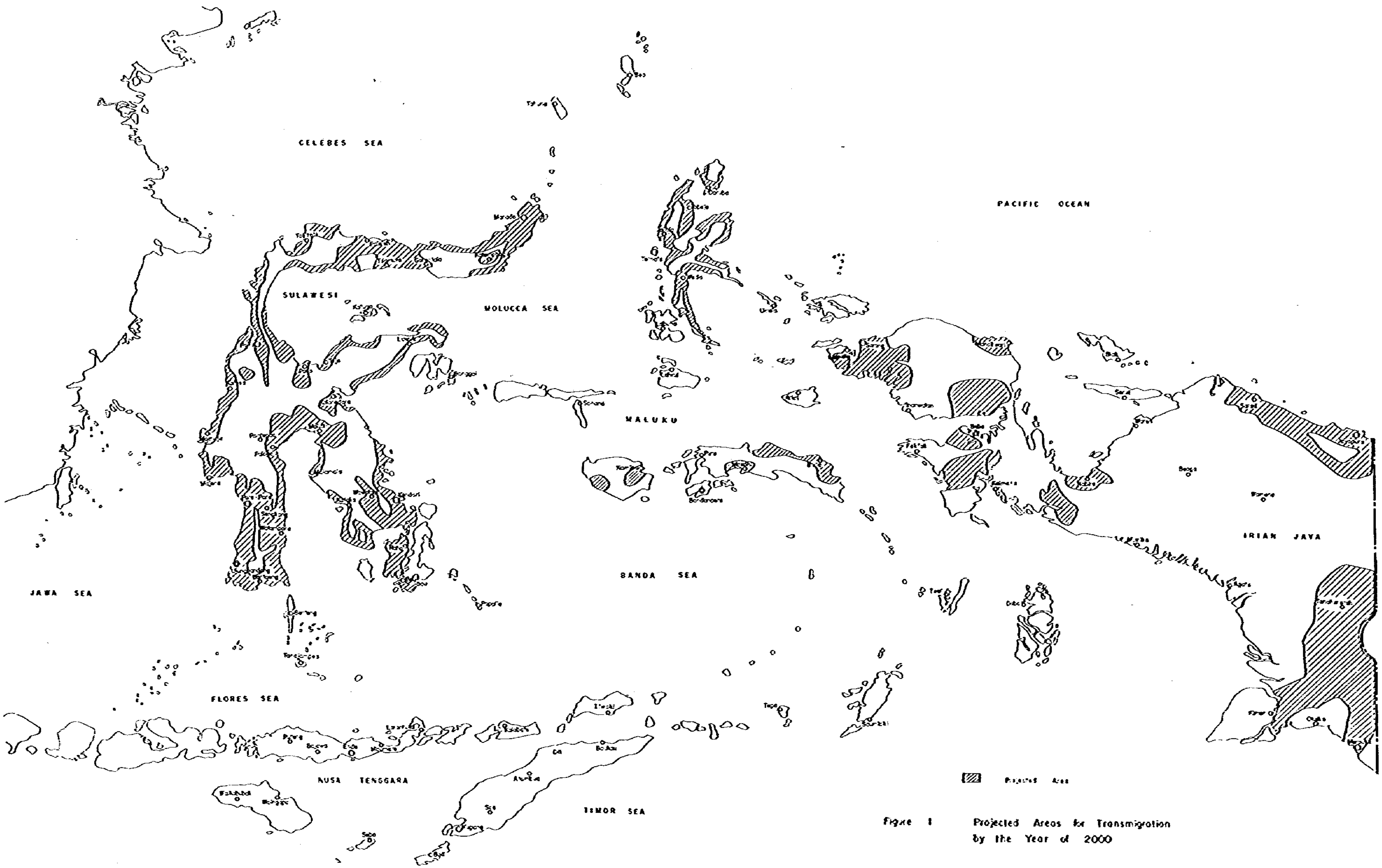


Figure 1 Projected Areas for Transmigration by the Year of 2000

Appendix II-2 Industrial Structure in Indonesia

IN GDP behaviors by industrial origins as shown in Table II-5, agriculture/forestry/fishery traditionally holds large weight, but the share of 40% in 1973 registeres a sharp drop of 30% in 1979. The manufacturing sector has its share stumbling at a low level of 9.2%. In the mining sector, the growth of share is from 12.3% in 1973 to some 17% in 1979, attesting to the important position of this sector.

Indonesia is basically an agricultural country. The industrial development pattern of the country is firstly to earn revenue from exploitation of rich mineral deposits, such as petroleum and natural gas, and to promote industrialization by means of such revenue and by aid of foreign capital investment.

(1) Agriculture

Staple agricultural products are food products centering upon rice and tropical farm products. The scale of production is large. In rice production, the country places 3rd in the world list and, in soyabean production, takes 4th place. Furthermore, the country is among the leading maize producing countries. The lands under cultivation leave much room for expansion.
Table 1 presents food crop records in recent years.

(2) Forestry

In Indonesia, the forest land covers approximately 122,000 million hectares. This corresponds to some 64% of the whole national territories. Main forest zones are in Kalimantan, Irian Jaya and Sumatra islands and aggregate 101,000 million hectares. This occupies up to 83% of all forest zones.

The lumber industry is making rapid growth as export industry since 1969. Ever since 1972, lumber is an important export item second to petroleum. The lumber export in 1979 accounts for 11.5% in the year's total export record.

(3) Fishery

Catches and hauls in Indonesian fishery totaled approximately 1,648,000 tons in 1978. The regional breakdown consists of 23% of Jawa, 18% of Kalimantan, 16% of Sulawesi and 15% of Sumatra etc. Catches and hauls in value as of 1977 comprised 185,500 million Rupiahs in inland open water fishery and 1,308,000 million Rupiahs in marine fishery. Products in marine fishery are of high unit product prices. In terms of value, the leading marine fishery products consist of lobsters, shrimps and prawns and account for 22% of the total. (Up to 90% of total catches are from Irian Jaya and Maluku offings.)

(4) Manufacturing

Since 1969, modern iron producing factories have been constructed by Government of Indonesia investment or by domestic/foreign civilian investment. The production of iron and secondary pig iron products is increasing rapidly.

Among nonferrous metals, tin ingot is an important item. The tin ingot production totaled 27,700 tons in 1979. The most part of tin ingot produced is for export.

For machinery, the final product assembly is made in Indonesia. However, the procurement of principal parts and components is by import for the most part.

Agricultural chemistry is fast developing. Presently, the fertilizer production is at a level of 2,200,000 tons annually for urea and 120,000 tons for ammonium sulphate.

In the field of inorganic chemistry, cement is the top product. The cement production of 4,700,000 tons annually serves the purpose of self-sufficiency. The demand for cement is expected to increase by as much as 18% per annum; in 1983, the domestic demand alone will reach 8,900,000 tons. The Ministry of Industry estimates the cement production in that year at 11,500,000 tons inclusive of 2,300,000 tons for export.

The textile production made rapid strides during the First and Second Five-Year National Development Plan period. An outstanding feature in recent years is the broad increase of export. The textile export in 1978 grew to 2.6 times (US$21 million in value) that of the preceding year and, in 1979, to 5.6 times (US$118 million in value) as much as in the year before.

(5) Mining

Mineral products are the important means for Indonesia to earn foreign currencies. Out of the total export in 1979, the mineral product export including that of petroleum, natural gas (LNG) and petroleum products amounted to US$10,734 million. This figure accounted for nearly 70% of the total.

Table 2 presents the mineral production in Indonesia in recent years. Meanwhile, in Irian Jaya and Northern Kalimantan, as well as other vast undeveloped areas, the investigation about mineral deposits has not yet been carried out on a full scale. There is much to depend upon development activities henceforward.

Petroleum production in 1979 totaled 580 million barrels (1,590,000 barrels daily) or down 2% compared with the preceding year. This fact reflects the production curtailment that continues since 1977.

Also in 1979, natural gas (LNG) production aggregated nearly 100,000,000 million ft^3. The production is being rapidly expanded these days. In the final year of Repelita III (1983/84), the production is scheduled to increase to 160,000,000 million ft^3. While the petroleum production remains at a standstill, prospects loom large for LNG as an energy source for export.

Table 1 Area Harvested, Production and Yield Rate of Food Crops in Indonesia, 1974 - 1979

	1974	1975	1976	1977	1978	1979
1. Paddy						
Area Harvested (Ha)	8508 598	8495 036	9368 759	8359 569	8929 169	8849 933
Production (Ton)	22464 376	22330 650	23300939	23347 132	25771 570	26350 256
Yield Rate (100 kg/Ha)	26.40	26.29	27.84	27.93	28.86	29.77
2. Wet Land Paddy						
Area Harvested (Ha)	7340 234	7334 474	7229 417	7202 360	7698 493	7663 501
Production (Ton)	21052 924	20849 819	21851528	21808 369	24172 366	24818 978
Yield Rate (100 kg/Ha)	28.68	28.43	30.22	30.28	31.40	32.39
3. Dry Land Paddy						
Area Harvested (Ha)	1168 354	1160 622	1139 342	1157 208	1230 760	1185 498
Production (Ton)	1411 452	1480 831	1449 411	1538 792	1599 204	1531 278
Yield Rate (100 kg/Ha)	12.08	12.76	12.72	13.30	12.99	12.91
4. Maize						
Area Harvested (Ha)	2666 858	2444 865	2095 054	2566 509	3024 611	2594 809
Production (Ton)	3010 781	2902 837	2572 139	3142 654	4029 201	3305 438
Yield Rate (100 kg/Ha)	11.28	11.87	12.28	12.24	13.32	12.84
5. Cassava						
Area Harvested (Ha)	1509 449	1410 025	1353 328	1363 522	1382 902	1417 952
Production (Ton)	3030 674	12545 544	12190728	12487654	12902011	13330 002
Yield Rate (100 kg/Ha)	86	89	90	92	93	94
6. Sweet Potatoes						
Area Harvested (Ha)	330 250	310 917	301 055	325 239	300 540	540278471
Production (Ton)	2469 208	2432 614	2381 213	2460 354	2082 801	2043 059
Yield Rate (100 kg/Ha)	75	78	79	75	69	73
7. Peanuts						
Area Harvested (Ha)	410 663	474 519	414 211	507 249	506 445	459 521
Production (Ton)	307 166	379 693	341 089	408 950	445 812	417 693
Yield Rate (100 kg/Ha)	7.48	8.00	8.23	8.06	8.80	8.53
8. Soya Beans						
Area Harvested (Ha)	768 027	751 689	646 336	646 121	733 142	784 093
Production (Ton)	589 239	589 831	521 777	522 821	616 599	673 859
Yield Rate (100 kg/Ha)	7.67	7.86	8.07	8.09	8.41	8.02

Source: Statistical Pocketbook of Indonesia
Biro Pusat Statistik

Table 2 Mineral Production, 1974 - 1979

COMMODITY	YEAR						
	UNIT	1974	1975	1976	1977	1978	1979
Crude Oil	1000 brl	501 838	476 855	550 319	615 123	596 698	580 447
Natural Gas	100 Mcf	202 334	222 256	312 149	542 659	820 130	998 457
Tin	M. TON	25 709	25 337	24 456	25 926	27 437	29 436
Coal	M. TON	156 153	206 390	192 910	230 627	264 180	278 589
Bauxite	M. TON	290 054	992 556	940 269	1301 416	1007 746	1057 905
Nickel ore	M. TON	878 855	801 072	1124 346	1302 512	1206 680	1551 872
Gold	Kg	265	331	335	256	254	170
Silver	kg/	6 465	4 755	3 397	2 832	2 506	1 645
Iron Sand Consen-trate	M. TON	365 206	352 991	292 334	311 519	218 439	79 877
Asphalt	M. TON	75 170	115 679	104 990	137 701	161 817	96 805
Manganese	M. TON	18 037	13 682	9 833	5 981	5 290	...
Copper Consentrate	M. TON	212 620	201 273	223 301	189 103	180 932	188 769

Source: Statistical Pocketbook of Indonesia
Biro Pusat Statistik

Appendix II-3 Industrial Structure in Objective Areas

For each province in the objective areas of this Study, the gross regional domestic product by industries is given in Table 1 and Table 2. In each province, agriculture occupies a very large share. In Irian Jaya, mining holds relatively great weight; however, generally speaking, this province nevertheless remains to be an agricultural province. In spite of such general outlook, all other industrial sectors than agriculture also indicate considerably high growth rates, reflecting the policy lines for industrial development of the Government of Indonesia.

The existing state of main industries in each province is described below.

(1) Sulawesi Utara

About half the provincial population are engaged in palm plantation. Palm production in 1978 totaled 199,767 tons, taking a 15% share in the country's total production. Clove plantation prospers with the production aggregating 12,000 tons as of 1978. This figure accounts for 55% of the total production in the country.

Fishery:
Tuna, as well as lobster, shrimp and prawn, catches are exported.

(2) Sulawesi Tengah

Forestry:
Ebony plant felling for export is prosperous. The export record during the period of Repelita II amounted to 77,718 tons, valued at US$22.8 million.

Agriuclture:

Palm plantation thrives. The production as of 1977 totaled 1,650,000 tons, taking a 12% share in the country's total production.

Mining:

Copper deposit development is being carried out on a large scale.

(3) Sulawesi Selatan

Agriculture:

Rice production in 1978 totaled 1,210,000 tons. This takes a 7.4% share in the national total.

Fishery:

Lobster, shrimp and prawn catches a exported. The export record as of 1978 totaled 1,880 tons. Foreign currency earnings by this export amounted to US$13 million.

Forestry:

Ebony, rattan and other timber constitute an important export item. In 1977, ebony export amounted to US$589,000, rattan export US$29,000 and other timber export US$2,176,000. All these combined took a 3% share in the year's export record.

Mining:

Chief mining items are cement production and chrome, iron and tin deposit development.

(4) Sulawesi Tenggara

Agriculture:

No featured product exists. Agricultural settlers are invited from Jawa every year for the purpose of paddy field expansion.

Mining:

Open air asphalt quarrying and nickel ore development are the main features.

(5) Maluku

Fishery:

Marine fishery prospers. In the 1971 through 1977 record, lobster/shrimp/prawn catch totaled 23,735 tons and tuna catch 5,807 tons.

Forestry:

General timber export is brisk. The 1977 record consisted of 717,429m^3, valued at US$38 million. The share in the year's national total is about 4%.

Mining:

At Gabe Island, nickel are development continues since 1977.

(6) Irian Jaya

Mining:

Petroleum deposit development under foreign aid is being carried out. Petroleum production was 11,490,000 barrels in 1974, but the subsequent yearly increases brought the production to 39,620,000 barrels in 1978. This figure accounts for 7% of the national total of that year. Much can be expected from New oil field development in the still unexplored areas.

Forestry:

The forest land coverage totals 31,500 million hectares. Development is yet to be made.

Fishery:

Lobster/shrimp/prawn fishery is brisk. Sorong is the base port for such fishery activities. In 1978, the catch was as much as 47% of the country's total.

Table 1 Gross Regional Domestic Product by Provinces by Industrial Origin at Current Market Prices, 1975 - 1978

Unit : Million Rupiah

Year	Province	Agriculture	Mining and Quarrying	Manufacturing Industries	Electricity Gas and Water Supply	Construction	Trade, Restaurants and Hotels	Transport and Communication	Banking, Other Finance Interest	Ownership of Dwelling	Public Administration & Defence	Services	Gross Regional Domestic Product
1975	Sulawesi Utara	58 268,65	543,73	11 634,31	456,57	5 284,19	38 690,43	11 655,85	2 849,29	3 437,93	15 330,58	8 382,32	154 783,03
	Sulawesi Tengah	33 986,07	140,59	653,93	45,02	1 411,77	12 222,93	1 638,33	349,18	673,48	5 339,46	397,85	56 834,12
	Sulawesi Selatan	195 172,65	258,32	13 845,92	1 769,28	3 381,73	61 972,27	22 342,83	2 456,45	11 869,56	43 832,38	3 162,28	358 623,53
	Sulawesi Tenggara	16 939,95	2 910,53	538,66	44,45	516,15	4 377,72	1 525,65	58,23	1 772,54	4 919,15	274,86	38 820,53
	Nusa Tenggara Timur	64 868,16	169,18	2 155,84	92,76	1 726,38	8 656,22	1 849,85	177,93	3 245,73	9 521,03	1 229,53	93 437,01
	Maluku	64 936,36	2 317,32	1 133,77	126,77	1 851,47	16 838,29	3 317,11	545,15	2 936,12	7 487,15	1 651,07	102 535,58
	Irian Jaya + Mining	42 895,61	125 939,26	8 122,86	532,57	4 197,41	14 832,94	3 522,45	586,83	1 649,30	9 937,29	3 858,77	212 485,50
	Irian Jaya - Mining	42 855,61	295,76	1 122,85	532,57	4 192,41	14 832,04	3 522,45	586,83	1 889,30	9 937,29	3 854,77	82 831,01
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-
1976	Sulawesi Utara	73 459,22	743,69	12 975,72	624,26	6 854,97	41 732,43	15 638,36	2 575,21	4 503,14	16 870,97	9 758,72	185 355,33
	Sulawesi Tengah	45 261,73	341,75	1 435,59	67,53	2 259,04	17 892,53	2 554,48	578,83	939,28	9 182,55	522,61	83 319,04
	Sulawesi Selatan	239 209,74	293,78	16 766,49	2 149,69	4 759,62	72 836,01	25 874,75	3 893,07	13 784,29	54 936,36	3 718,25	428 377,45
	Sulawesi Tenggara	21 024,16	15 493,00	613,79	76,20	578,15	5 739,23	1 934,33	174,55	2 856,24	5 737,45	369,16	54 526,48
	Nusa Tenggara Timur	83 035,49	219,26	3 027,35	135,59	2 172,54	16 776,17	2 353,20	249,38	3 736,43	11 532,27	1 661,17	119 749,31
	Maluku	87 461,91	2 492,42	1 926,22	133,22	1 837,43	23 110,95	4 175,48	659,37	3 230,37	10 563,42	1 662,91	138 259,11
	Irian Jaya + Mining	57 156,58	169 957,93	1 347,72	638,39	4 769,61	17 310,37	5,343,17	718,86	1 329,66	13 442,78	6 669,45	269 154,43
	Irian Jaya - Mining	57 155,58	336,93	1 347,72	638,30	4 769,61	17 310,37	5 343,17	718,85	1,329,65	13 442,78	6 669,45	178 553,43
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-
1977	Sulawesi Utara	133 971,55	1 162,45	14 233,54	939,49	9 545,98	53 071,29	21 552,31	2 536,00	4 591,45	26 789,48	11 772,10	293 525,02
	Sulawesi Tengah	59 955,52	366,87	3 433,74	136,96	2 785,32	17 431,91	4 315,15	1 145,03	1 669,21	12 035,60	612,30	124 885,41
	Sulawesi Selatan	231 158,78	381,72	20 416,63	2 725,77	6 411,13	93 636,76	28 768,60	4 447,44	18 139,53	74 451,95	4 132,50	514 136,05
	Sulawesi Tenggara	25 411,97	19 438,15	636,24	91,03	849,93	7 363,83	2 814,17	278,61	2 533,70	6 424,29	418,76	66 118,16
	Nusa Tenggara Timur	58 445,21	238,19	3 932,61	176,75	2 458,12	13 683,02	3 213,26	365,66	4 128,35	13 667,45	1 669,58	142 144,67
	Maluku	178 278,02	2 038,72	1 369,57	232,65	4 767,95	32 024,93	6 028,64	350,79	3 659,36	14 837,42	1 917,83	195 539,75
	Irian Jaya + Mining	73 254,96	183 631,59	2 667,55	769,91	6 275,93	20 518,72	6 555,77	1 112,44	1 583,37	17 638,69	6 919,73	329 228,93
	Irian Jaya - Mining	73 254,86	479,47	1 647,59	769,91	6 275,99	29 518,72	6 955,77	1 112,44	1 583,37	17 638,69	6 519,73	137 072,42
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-
1978	Sulawesi Utara	-	-	-	-	-	-	-	-	-	-	-	-
	Sulawesi Tengah	83 765,70	765,93	6 256,55	164,58	3 613,85	20 737,19	6 212,56	1 438,46	2 339,33	13 891,24	722,10	137 519,48
	Sulawesi Selatan	366 101,72	2 559,02	23 632,35	3 226,74	6 176,56	112 440,19	34 841,10	5 692,25	19 855,35	87 225,68	4 731,81	666 814,83
	Sulawesi Tenggara	30 168,81	19 637,99	686,25	121,86	937,16	8 924,72	4 373,65	424,33	2 614,05	8 547,65	447,97	76 814,89
	Nusa Tenggara Timur	126 779,22	284,23	5 013,45	273,80	2 956,38	18 513,37	4 632,53	669,44	4 697,74	19 349,01	4 471,05	185 174,83
	Maluku	135 972,32	3 632,43	8 919,59	369,80	6 730,58	32 855,03	7 454,16	1 187,43	4 446,01	17 725,02	2 250,44	213 483,63
	Irian Jaya + Mining	85 651,93	242 937,24	1 861,93	851,32	7 741,54	24 872,78	9 426,78	1 855,58	1 825,43	28 158,00	8 138,44	424 455,79
	Irian Jaya - Mining	85 651,93	554,98	1 861,93	851,32	7 741,54	24 872,78	9 426,78	1 855,58	1 845,43	28 158,00	8 138,44	162 493,43
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-

Source: Provincial Income in Indonesia, 1975 - 1978
Biro Pusat Statistik

Table 2 Gross Regional Domestic Product by Provinces by Industrial Origin at Constant 1975 Market Prices, 1975 - 1978.

Unit: Million Rupiah

Year	Province	Agriculture	Mining and Quarrying	Manufacturing Industries	Electricity Gas and Water Supply	Construction	Trade, Restaurants and Hotels	Transport and Communication	Banking, Other Finance Interest	Ownership of Dwelling	Public Administration & Defence	Services	Gross Regional Domestic Product
1975	Sulawesi Utara	58 260,69	543,77	11 634,31	436,57	5 204,19	38 600,43	11 455,85	2 669,29	3 437,91	15 338,50	8 382,32	154 703,89
	Sulawesi Tengah	33 955,67	144,54	653,93	45,02	1 611,77	12 222,91	1 638,33	349,18	673,44	5 369,45	397,85	56 834,12
	Sulawesi Selatan	153 172,66	268,32	13 645,92	1 749,28	3 391,73	61 972,27	22 362,03	2 436,45	11 669,56	43 697,39	3 162,24	358 623,53
	Sulawesi Tenggara	16 939,95	7 910,57	534,66	40,45	516,15	4 377,72	1 525,65	58,23	1 299,54	4 919,75	214,86	38 829,53
	Nusa Tenggara Timur	64 868,16	169,18	2 155,68	97,36	1 726,38	8 656,22	1 649,63	177,59	3 249,73	9 521,43	1 229,51	93 437,81
	Maluku	64 956,36	2 317,32	1 931,77	126,77	1 861,47	16 838,29	3 312,11	586,15	2 936,12	7 687,75	1 651,47	102 535,58
	Irian Jaya + Mining	42 835,61	139 989,36	1 122,86	532,57	4 392,41	14 832,65	3 522,44	586,03	1 683,39	9 937,20	3 834,77	212 855,59
	Irian Jaya - Mining	42 835,61	255,76	1 122,86	532,57	4 192,41	14 832,64	3 522,45	586,03	1 683,39	9 937,20	3 834,77	82 831,81
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-
1976	Sulawesi Utara	61 582,93	571,56	11 915,95	225,91	3 649,96	36 793,76	12 362,53	2 979,73	4 245,71	13 818,86	7 967,82	155 810,68
	Sulawesi Tengah	36 236,55	273,84	535,41	55,70	2 176,84	14 186,77	2 165,97	502,11	691,15	7 565,03	682,21	65 586,66
	Sulawesi Selatan	156 649,41	714,89	14 235,26	1 824,28	3 424,93	63 778,51	24 435,92	2 849,02	11 656,29	54 815,25	3 698,53	373 638,71
	Sulawesi Tenggara	19 745,67	8 345,28	531,30	62,91	550,35	5 023,91	1 743,07	117,33	1 691,85	4 976,85	259,01	43 282,33
	Nusa Tenggara Timur	67 453,64	182,12	2 643,35	133,51	1 874,36	9 833,69	2 079,27	221,36	3 327,44	10 074,34	1 324,83	99 256,85
	Maluku	75 210,48	2 337,51	1 628,52	150,79	2 735,03	19 839,02	3 738,07	578,26	3 603,65	8 973,81	1 443,05	119 356,66
	Irian Jaya + Mining	43 870,69	155 634,96	1 241,68	557,41	4 583,42	15 668,38	4 636,73	627,82	1 191,99	10 931,95	4 238,32	247 539,95
	Irian Jaya - Mining	43 870,69	363,30	1 241,65	557,41	4 583,42	15 658,30	4 636,73	662,12	1 191,93	10 931,95	4 238,32	92 259,29
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-
1977	Sulawesi Utara	97 810,76	809,46	13 687,74	278,14	4 037,84	43 921,63	16 635,85	1 859,65	4 269,44	18 479,76	8 365,16	206 519,81
	Sulawesi Tengah	43 858,86	488,84	1 252,27	165,51	2 542,74	11 676,23	2 599,25	437,49	737,35	9 720,25	592,33	71 333,03
	Sulawesi Selatan	234 360,56	237,16	15 562,77	2 076,45	3 616,99	74 799,03	25 617,50	3 555,55	13 864,12	65 430,57	3 857,15	438 973,55
	Sulawesi Tenggara	21 819,28	9 839,14	533,12	70,18	558,57	5 426,36	2 454,78	229,15	1 815,44	5 471,66	330,30	48 535,31
	Nusa Tenggara Timur	70 876,57	135,83	3 265,10	114,86	2 630,76	18 488,68	2 669,56	265,85	3 835,27	11 352,53	1 432,39	145 724,51
	Maluku	81 272,53	2 246,56	931,73	191,93	4 352,71	21 659,46	5 153,28	333,21	3 147,02	10 958,72	1 697,97	132 207,43
	Irian Jaya + Mining	55 852,55	166 349,32	1 835,84	672,69	5 729,32	15 922,59	5 639,36	913,19	1 199,63	11 616,99	4 835,73	269 762,63
	Irian Jaya - Mining	55 852,55	370,15	1 835,08	677,69	5 729,32	15 922,59	5 639,36	913,19	1 199,63	11 616,93	4 835,74	163 837,64
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-
1978	Sulawesi Utara **	-	-	-	-	-	-	-	-	-	-	-	-
	Sulawesi Tengah	41 939,76	526,10	1 882,36	122,84	3 034,56	11 955,45	3 626,56	1 143,67	759,56	10 295,51	540,29	75 358,65
	Sulawesi Selatan	261 870,55	1 707,84	16 292,55	2 454,36	3 932,38	81 937,19	29 663,37	4 195,66	14 573,26	71 657,83	4 244,93	492,583,49
	Sulawesi Tenggara	23 933,87	11 347,66	542,40	65,43	567,23	5 932,81	3 435,20	320,73	1 843,79	6 039,58	353,49	55 222,17
	Nusa Tenggara Timur	79 657,53	223,43	3 944,02	167,14	2 324,73	11 926,09	2 232,25	531,26	3 530,78	15 121,94	1 710,33	113,372,23
	Maluku	73 447,28	2 370,68	1 364,65	253,81	5 651,61	20 534,15	5 370,15	820,45	3 225,63	12 371,48	1 539,01	126,915,51
	Irian Jaya + Mining	62 718,43	253 336,98	1 355,01	765,36	6 599,57	18 613,47	6 024,63	375,22	1 833,39	12 136,70	4 639,68	319,859,92
	Irian Jaya - Mining	62 718,43	437,43	1 122,86	766,36	6 509,57	18 613,47	6 024,63	375,22	1 833.39	12 136,70	4 639,68	116 269,97
	Timor Timur	-	-	-	-	-	-	-	-	-	-	-	-

Source: Provincial Income in Indonesia, 1975 - 1978
Biro Pusat Statistik

Appendix II-4 Outline of the Third Five-Year National Development Plan

Keynotes of the Third Five-Year National Development Plan are threefold. They are: (1) To realize equal distribution of development results among the entire nation in order to ensure equality in their social life; (2) To attain economic growth at a sufficiently high level; (3) to create the sound and dynamic national stability.

Solution to population problem constitutes an important objective. That is to say, the rate of population growth is to be reduced to 2% from 2.3% during the second five-year development plan and the transmigration is to be carried out from overpopulated areas to underpopulated areas.

The target growth rates by industrial origins consist of 11% for manufacturing, 9% for construction, 10% for transportation and communications, 3.5% for agriculture, 4% for mining and 8% for others. Table 1 presents the governmental development budget breakdown by sectors. The implementation budget for the Third Five-Year National Development Plan is four times the initial budget plan for the second development plan and 2.4 times the working budget thereof. This budget growth is mainly due to the broad, i.e., 50%, Rupiah currency devaluation carried out in November 1978. This devaluation has resulted in the increase of budget amount indicated by Rupiah.

Table 1 Governmental Development Budget by Sectors

(Unit : Billion Rupiah)

Sector	1 Repelita II		2 Repelita III		2 / 1
	Bil. Rp.	%	Bil Rp.	%	%
Agriculture	1,001.6	19.0	3,048.9	14.0	204.4
Industry	150.7	2.9	1,174.0	5.4	679.0
Mining and Energy	422.8	8.1	2,943.9	13.5	596.3
Communication and Tourism	831.7	15.8	3,384.3	15.5	306.9
Manpower and Transmigration	69.4	1.3	1,240.7	5.7	1,687.8
Rural and Urban Development	930.6	17.7	2,142.9	9.8	130.3
Education	525.8	10.0	2,276.8	10.4	333.0
Social Welfare	192.1	3.7	829.1	3.8	331.6
Housing	101.6	1.9	532.0	2.4	423.6
National Defence	126.0	2.4	1,483.6	6.8	1,077.5
Total	5,249.2	100.0	21,849.4	100.0	316.2

Source: The Third Five-Year Development Plan, 1979 - 84

Appendix III Domestic Satellite Communication System versus Terrestrial Transmission System

1. Features of Satellite Communication System

The satellite communication system holds many features that distinguish it from the terrestrial transmission system. These features can be segmented into merits and demerits as summarized below.

(1) Merits

(a) Communication is possible to/from all places inside the coverage area by the satellite antenna. (When the non-directional antenna is used, the almost uniform quality service can be provided in the area having a radius of about 8,000 km.)

(b) Connection of one earth station to another in the coverage area can be realized by a single satellite relay. Therefore, the transmission cost and performance are not influenced by the distance between earth stations.

(c) Simultaneous transmission of information of the same contents from one earth station to a plural number of other earth stations is possible.

(d) The multiple access function makes the flexible circuit establishment possible, so that the transmission capacity betwen earth stations can be changed as required.

(e) Earth stations are the sole ground facilities required so that the system construction and maintenance are easy compared with the terrestrial transmission system. The earth station location can be changed where necessary.

(f) The system is least vulnerable to ground disasters.

(2) Demerits

(a) The via satellite relay distance between earth stations is as long as 72,000 km, and this causes the radio wave to take 260 milliseconds for propagation in one direction. Hence the restriction on communication by two satellite links. (Refer to CCITT Rec. G 114 and Q 14.)

(b) To observe secrecy of communication is difficult, compared with the terrestrial transmission system.

(c) The satellite life is short (7 to 8 years).

(d) System development and practicing by in-house technology require vast financial investment.

(e) The satellite orbit is internationally co-used so that the satellite operation requires international agreements and regulations.

Out of these demerits, the reduction of propagation time is the sole item that will be unaccomplishable even by the further technical renovation expected in the future. Meanwhile, in the terrestrial transmission system, the propagation time is 40 milliseconds or thereabouts. (This propagation time applies when the maximum transmission route length is set at 10,000 km out of safety consideration, or twice the east to west geographical distance of the Indonesian national territories extending about 5,000 km.) The delay in radio wave propagation in the satellite system compared with the terrestrial system is bound to worry communication users, especially the users of two-directional communication services, such as telephony.

2. Scopes of Application of Both Systems

This section presents the results of comparative study of the satellite and terrestrial transmission systems in the scopes of application at reasonable cost. The study is based on the provisional data obtained in the research and development process for the Japanese domestic satellite communication system (CS-2) scheduled to be serviced in and after 1983, as well as the development research documents of foreign countries.

Three systems were used in the comparaative study. They are the TDMA system satellite transmission system, the line-of-sight digital radio transmission system and the optical fiber cable transmission system.

(a) The satellite system cost remains fixed regardless of the transmission distance whereas the terrestrial system cost increases in proportion to the transmission distance. Therefore, up to a certain transmission distance the terrestrial system is economically advantageous; however, when the transmission distance is beyond that limit, the satellite system becomes advantageous. Shown below are the break-even point estimates of satellite and terrestrial systems, using the system capacity as variable.

System Capacity	Satellite vs Radio Systems	Satellite vs Optical Fiber Cable Systems
About 500 ch	900 - 1,000 km	300 - 400 km
" 100 ch	600 - 800 km	200 - 300 km
" 10 ch	300 - 400 km	40 - 60 km

(b) For all three systems, cost per circuit increases in inverse proportion to system capacity. Therefore, cost per circuit according to system capacity can be estimated as under. In this case, the maximum system capacity is set at 2,000 channels or thereabouts.

- When the transmission distance is aobut 100 km:

  Regardless of system capacity, the both terrestrial systems command advantage over the satellite system.

- When the transmission distance is about 500 km:

  Regardless of system capacity, the radio system commands top advantage. For the satellite and optical fiber cable systems, the break-even point presupposes the system capacity of about 700 - 900 channels. Up to this limit, the satellite system commands advantage.

- When the transmission distance is about 1,000 km:

  The optical fiber cable system is disadvantageous in all range. For the satellite and radio systems, the system capaicty of 400 - 600 channels or thereabouts constitutes the break-even point critical path, and up to this limit the satellite system commands advantage though the cost difference between both systems is small.

The foregoing study results lead to the following conclusion as to the scopes of application at reasonable cost of the three, i.e., satellite, radio and optical fiber cable systems:

(a) The satellite system is best suited for small capacity, long distance transmission.

(b) The optical fiber cable system is best suited for large capacity, short distance transmission.

(c) The radio system comes midway between the above two systems. That is to say, it is best suited for medium capacity, medium distance transmission.

3. Concluding Remarks

The foregoing estimates are the study results based on the available data at the present stage. Therefore, they only indicate the general trends about the scopes of application at reasonable cost of the aforementioned three transmission systems. For evaluation of their scopes of application in concrete terms, the study must be made not simply about the cost performance, but the merits and demerits of each system must also be duly considered.

As regards the system availability for the nationwide public communication network, it must be noted that the satellite system alone will not be able to satisfy the ever-increasing demand, especially the demand for high frequency band, non-voice communication services, such as TV, video and high-speed data communication. For the remedy, the transmission network will have to be composed of both satellite and terrestrial systems according to the following application philosophy:

(a) For communication to/from remote areas, such as isolated islands, the satellite system is to be adopted.

(b) For communication between main cities in each areas, both the satellite and terrestrial systems are to be adopted to constitute the transmission route. This is to make the best advantage of the merits of both systems for the purpose of stable and reliable services.

(c) For communication between main cities and surrounding minor cities, the terrestrial system is to be adopted.

(d) For main transmissin media for TV and video telephone, as well as high-speed data communication, the satellite system is to be utilized because of its wide coverage and simultaneous service capabilities. The satellite system is further to be utilized for establishing and maintaining special service circuits during emergency.

Appendix IV. 1

Table (1/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
381	Ende	Ende	M-LB	400	293	+1,000	-400	1,000		
		Wolowaru	"	50	11	0	0		50	
		(Total-Ende)		(450)	(304)	(+1,000)	(-400)	(1,000)	(50)	640
382	Manmere	Maumere	M-LB	300	255		+250		550	550
383	Larantuka	Larantuka		0	0		+100		100	100
384	Bajawa	Bajawa		0	0		+200		200	100
385	Ruteng	Ruteng	M-LB	300	237		+200		500	
		Reo	"	50	11		0		50	
		(Total-Ruteng)		(350)	(248)	(0)	(+200)		(550)	580

Source: PRANSEN, PERUMTEL

Appendix IV. 1 Table (2/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
386	Waingapu			0	0		0		0	0
387	Waikabubak	Waikabubak		0	0		+100		100	100
Total - Ende				1,100	807	+1,000	450	1,000	1,550	2,070

Appendix IV. 1 Table (3/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
391	Kupang	Kupang	A	3,000	1,144		0	3,000		
		Camplong	M-LB	20	7				20	
		(Total-Kupang)		(3,020)	(1,151)	(0)	(0)	(3,000)	(20)	1,400
392	Soe	Soe	M-LB	100	58				100	
		Nikiniki	"	50	13				50	
		(Total-Soe)		(150)	(71)	(0)	(0)		(150)	100
393	Kefamenau	Kefamenau	M-LB	100	57				100	
		Oelolok	"	20	4				20	
		(Total-Kefamenau)		(120)	(61)	(0)	(0)		(120)	100
394	Atambua	Atambua	M-LB	160	105		+40		200	400

Appendix IV. 1 Table (4/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
395	Bau	Baa	M-LB	50	22				50	50
396	Seba			0	0			0	0	0
397	Kalabahi	Kalabahi	M-LB	100	66		0		100	200
398	Ilwaki			0	0		0	0	0	0
399	Baukau			0	0		+200		200	200
390	Dili		A	900	320		0	900		900
Total - Kupang				4,500	1,796		+240	3,900	840	3,350

Appendix IV. 1 Table (5/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
411	Ujung Pandang	Ujung Pandang 1	A	8,200	7,030			8,200		
		" 2	"	4,000	1,073			4,000		
		Maros	M-LB	150	142		+170		320	
		Sungguminasa	"	200	146		+100		300	
		Takalar	"	80	44				80	
		Malino	"	50	30				50	
		Mandai	"	50	24				50	
		Pangkejene	"	200	159		+100		300	
		(Total-U.P)		(12,930)	(8,648)		(+370)	(12,200)	(1,100)	14,650
412	Watampone	Watampone	M-LB	330	320		+120		450	450

Appendix IV. 1 Table (6/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
413	Bantaeng	Bantaeng	M-LB	200	166		+200		400	
		Bulukumba	"	170	134		+130		300	
		Janeponto	"	100	65		0		100	
		Sinjau	"	100	81		+50		150	
		(Total-Bantaeng)		(570	(446)		(+380)		(950)	800
414	Benteng	Benteng		0	0		+400		400	0
415	Tanajampea			0	0		0	0	0	0
Total - Ujung Pandang				13,830	9,414		1,270	12,200	2,900	15,900

Appendix IV. 1 Table (7/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
421	Pare-Pare	Pare-Pare 1			0			0	0	
		" 2	A	1,000	895		0	1,000		
		Enrekajene	M-LB	50	38		0		50	
		Pang Kajene	"	150	109		+150		300	
		Pinrang	"	150	116		+150		300	
		Barru	"	100	50		+100		200	
		Rappang	"	100	48		+100		200	
		Watansopeng	"	170	116		0		170	
		(Total-Pare 2)		(1,720)	(1,372)		(+500)	(1,000)	(1,220)	3,200
422	Majene	Majene	M-LB	100	81		0		100	
		Polewari	"	110	87		+90		200	
		(Total-Majene)		(210)	(168)		(+90)		(300)	100

Appendix IV. 1 Table (8/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
423	Rantepao	Rantepao	M-LB	100	90		0		100	
		Makale	"	100	71		0		100	
		(Total-Rantepao)		(200)	(161)		(0)		(200)	80
424	Palopo	Palopo	M-LB	200	186		+100		300	300
425	Seng-kang	Seng-kang	M-LB	170	153		+130		300	
		Cabenge	"	50	12		0		50	
		(Total-Sengkang)		(220)	(165)		(+130)		(350)	400
426	Mamuju	Mamuju		0	0		+200		200	0
		(Total-Mamuju)								
427	Masamba	Masamba		0	0			0	0	0

Appendix IV. 1 Table (9/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
428	Malili	Malili		0	0			0	0	0
429	Karosa	Karosa		0	0			0	0	0
Total - Pare-Pare				2,550	2,052		1,020	1,000	2,570	4,080

Appendix IV. 1 Table (10/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
431	Manado	Manado 1	A	2,600	2,081			2,600		
		" 2	A	2,000	1,133			2,000		
		Tondano	M-LB	200	169	+600	-200	600		
		Amurang	"	50	46				50	
		Airmadidi	"	50	26				50	
		Bitung	"	400	312	+1,000	-400	1,000		
		Kawangkoan	"	50	39				50	
		Tomohom	"	200	172		+200		400	
		(Total-Manado)		(5,550)	(3,978)	(+1,600)	(-400)	(6,200)	(550)	6,800
432	Tahuna	Tahuna		0	0		+200		200	200
433	Beo	Beo		0	0		0	0	0	0
434	Kotamobagu	Kotamobagu	M-LB	200	176		+200		400	
		(Total-Kotamobagu)		(200)	(176)		(+200)	(0)	(400)	360

Appendix IV. 1 Table (11/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
435	Gorontalo	Gorontalo 1	M-CB	1,160	1,147	+2,000	-1,160	2,000		
		" 2	M-LB	40	13				40	
		(Total-Gorontalo)		(1,200)	(1,160)	(+2,000)	(-1,160)	(2,000)	(40)	2,000
436	Tilamuta	Tilamuta		0	0		0	0	0	0
437	Paleleh	Paleleh		0	0		0	0	0	0
Total - Manado				6,950	5,314	3,600	-1,160	8,200	1,190	9,360

Appendix IV. 1 Table (12/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
451	Palu	Palu	A	1,000	931		0	1,000		
		Donggala	M-LB	200	136		+100		300	
		Tawaeli	"	50	20		0		50	
		(Total-Palu)		(1,250)	(1,087)	(0)	(+100)	(1,000)	(350)	2,400
452	Poso	Poso	M-LB	600	559	+900	-600	900		
		(Total-Poso)		(600)	(559)	(+900)	(-600)	(900)		900
453	Toli-toli	Toli-toli		0	0		0	0	0	0
		Parigi	M-LB	50	18		0		50	
		(Total-Toli-toli)		(50)	(18)	(0)	(0)		(50)	640
454	Tojo			0	0			0	0	0
455	Kolonedale			0	0			0	0	0
456	Bungku			0	0			0	0	0

Appendix IV. 1 Table (13/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
457	Katuga			0	0					
458	Luwuk		M-LB	600	591	+1,000	-600	1,000		800
459	Banggai			0	0			0	0	0
Total - Palu				2,500	2,255	1,900	-1,100	2,900	400	4,740

Appendix IV. 1 Table (14/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
401	Kendari	Kendari	A	1,000	776			1,000		
		(Total-Kendari)		(1,000)	(776)	(0)	(0)	(1,000)		1,000
402	Baubau			0	0		+100		100	100
403	Raha			0	0	0	0	0	0	0
404	Papalia			0	0	0	0	0	0	0
405	Kolaka			0	0		+200		200	200
406	Malamala			0	0			0	0	0
407	Wawotobi			0	0			0	0	0
Total - Kendari				1,000	776	0	300	1,000	300	1,300

Appendix IV. 1 Table (15/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
911	Ambon	Ambon	A	1,600	1,553			1,600		
		Paso	M-LB	10	9				10	
		(Total-Ambon)		(1,610)	(1,562)	(0)	(0)	(1,600)	(10)	3,600
912	Piru			0	0			0	0	0
913	Namlea			0	0			0	0	100
914	Masohi	Masohi	M-LB	120	114				120	
		(Total-Masohi)		(120)	(114)	(0)	(0)		(120)	100
915	Bula			0	0			0	0	0
916	Tual	Tual	M-LB	300	247	+600	-300	600		
		(Total-Tual)		(300)	(247)	(+600)	(-300)	(600)	(0)	480
917	Dobo			0	0		+200		200	220
918	Saumlaki			0	0			0	0	0

Appendix IV. 1 Table (16/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
919	Tepa			0	0			0	0	0
910	Bandanaera			0	0			0	0	0
Total - Ambon				2,030	1,923	600	-100	2,200	330	4,500

Appendix IV. 1 Table (17/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
921	Ternate	Ternate	A	1,000	635			1,000		
		Soasiu	M-LB	100	57				100	
		(Total-Ternate)		(1,100)	(692)	(0)	(0)	(1,000)	(100)	1,000
922	Jailolo			0	0			0	0	0
923	Daruba			0	0			0	0	0
924	Tobelo			0	0			0	0	200
925	Weda			0	0			0	0	0
926	Umela			0	0			0	0	0
927	Labuka			0	0			0	0	0
928	Laiwui			0	0			0	0	0
929	Sanana			0	0			0	0	0
Total - Ternate				1,100	692			1,000	100	1,200

Appendix IV. 1 Table (18/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
951	Sorong	Sorong	M-LB	400	338	+1,000	-400	1,000		
		Remu	"	400	365				400	
		Doom	"	50	25				50	
		(Total-Sorong)		(850)	(728)	(+1,000)	(-400)	(1,000)	(450)	1,000
952	Samate			0	0			0	0	0
953	Atkri			0	0			0	0	0
954	Inanwatan			0	0			0	0	0
955	Babo			0	0			0	0	0
956	Fak-fak	Fakfak	M-LB	300	280	+800	-300	800		
		(Total-Fakfak)		(300)	(280)	(+800)	(-300)	(800)		0
957	Kaimana			0	0			0	0	100
958	Mimika			0	0			0	0	0
Total - Sorong				1,150	1,008	1,800	-700	1,800	450	1,100

Appendix IV. 1 Table (19/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
961	Biak	Biak	A	1,000	635			1,000		
		(Total-Biak)		(1,000)	(635)			(1,000)		1,000
962	Manokwari	Manokwari	M-LB	450	394	+1,000	-450	1,000		
		(Total-Manokwari)		(450)	(394)	(+1,000)	(-450)	(1,000)		1,000
963	Serui	Serui	M-LB	400	252				400	
		(Total-Serui)		(400)	(252)	(0)	(0)		(400)	100
964	Nabire			0	0		+200		200	200
965	Waren			0	0			0	0	0
966	Sarmi			0	0			0	0	0

Appendix IV. 1 Table (20/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
967	Jayapura	Jayapura	A	1,200	1,107			1,200		
		Abepura	M-LB	400	267				400	
		Sentani	"	200	96				200	
		Ifar	"	50	3				50	
		(Total-Jayapura)		(1,850)	(1,473)	(0)	(0)	(1,200)	(650)	3,000
968	Beoga			0	0			0	0	0
969	Wamena			0	0		+200		200	200
960	Kive			0	0			0	0	0
Total - Jayapura				3,700	3,861	+1,000	-50	3,200	1,450	5,500

Appendix IV. 1 Table (21/21) Installation Plan of Telephone Exchanges until 1984 in Eastern Part of Indonesia

Primary Area		Terminal Exchange	Existing (1981)			Additional Line Capacity (1982 - 1984)		Total Line Capacity (1984)		Estimated Capacity in the Year 2000 Plan (1984)
Area Code	Area Name		Type	Line Capacity	No. of Lines	Auto.	Manual	Auto.	Manual	
971	Merauke	Merauke	A	1,000	343			1,000		
		Mopah	M-LB	200					200	
		(Total-Merauke)		(1,200)	(343)	(0)	(0)	(1,000)	(200)	1,000
972	Okaba			0	0			0	0	0
973	Kiman			0	0			0	0	0
974	Koba			0	0			0	0	0
975	Tanah Merah			0	0			0	0	0
976	Agats			0	0			0	0	0
977	Cumbuyum			0	0			0	0	0
978	Waropko			0	0			0	0	100
Total - Merauke				1,200	343	0	0	1,000	200	1,100

Appendix IV. 2

Installation Plan of Gentex Exchanges until 1984 - Whole Indonesia (1/3)

Witel	Area Code	Tandem Exchange	Terminal Exchange	Existing (1980)		Additional Line Capacity (1981 - 84)	Total Line Capacity (1984)	Estimated Cap. in the Year 2,000 Plan (1984)
				Line Capacity	No. of Telex Lines			
I	5	Medan	Medan	1,000	366		1,000	
			Banda-Ache	-		100	100	
			Batam/Sekupang	-		40	40	
			(Witel-I Total)	(1,000)	(366)	(140)	(1,140)	1,100
II			Padang	500	105		500	
			Pakanbaru	500			500	
			Tanjung Pinang	100			100	
			(Witel-II Total)	(1,100)	(105)	(0)	(1,100)	1,200
III	2	Jakarta	Pelembang	500	247		500	
			Tanjung Karang	-		200	200	
			(Witel-III Total)	(500)	(247)	(200)	(700)	500
IV	4		Jakarta	5,300	3,010	2,300	7,600	
			(Witel-IV Total)	(5,300)	(3,010)	(2,300)	(7,600)	7,600
V	2		Bandung	500	220	200	700	
			(Witel-V Total)	(500)	(220)	(200)	(700)	700