REPUBLIC OF INDONESIA
FEASIBILITY STUDY REPORT
ON
TELECOMMUNICATION NETWORK IN DEVELOPING AREAS SURROUNDING MEDAN AND UJUNG PANDANG

FEBRUARY, 1981

[redacted]

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the Republic of Indonesia, the Japanese Government decided to conduct a survey on the telecommunication network in developing areas surrounding Medan and Ujung Pandang and entrusted to the Japan International Cooperation Agency (JICA). The JICA sent to Indonesia a survey team headed by Mr. Shigeru FUKUDA, Special Advisor of International Cooperation, Minister's Secretariat, Ministry of Post and Telecommunications, from June 23 to August 31, 1980.

The team had discussions with the officials concerned of the Government of Indonesia, Post and Telecommunications (POSTEL), Persahaan Umum Telekomunikasi (PERUMTEL) and conducted a field survey in developing areas surrounding Medan and Ujung Pandang. After the team returned to Japan, further studies were made and the present report has been prepared.

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

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

February 1981

Keisuke Arita

Keisuke ARITA
President
Japan International Cooperation Agency

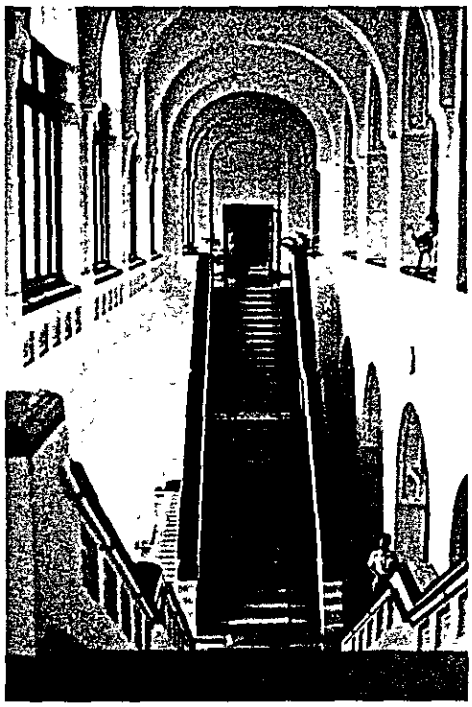
GLOSSARY OF ABBREVIATIONS

mm	Milimeter
km	Kilometer
km^2	Square kilometer
W	Watt
AH	Ampere hour
KVA	Kilovolt ampere
Hz	Hertz
kHz	Kilohertz
MHz	Megahertz
GHz	Gigahertz
dB	Decibel
nF	Nano Farad
CH	Telephone channel
RF CH	Radio frequency channel
BER	Bit error rate
CR	Calling rate
ESS	Electronic switching system
MAS	Multi-access subscriber radio telephone system
SMA	Analog subscriber loop multipelxer system
PE	Polyethylene
JF	Jelly filled
L.U.	Line unit
GDP	Gross domestic product
NI	National income
Rp.	Indonesian Rupiah
¥	Japanese Yen

POSTEL	Direktorat Jenderal Pos dan Telekomunikasi (Directorate General of Posts and Telecommunications)
PERUMTEL	Perusahaan Umum Telekomunikasi (Telecommunication Public Corporation)
CCITT	The International Telegraph and Telephone Consultative Committee
CCIR	International Radio Consultative Committee
BAPPEDASU	Provincial Development Planning Board of North Sumatra
JICA	Japan International Cooperation Agency
OECF	The Overseas Economic Cooperation Fund
REPELITA	Indonesian Five-Year Economic Development Plan

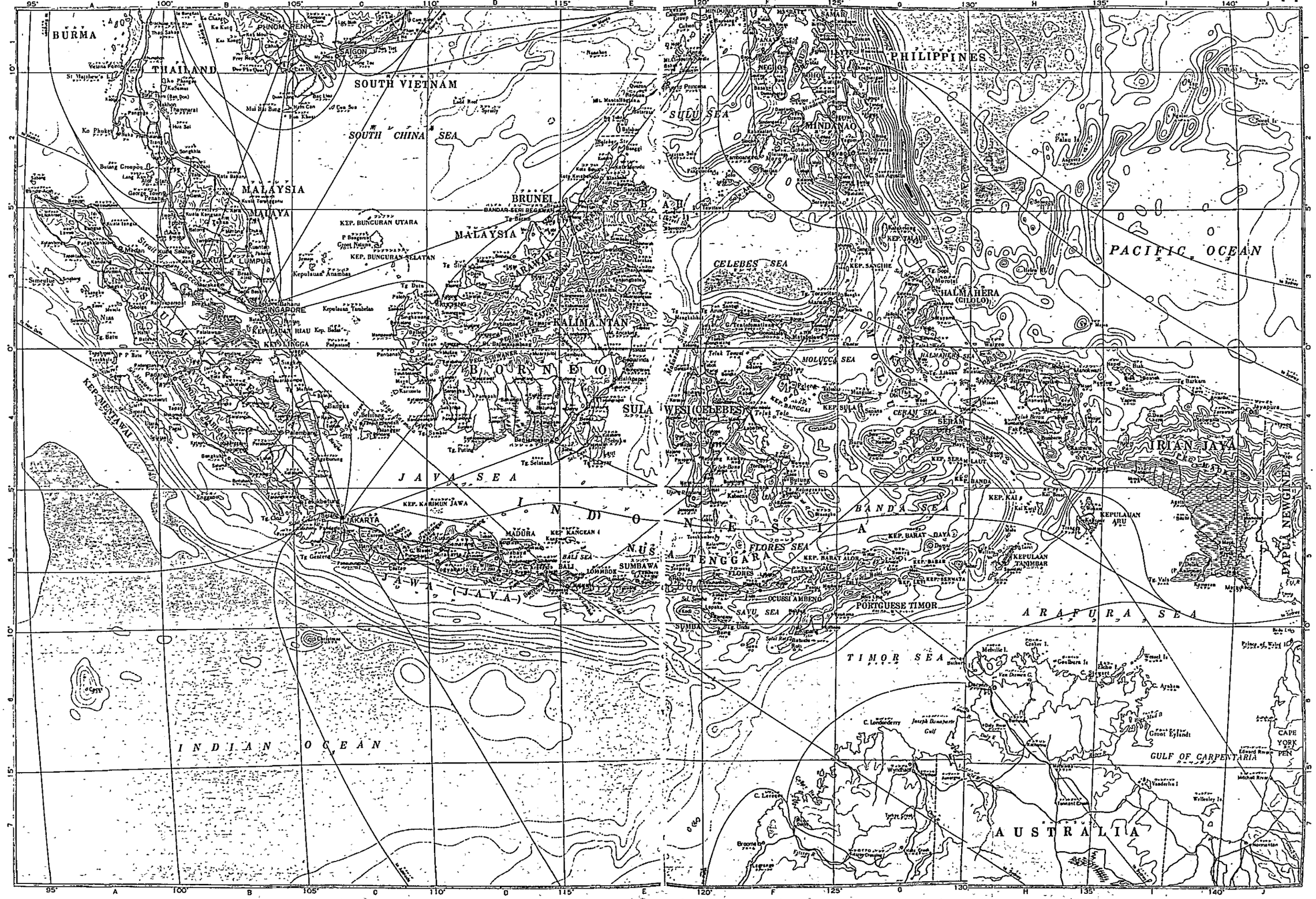
Propinsi	Province
Kabupaten	District
Kotamadya	Municipality
Kecamatan	Sub-district
Desa	Village

Member of the survey team explaining a draft of the report to key individuals in POSTEL. (Jan. 1981, at Directorate General of the POSTEL, Jakarta)



The main lobby of the Indonesia Telecom. Public Corp. Head Office (the PERUMTEL), Bandung. The lobby has a feeling of openness and warmth.

Front view of the PERUMTEL Head Office, an attractively designed building which harmonizes with the surrounding landscape



MALAYSIA, INDONESIA

マレーシア, インドネシア

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SUMMARY

SUMMARY

1. General

For the local telecommunication network project of the Sumatera Utara and Sulawesi Selatan areas, the study team has made a telephone demand forecast, and has devised a facility plan to cover the expected demand. A forecast of costs and earnings, and a financial analysis have also been made.

It has been determined as a result, that the plan for the Sumatera Utara is sufficiently feasible even if telephone facilities are to be installed in all Kecamatan, and the plan for the Sulawesi Selatan area is fairly feasible if telephone facilities are to be installed in important Kecamatan in the area.

The constraction cost necessary for fulfilling demand during the first ten years in the Sumatera Utara area is Rp. 31.6 billion, and that necessary to fulfil demand during the first ten years in the Sulawesi Selatan area is Rp. 19.4 billion, that is; a total of Rp. 51 billion is necessary to cover construction cost for the whole project.

This project will provide employment opportunities for 600 persons in the Sumatera Utara project and for 320 persons in the Sulawesi Selatan project, that is; a total of 920 persons will enjoy employment opportunities by the implementation of this project.

The financial analysis shows that accomplishing the project by adopting the manual exchange system is not good, although there is an advantage in that the sum of investment is less in this case. That is, the estimated internal rate of return for the Sumatera Utara area is almost 0% and the estimated total cost for the Sulawesi Selatan area is three times as large as the estimated total earning, so that the project is not feasible at all from the financial

standpoint if the manual exchange system is adopted. In addition, since the absolute earnings total is small in the case of the manual exchange system, the number of employment opportunities provided by the manual exchange system is less than that provided by the automatic exchange system.

At the same time the study team made a telegram demand forecast, by which it has been determined that there are not so many telegram demands as worthy of a full-fledged investment in these facilities. Accordingly, we have not proposed any telegram facilities and, regarding telegram and telex, the study team has made only a demand forecast, the results of which are contained in the appendix (SECTION V, paragraph 2 "Telegraph (Telegram and Telex) Demand Forecast").

The construction of the project is expected to start from 1983 and to finish in two years.

2. Sumatera Utara

In the Sumatera Utara area Ibukota Kecamatan are reached by paved roads and such infrastructure facilities as commercial power supply and water supply have either been planned or improved to some extent. The GDP per capita in Sumatera Utara is 25% higher than the national average and a number of plantations, plants, Kantor Bupati, etc., have their own telecommunication facilities, so that this area has a high potential and there is a necessity for improving and developing telecommunication facilities.

Aiming at providing telephone facilities in all desa (villages) having Kecamatan offices and surrounding desa in all Kecamatan, we have examined the feasibility for the improvement and development of telecommunications in this area.

2-1 Demand Forecast

The estimated demand for telephones in the year 2005 is expected to reach 191 thousand, 329 thousand and 564 thousand for an economic growth rate of 3%, 4.5% and 6%, respectively.

The average annual telephone increase rates for these estimated numbers of telephone demands are respectively 6.7%, 8.8% and 11.1%.

Since the average annual telephone increase rate for the past ten years in Indonesia, is 8%, we have made a demand forecast for the area to be covered by the project on the basis of the 329 thousand demands corresponding to an economic growth rate of 4.5%.

We first assigned the 329 thousand demands to the individual Kotamadya and Kabupaten. In doing so, we considered not only the total population but also the populations of different industrial sectors. The estimated number of demands thus obtained for the intended area is 239 thousand when Medan is included, and 81 thousand when it is not included. (That is , the estimated number of demands

expected in the year 2005 in Medan, is 158 thousands.)

Furthermore, we have assigned the estimated number of demands for each Kabupaten to individual Kecamatan depending on the population ratio.

On the basis of the numbers of demands obtained ultimately for individual Kotamadya and Kecamatan, we have prepared a telephone demand supply program and a facility plan.

In determining the number of fulfilled demands, we have raised the estimated demand fulfilment ratio in constructing new telephone offices and have lowered the demand fulfilment ratio by utilizing telephone lines originating at other Kecamatan through the means of line concentrators etc., so as to achieve the greatest savings in cost.

2-2 Principles of System Design

We compared the system using a new technique (automatic switching system) with the system using the conventional technique (manual switching system) the latter of which is intended to create an increase in the number of employment opportunities for technicians and as a result, we determined to propose the system using the new thchnique (comprising a digital telephone exchange and PCM transmission equipment as major items for installation) and having excellent features, such as excellent serviceability, earning capability, maintenability, and compatibility with future digital networks. In 1985 low-cost optical fiber systems will perhaps be put into commercial use everywhere in the world, but for the time being it is rather difficult to estimate accurate prices of optical fiber systems, so that the costs of transmission lines have been estimated on the basis of the prices of transmission systems widely available at present for commercial use.

The standards for setting up telephone offices, have been decided as follows: In such Kecamatan that are expected to have more than 600 demands in the year 2005 and that are expected to have more than 200 demands in the first

year (1985) a standard telephone office is to be constructed at the initial phase.

In such Kecamatan that will not reach this standard in the estimated number of demands, a telephone office is to be constructed when the number of demands reaches 200 and until that time important subscribers, etc., are to be accommodated at adjacent telephone offices by means of the multi-access subscriber radio system (hereinafter referred to as the MAS system) or line concentrator using cable. For those Kecamatan where the estimated number of demands is extremely small, we have planned to introduce a subscriber area merging with adjacent Kecamatan.

For initial capacity of the facilities, we have designed fundamental facilities such as, the foundations to be accomplished by civil work and buildings to meet the demands expected in the 20 years after 1985, and have designed telephene exchange switches, transmission lines, radio and carrier equipment, etc., which are suitable for facility expansion, to meet the demands expected in the 10 years after that.

2-3 Volume of Facilities

The types and quantities of facilities to be introduced for this project are given in Table 2-3. The right-hand half of the table shows the quantities of facilities necessary for meeting the demands expected in 20 years and the left-hand half shows the amount of initial investment from the standpoint of financial analysis, that is, the quantities of fundamental facilities for meeting all demands made for the 20 years plus the quantities of facilities necessary for meeting demands made in the first ten years. For details, see SECTION III, paragraph 2 "Telephone Facility Plan."

Table 2-3 Volume of Facilities

Classification	Initial	Overall
1. Telephone Office Setup	18 offices *1	48 offices
2. Subscriber's Facilities		
(1) Subscriber's lines (including telephone sets)	18 offices	48 offices
(2) MAS	18 base stations	14 base stations *2
3. Transmission Lines		
(1) Radio	19 sections *3	36 sections
(2) Carrier	7 sections *3	17 sections
4. Buildings and Power Plants	18 offices	48 offices

*1 In addition to the above, facility expansion is to be accomplished at eight existing offices.

*2 The number of base stations to remain within the intended area in the year 2005.

*3 Plus a total of about 700 circuits (including both radio and cable circuits) which are to undergo circuit expansion in the existing sections.

2-4 Outline of Construction Costs

Construction costs necessary for implemantation of this project are given in Table 2-4. A total construction cost of Rp. 31.6 billion is the estimated investment for facilities necessary to meet the demand expected in the years after commencement (and fundamental facilities for meeting the demand expected in the 20 years after commencement). The investment necessary for fulfilling demand expected in the 20 years after commencement will be nearly twice as large as the above sum of investment. Prices used for cost estimation are those as of 1980 and any price rise due to future inflation is not considered. Investment in the local currency is about 53% of the whole sum invested.

Table 2-4 Construction Costs

(Unit: million Rp.)

Classification	Breakdown of Cost			Remarks
	Foreign Currency	Local Currency	Total	
1. Telephone Exchange	5,127	1,362	6,489	
2. Subscriber's Facilities	3,173	11,428	14,601	
(1) Subscriber's lines (including telephone sets)		11,346	11,346	
(2) MAS	3,039	66	3,105	
(3) Subscriber's carrier equipment	134	16	150	
3. Transmission Lines	3,413	1,322	4,735	
(1) Radio	2,360	1,210*	3,570	* Including radio towers and VHF radio equipment.
(2) Carrier	485	45	530	
(3) Expansion of existing transmission lines	568	67	635	
4. Buildings and Power Plants	2,424	1,849	4,273	
(1) Buildings		1,797	1,797	
(2) Power plants	2,424	52	2,476	
Total	14,137	15,961	30,098**	**Including measuring instruments.
5. Consultant's Fees and Reserve Fund (5%)	707	798	1,505	
Grand Total	14,844 (4,948)	16,759 (5,586)	31,603 (10,534)	

Figures in ( ) are in million yen.

2-5 Outline of Financial Analysis

The results of the financial and economic analysis of this project are as follows: The total income for 20 years from 35,000 subscribers who are to begin to receive service during ten years after commencement (including 15,000 new subscribers immediately before the commencement) for 20 years is Rp. 52.9 billion at the 1980 constant price and the amount of total cost (including initial installation cost, maintenance and operating costs and working capital cost) is to be Rp. 41.2 billion at the 1980 constant price. Accordingly, the estimated overall cost benefit ratio is 78% and the estimated internal rate of return is 16.8%, so that the rural telecommunication network project for the Sumatera Utara area has been determined as feasible.

When this project is considered from the standpoint of national economy, the present worth of the project may be estimated to be Rp. 83 billion. The average annual number of employment opportunities to be provided by this project alone is estimated to be 600 (persons) and that through other industrial sectors 1800 (persons).

3. Sulawesi Selatan

Sulawesi Selatan is behind Sumatera Utara not only in telecommunication service but also in such public services as electric power supply, water supply, and roads and industrialization. Accordingly, we recommend, as the principles of the Sulawesi Selatan project:

1) to construct such fundamental facilities as will meet telecommunication service requirements with the development of the future Propinsi and
2) to provide the minimum facilities necessary for enhancing the economic development of the Propinsi, although not ideal in quantity and quality.

3-1 Demand Forecast

In the study of the Sulawesi Selatan area, unlike the study of the Sumatera Utara area, forecast demand by using a gravity model has been employed because of the inability of acquiring GDP data for individual Kabupaten or equivalent economic data. Demand forecast by using the same method as employed in the case of Sumatera Utara by using the GDP data obtained later was conducted, of which the results are given in SECTION V "APPENDIX," paragraph 1 for reference. We have determined, through comparison of these two methods, that the method using the gravity model is more suitable and matches the actual conditions as mentioned in detail in the APPENDIX, so that we have adopted this method using the gravity model.

In the method using the gravity model, a future traffic model is obtained from the traffic flow record on hand, data on the populations of Ibukota Kabupaten and Ibukota Kecamatan, data on distances to Kotamadya, Kabupaten and Kecamatan so as to estimate telephone demands. By this method, the number of demands predicted for the following individual major years are as given (excluding Ujung Pandang and Pare Pare). From this, an annual growth rate

of 2.8% in telephone demand is obtained.

Year	Estimated Number of Demands
1985	10,309
1995	13,606
2005	18,196

3-2 Principles of System Design

3-2-1 Measures for Non-Telephone Kecamatan

(1) Important Kecamatan are to be selected and proper countermeasures are to be taken depending on the degree of development of each Kecamatan.

(2) In consideration of the existing charging system and numbering plan, service area sectioning is to be effected according to administrative districts.

(3) For facilities, the MAS system is to be employed in principle by locating a base station at every Ibukota Kabupaten, with some exceptions where a manual switchboard office may be set up in towns having been developed similarly as Ibukota Kabupaten (such as Sidodadi and Tanrutedong) and an automatic exchange office may be set up in one town expecting to see rapid development as a mineral loading port (Malili).

3-2-2 Automatization

(1) Automatization is to be introduced at offices presently furnished with manual switchboard system in Ibukota Kabupaten, at manual switchboard offices in important sight-seeing places (such as Rantepao), and at airport offices (such as Mandai).

(2) The Time Division Electronic Switching System (TD-ESS) is to be employed.

(3) Power supply equipment to be employed is to feed power not only to the exchange but also to the transmission/radio equipment.

(4) Automatized telephone offices at Ibukota Kabupaten are to become primary centers and are to be furnished with manual switchboard for telephone directory, toll information, operator toll call, and international call services.

The criteria for automatization in Sulawesi Selatan are to be different from those in Sumatera Utara in that stress is put on quantity rather than quality in the case of facilities in Sulawesi Selatan, because of the difference in quantity of existing facilities between Sulawesi Selatan and Sumatera Utara. That is, such automatization as is intended not for grading up service but for raising the earning rate, is to be introduced in Sulawesi Selatan.

In order to set up automatic exchange offices, it is necessary to consider the construction cost for office buildings, power plants, etc., and we have prepared a facility plan while keeping balance between cost and earnings.

3-2-3 Installation of Toll Trunk Lines

(1) A toll transmission network is to be established for transmission between Ujung Pandang or Pare Pare Kotamadya and individual Ibukota Kabupaten.

(2) In consideration of easy shift to a digital network in future, the new transmission network is, in principle, to be of the digital transmission type.

(3) Existing coaxial cable circuits and microwave links are to be used effectively.

(4) Existing shortwave and open wire circuits are to be used, if necessary, until the new transmission network is completed and no new shortwave and open wire circuits are to be constructed. Such shortwave circuits that become unnecessary are to be used for transmission between islands or between remote places in mountaneous areas, and such open wire circuits that become unnecessary are to be used for transmission within Kabupaten.

(5) Existing satellite circuits are to be used for communication to/from outside the Propinsi (inter-propinsi communication) and for emergency use. For inter-propinsi communication, new terrestrial links are to be set up.

(6) The transmission route and method are to be determined by the necessity of future trunk transmission lines to major cities outside the Propinsi.

3-3 Volume of Facilities

Table 3-3 shows the volume of facilities for each category of construction work.

3-4 Outline of Construction Costs

Construction costs necessary for the implementation of this project are given in Table 3-4. The estimated total construction cost of Rp. 19.4 billion has been obtained through calculation based on the same philosophy as employed in the Sumatera Utara project. The percentage of local currency of the total amount invested is about 34%.

3-5 Outline of Financial Analysis

The method and premises employed for the financial analysis of the Sulawesi Selatan project are the same as those employed for the financial analysis of the Sumatera Utara project. The estimated internal rate of return of the Sulawesi Selatan project, which accomodates 7200 subscribers during the first ten years, is 6.37%.

If emphasis is put on telephone installation for administrative organizations, the police, and public telephones the assumed substantial internal rate of return may be about 9.2%. In obtaining these percentage estimates, Ujung Pandang and Pare Pare have not been included.

Suppose a loan in Japanese yen is granted at a low interest rate, the ratio of profits to equity will be 14.37%. It may be determined that this project is feasible from the financial standpoint if such a long-range, low-interest rate loan as this is introduced. The present worth of this project at a social discount rate of 12% is assumed to be Rp. 20.7 billion.

3-6 Overall Evaluation

Telecommunication service sometimes functions as a trigger for activating social activities in the area in which it has been introduced and may be as important an infrastructure as electric power, roads, water supply, etc.

In the case of the Sulawesi Selatan project, some effort may be necessary to improve the earning rate but, in consideration of the remarkable social benefits attainable by the implementation of the project, we recommend its implementation.

Table 3-3 Volume of Facilities

Classification	Initial	Overall
1. Telephone Office Setup		
(1) Setup of new automatic exchange	22 offices	(+7) 29 offices
(2) Setup of new manual exchange		
a) Setup of manual exchange office	4 offices	(-4) 0
b) Setup of manual toll board	19 boards	19 boards
2. Subscriber's Facilities		
(1) Subscriber's lines (including telephone sets)	29 offices	(+5) 34 offices
(2) MAS	14 base stations	(+11) 25 base stations
3. Transmission Lines		
(1) Radio	20 systems	
(2) Cable transmission system (PCM)	5 systems	
(3) Channel expansion of existing system	252 channels	
4. Buildings and Power Plants		
(1) Construction of buildings	26 offices	
(2) Installation of power plants	26 offices	

Table 3-4 Construction Costs

(Unit: million Rp.)

Classification	Breakdown of Cost			Remarks
	Foreign Currency	Local Currency	Total	
1. Automatic Exchange	3,642	579	4,221	
2. Subscriber's Facilities (including telephone sets and MAS)	3,432	2,361	5,793	
3. Transmission Facilities	1,887	1,239	3,126	
4. Buildings and Power Plants	3,150	2,184	5,334	
Total	12,111	6,363	18,474*	*Including measuring instruments
5. Consultant Fees and Reserve Fund	606	318	924	
Grand Total	12,717 (4,239)	6,681 (2,227)	19,398 (6,466)	

Figures in ( ) are in million yen.

SECTION I. INTRODUCTION

SECTION I INTRODUCTION

1. Object of Study

The purpose of the study was to clarify the feasibility for the project of establishing a telecommunication network in developing areas surrounding Medan and Ujung Pandang in response to a request from the Government of Indonesia.

2. Course of Study

The study members met many officers of the Government of Indonesia to discuss the proposed project and related items and conducted site survey to collect necessary data for studying the project from both technical and economic standpoints.
The primary aim of the study was to estimate the costs and benefits of the project. In the cost estimation the amount of initial investment for the establishment of the telecommunication system, the operating and maintenance costs for 20 years after commencement and costs for expansion have been examined wherever applicable. Discussed in the benefit estimation are incomings to be gained from the system for 20 years after commencement. The premises and assumptions taken into acount in the study are specified in SECTION II "ASSUMED PREMISES."

Telecommunication facilities have been planned on the basis of demand forecast for each Kecamatan.
Although the old-fashioned manual exchange system is

not recommendable for reasons stated below, financial analysis has been made for reference's sake.

Note: We do not recommend the manual exchange system for the future telecommunication system for the following reasons:

(1) Out-of-date technology will not raise the sprits of technical personnel but may cause these technical personnel to leave their jobs,

(2) the maintenance level will not be developed and the efficiency of maintenance cost will not be good although considerable efforts will be required, and

(3) the grade of service for subscribers will be low

in the case of the manual exchange system.

3. Course of Events

In September 1979, the Government of Indonesia requested the Government of Japan to make survey on this project. In response to this request the Government of Japan decided to make the survey and the Japan International Cooperation Agency (JICA) conducted the survey. JICA dispatched a preliminary feasibility study team consisting of five members who stayed in Indonesia for a period of 21 days from March 17 to April 6, 1980 so as to conduct preliminary site survey and set the

Scope of Work for detailed feasibility study.
In conformity with the Scope of Work JICA sent a feasibility study team consisting of 12 members who stayed in Indonesia for a period of 70 days from June 23 to August 31, 1980.
This report has been prepared through thoroughly study of site survey for about three months and meeting with the officers of the Indonesian Government.

4. Background of Study

4-1 Outline

Indonesia has completed the First(Repelita I) and Second(Repelita II) 5-Year National Development Plan and is now advancing the Third 5-Year Plan (Repelita III from April 1979 to March 1984). In the field of telecommunication, a remarkable development has been experienced. Backbone circuits have been already completed in the form of the microwave network through the country and Palapa satellite network and from now on stress will be given on the improvement and development of spur routes and local networks. Among many Indonesian islands called Nusantara ranging over 5000 km in the east to west direction, Medan and Ujung Pandang are the most important junction centers respectively in the western and eastern parts of the country.

From these standpoints the Gonvernment of Indonesia has decided to make a feasibility study for the improvement and development of the local telecommunication networks and selected areas surrounding Medan (part of Sumatera Utara) and areas surrounding

Ujung Pandang (the whole Sulawesi Selatan) as the areas for which the feasibility study is to be made.

4-2 Present Conditions of Surveyed Areas

Indonesia has a land area of about 1,900,000 km^2 and a population of about 139,000,000 (as of 1979) and her average annual population increase is about 2% for the past several years. Her Gross Domestic Product (GDP) per capita is US$280 (Rp. 116 thousand) as of 1976 and the average annual growth rate of the GDP per capita (1970 ~ 1976) is 5.6%. Since as many as more than 60% in population live in Jawa, Jawa is overpopulated. In order to solve this over-population, transmigration to Sumatera, Kalimantan, Sulawesi, etc., has been progressed and several tens of thousands people have migrated to these areas every year since 1973.

Sumatera Utara has a land area of 71,000 km^2 (which corresponds to 3.7% of the entire area of Indonesia), a population of 8.14 million (as of 1979, which corresponds to 5.9% of the total population of Indonesia), and an annual population increase of 2.5% in average for the past several years. The GDP per capita of 1976 is US$350 (Rp.135 thousands), which is about 1.25 times as large as the national average. Sumatera Utara is studded with large-scale plantations where great amounts of palm oil, rubber, black tea, cacao, etc., are produced to be exported and they have their own telecommunication facilities there. At 30 km north of Medan, Belawan or the largest international port in Indonesia (largest in the amount

of export, US$850 million per year) is located. Along the basin of Asahan River the Asahan Project (construction of a power plant and an aluminum smelter) is in progress by the cooperation of Japan. Toba Lake adjacent to Simalungun and Karo Kabupaten (Districts) is expected to see a great development as a distinguished sight-seeing area in Indonesia.

Sulawesi Selatan has a land area of 73,000 km^2 (which corresponds to 3.8% of the entire area of Indonesia), a population of 5.72 million (which corresponds to 4.5% of the total population of Indonesia in 1978). Most of this province is covered with paddy field, so that this province is called the granary of Indonesia. Mining and fishing is extensively carried on and plants, shipbuilding yards, hospitals, have been invited to be set up at various places. The central and northern parts of this province is mountainous areas and Toraja or a famous sight-seeing place is located in the northern part. In general, the development of such infrastructures as roads, waterworks and power supply facilities in this province is behind those in Sumatera Utara, so that it may be said that this province is under the pressing necessity of future infrastructural investment.

4-3 Present Status of Telecommunication Service

As of 1978, the total number of telephone subscribers in Indonesia is 275 thousands, which corresponds to 0.2 in telephone density per 100 inhabitants. The breakdown of these telephone subscribers is: 193 thousand subscribers (70%) using automatic exchanges, 29 thousand subscribers (11%) using common battery (CB) systems,

and 53 thousand subscribers (19%) using local battery (LB) systems. The total number of telephone offices is 562 of which the number of automatic exchange offices is 69 (12%), the number of CB offices is 40 (7%) and the number of LB offices is 453 (81%). The annual incoming of PERUMTEL as of 1978 is nearly Rp. 63.5 billion of which the incoming from telephone is Rp. 52.2 billion (82%), the incoming from telex Rp. 8.2 billion (13%) and the incoming from telegram Rp. 3.1 billion (5%). The total number of PERUMTEL's employees is 260 thousands. The annual increase of PERUMTEL's incoming for the past several years is 40%.

The total amount of investment during the Repelita II was Rp. 560 billion including foreign investment. Although the installation of a total of 450 thousand telephone line units was planned in Repelita II, approximately 75% of the target was achieved and the total number of telephone line units constructed to be usable by the end of Repelita II was 540 thousands.

In the Repelita III, a total of Rp. 440 billion is to be invested and 80 thousand telephone line units is to be installed newly in addition to the 150 thousand telephone line units carried over from Repelita II. The 80 thousand telephone line units to be installed newly includes 7000 rural telephones expected to use small earth stations (27 initially planned stations plus stations to be installed later) of the Palapa satellite.

The number of telephone subscribers within the surveyed area in Sumatera Utara is 22 thousand (as

of 1979), which corresponds to a telephone density of 0.4 per 100 inhabitants. The number of telephone offices is 24 (7 automatic exchange offices, 4 common battery offices and 13 local battery offices). The breakdown of the number of subscribers is: 21 thousand subscribers belonging to automatic exchange offices (92%), 900 subscribers belonging to common battery offices (4%) and 1000 subscribers belonging to local battery offices (4%). Out of 87 Kecamatan in the Project area, 65 Kecamatan (75%) have no telephone.

The number of telephone subscribers in Sulawesi Selatan is 11 thousands, which corresponds to a telephone density of 0.2 per 100 inhabitants. The number of telephone offices in this province is 26 offices (one automatic exchange office, one common battery office and 24 local battery offices). The number of subscribers belonging to the automatic exchange office is 7300 (70%). Out of 115 Kecamatan, 129 Kecamatan (83%) have no telephone in this province.

5. Organization of Survey Team

5.1 Organization of Preliminary Survey Team

The preliminary survey team was organized with the following members who stayed in Indonesia for a period of 21 days from March 17 to April 6, 1980.

Member	In Charge of	Affiliated to
Shigeru FUKUDA	General Leader	International Cooperation Div., Minister's Secretariat, Ministry of Posts and Telecommunications
Akitoshi IIDA	Telephone	International Affairs Bureau, Nippon Telegraph and Telephone Public Corporation (NTT)
Masaru TSUDA	Transmission	International Affairs Bureau, NTT
Itaru KAI	Radio	International Affairs Bureau, NTT
Norimoto OHTAKE	Coordinator	Social Development Cooperation Dept., Japan International Cooperation Agency (JICA)

5.2 Organization of Detailed Survey Team

The detailed survey team was organized with the following members who stayed in Indonesia for a period of 70 days from June 23 to August 31, 1980.

Member	In Charge of	Affiliated to
Shigeru FUKUDA	General Leader	International Cooperation Div., Minister's Secretariat, Ministry of Posts and Telecommunications
Akitoshi IIDA	Medan Team Leader, Telephone	International Affairs Bureau, Nippon Telegraph and Telephone Public Corporation (NTT)
Masaru TSUDA	Ujung Pandang Team Leader, Transmission	International Affairs Bureau, NTT
Yoichi TAKAHASHI	Medan Team, Outside Plant	International Affairs Bureau, NTT
Yasuo SUZUKI	Medan Team, Radio	International Affairs Bureau, NTT
Kenji TANAKA	Ujung Pandang Team, Outside Plant	International Affairs Bureau, NTT
Masayuki NOJIRI	Medan Team, Exchange	International Affairs Bureau, NTT

(Continued)

Member	In Charge of	Affiliated to
Koji TOMODA	Ujung Pandang Team, Radio	International Affairs Bureau, NTT
Tetsuya OGINO	Medan Team, Carrier	International Operation Div., The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Ryushi SUENAGA	Ujung Pandang Team, Exchange	International Operation Div., NTC
Shigehiko NAOE	Economic Evaluation	International Operation Div., NTC
Norimoto OHTAKE	Coordinator	Social Development Cooperation Dept., Japan International Cooperation Agency (JICA)

6. Itinerary

6-1 Preliminary Survey

Date	Course	Survey Activities
Mar. 17	Leave Narita 10:00, JL711 Arrive Jakarta 17:50	Leave Japan
Mar. 18	Jakarta	Salutation to Japanese Embassy in Indonesia and JICA Office and meeting with NTT Office on survey schedule.
Mar. 19	Jakarta	9:00 Meeting with POSTEL staff. 14:30 Salutation to Japanese Ambassador Sawaki.
Mar. 20	Jakarta	9:00 Meeting with PERUMTEL staff at Jakarta Offfice.
Mar. 21	Jakarta → Tangerang → Ancol → Jatinegara → Jakarta	Site survey of Tangerang, Ancol and Jatinegara in suburbs of Jakarta.
Mar. 22	Jakarta → Halim → Bogor → Jakarta	Site survey of Halim and Bogor in suburbs of Jakarta.
Mar. 23	Leave Jakarta 8:15, GA202 Arrive Medan 10:15	Site survey of Belawan in suburbs of Medan. Meeting with Japanese consulate officials in Medan.
Mar. 24	Medan → Binjai → Medan	8:00 Meeting with WITEL-I. 11:00 Site survey of Binjai in suburbs of Medan.
Mar. 25	Medan → Tebing Tinggi → New Town → Tebing Tinggi → P. Siantar → Parapat	Site survey of Tebing Tinggi, Asahan (New Town), P. Siantar and Parapat.
Mar. 26	Parapat → Kabanjahe → Berastagi → Medan Leave Medan 13:30, GA183 and arrive Jakarta 15:30	Site survey of Kabanjahe and Berastagi.
Mar. 27	Leave Jakarta 5:00, GA780 Arrive Ujung Pandang 8:10	9:30 Meeting with Japanese consulate officials. 10:30 Meeting with WITEL-X. Site survey of Takalar and Jeneponto.

(Continued)

Date	Course	Survey Activities
Mar. 28	Ujung Pandang → Maros → Pare Pare → Rappang	Site survey of Maros, Rapang and Rantepao.
Mar. 29	Rantepao → Makale → Kalosi Pare Pare → Ujung Pandang	Site survey of Makale and Pare Pare.
Mar. 30	Leave Ujung Pandang 8:55, GA781 Arrive Jakarta 10:00	Move from Ujung Pandang to Jakarta. Filing of data.
Mar. 31	Jakarta	9:00 Meeting with POSTEL staff.
Apr. 1	Jakarta ———— Bandung (by car)	9:00 Meeting with PERUMTEL staff.
Apr. 2	Leave Bandung 13:30, GA465 Arrive Jakarta 14:00	Inspection of P.T. INTI, Training Center. Move from Bandung to Jakarta.
Apr. 3	Jakarta	8:00 Meeting with POSTEL staff. 13:00 Sign Minutes.
Apr. 4	Jakarta	Filing of data.
Apr. 5	Leave Jakarta 19:20, JL712	Report to JICA Office and Japanese embassy. Luncheon
Apr. 6	Arrive Narita 06:35	Arrive in Japan.

6.2 Detailed Survey

Date	General Leader	Medan Team	Ujung Pandang Team	Financial Analyst	Coordinator
June 23	Leave Narita 10:00, JL711 Arrive Jakarta 17:50	Same as left.	Same as left.		Same as in "General Leader."
June 24	Meeting with POSTEL, Embassy and JICA staff.	Same as left.	Same as left.		Same as in "General Leader."
June 25	Meeting with JICA and Embassy staff.	Same as left.	Same as left.		Same as in "General Leader."
June 26	Meeting with PERUMTEL staff (Bandung).	Same as left.	Same as left.		Same as in "General Leader."
June 27	Bandung Jakarta	Same as left.	Same as left.		Same as in "General Leader."
June 28	Collection of data.	Same as left.	Same as left.		Same as in "General Leader."
June 29	Collection of data.	Same as left.	Same as left.		Same as in "General Leader."
June 30	Jakarta → Ujung Pandang Meeting with KAWITEL.	Collection of data.	Same as in "General Leader."		Same as in "General Leader."
July 1	Meeting with counsular officials and KAWITEL staff.	Collection of data.	Same as in "General Leader."		Same as in "General Leader."
July 2	Ujung Pandang → Jakarta	Collection of data.	Set up working office.		Same as in "General Leader."
July 3	Jakarta → Medan Meeting with consulate officials and KAWITEL staff.	Same as left.	Ujung Pandang Tel. Office and Sungminasa Tel. Office and Kabupaten Office.		Same as in "General Leader."
July 4	Meeting with consultate officials.	Same as left.	Inspection in Ujung Pandang Kotamadya.		Same as in "General Leader."
July 5	Meeting with KAWITEL.	Same as left.	Jeneponto Kabupaten Office and Takalar Tel. Office.		Same as in "General Leader."
July 6	Holiday	Holiday	Ujung Pandang → Malino		Same as in "General Leader."
July 7	Leave Jakarta 08:00, CX710 (Hong Kong)	Visit Sumatra Provinsi Office (Medan).	Bonthain Tel. Office and Kabupaten Office and Bulukumba Tel. Office.		Collection of data.
July 8	H.K. CX410 → Taipei CX450 → Narita 13:40	Visit to Medan Kotamadya Office and inspection of New Medan Telephone Office.	Bulukumba Kabupaten Office and Sinjai Tel. Office.		Collection of data.

(Continued)

Date	Ceneral Leader	Medan Team	Ujung Pandang Team	Financial Analyst	Coordinator
July 9		Visit to Deli Serdang Kabupaten Office and inspection in old Medan Tel. Office.	Sinjai → Watanpone Tel. Office		
July 10		Belawan Bay and Belawan Tel. Office	Sengkang Tel. Office		
July 11		Medan → T. Tinggi and Lubukpakam Tel. Office	Watansopen Tel. Office → Pare Pare		
July 12		Inspection in T. Tinggi Tel. Office.	Pankajene Tel. Office and Sinderen Kabupaten Office and Rappan Tel. Office		
July 13		Holiday	Holiday		
July 14		P.T. INALM and New Town Tel. Offices	Polewall Tel. Office and Kabupaten Office		
July 15		Asahan Kabupaten Office Kisaran Tel. Office and Tg. Balai Kotamadya Office.	Madjene Tel. Office and Kabupaten Office and Pinlang Tel. Office and Kabupaten Office		
July 16		T. Tinggi → P. Siantar → D. Rangin Tel. Offices	Barru Tel. Office and Pangkajene Tel. Office and Kabupaten Office		
July 17		P. Siantar Kotamadya Office and Simalungun Kabupaten Office	Enrekang Tel. Office and Kabupaten Office		
July 18		P. Siantar → Parapat Tanahjawa	Makale Tel. Office and Kabupaten Office and Rantepao Tel. Office		
July 19		Parapat Tel. Office	Palapo Tel. Station and Kabupaten Office		
July 20		Holiday	Palopo → Masamba		
July 21		Parapat Berastagi Microwave Repeater Station	Palopo → Pare Pare		
July 22		Karo Kabupaten Office and Tigabinanga Tel. Office	Maros Tel. Office and Kabupaten Office and Mandai Tel. Office		

(Continued)

Date	General Leader	Medan Team	Ujung Pandang Team	Financial Analyst	Coordinator
July 23		Berastagi → Medan	Filing of data		
July 24		Binjai Kotamadya Office and Langkat Kabupaten Office	Filing of data		
July 25		Filing of data	Meeting with KAWITEL staff		
July 26		Meeting with KAWITEL staff.	Holiday		
July 27		Medan → Jakarta	Ujung Pandang → Jakarta		
July 28		Meeting by two survey teams.	Same as left.		
July 29		Meeting by two survey tesms.	Same as left.		
July 30		Jakarta Bandung Meeting with PERUMTEL staff.	Same as left.		
July 31		Bandung → Jakarta	Same as left.		
Aug. 1		Filing of data	Same as left.		
Aug. 2		Filing of data	Same as left.		
Aug. 3		Jakarta → Medan	Jakarta → Ujung Pandang		
Aug. 4		Medan (Lecture to counterparts)	Old Ujung Pandang Tel. Office and Sungguminasa		
Aug. 5		Medan (Lecture to counterparts)	Ujung Pandang Earth Station		
Aug. 6		Medan (Lecture to counterparts)	Ujung Pandang Shortwave Station and Takalar Kabupaten Office		
Aug. 7		P.K. Branlang Tel. Office and P.K. Susu Tel. Office	Pare Pare Kotamadya Office		
Aug. 8		Galang Tel. Office and Kuala Tel. Office	Malino Tel. Office and Saretene Radio Repeater Station		
Aug. 9		Filing of data	Filing of data		
Aug. 10		Holiday	Holiday		
Aug. 11		Inspection in Medan Kotamadya	Filing of data		

(Continued)

Date	General Leader	Medan Team	Ujung Pandang Team	Financial Analyst	Coordinator
Aug. 12	Leave Narita 10:20, JL711 → Singapore	Inspection in Medan Kotamadya.	Filing of data	Same as in "General Leader."	Same as left.
Aug. 13	Singapore → Medan Belawan Tel. Office, Medan Tel. Office	Inspection in Medan Kotamadya.	Filing of data	Same as in "General Leader."	Same as left.
Aug. 14	Kabanjahe Tel. Office and Berastagi Tel. Office	Inspection in Medan Kotamadya.	Filing of data	Same as in "General Leader."	Same as left.
Aug. 15	Meeting with KAWITEL staff. Report to consulate General Party.	Same as left.	P.T. INCO and Soroako Tel. Office	Same as in "General Leader."	Same as left.
Aug. 16	Medan → Jakarta	Inspection in Medan Kotamadya.	Filing data	Same as in "General Leader."	Same as left.
Aug. 17	Jakarta → Ujung Pandang	Holiday	Holiday	Same as in "General Leader."	Same as left.
Aug. 18	Report to Consulate General and to KAWITEL. Party	Inspection in Medan Kotamadya.	Same as in "General Leader.'	Same as in "General Leader."	Same as left.
Aug. 19	Jeneponto	Close working office. Report to Consulate General.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 20	Ujung Pandang → Jakarta	Medan → Jakarta	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 21	Meeting by all survey members.	Same as left.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 22	Meeting with POSTEL staff.	Preparation of Interim Report.	Same as in "General Leader."	Jakarta → Bandung	Same as left.
Aug. 23	Preparation of Interim Report.	Preparation of Interim Report.	Same as in "General Leader."	Meeting with PERUMTEL staff.	Same as left.
Aug. 24	Preparation of Interim Report.	Preparation of Interim Report.	Same as in "General Leader.'	Bandung → Jakarta	Same as left.
Aug. 25	Preparation of Interim Report.	Preparation of Interim Report.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 26	Preparation of Interim Report.	Preparation of Interim Report.	Same as in "General Leader."	Same as in "General Leader."	Same as left.

(Continued)

Date	General Leader	Medan Team	Ujung Pandang Team	Financial Analyst	Coordinator
Aug. 27	Report to POSTEL and PERUMTEL.	Same as left.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 28	Report to Japanese Embassy and JICA Office. Party.	Same as left.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 29	Filing of data	Same as left.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 30	Leave Jakarta 19:20, JL712	Same as left.	Same as in "General Leader."	Same as in "General Leader."	Same as left.
Aug. 31	Arrive Narita 06:35	Same as left.	Same as in "General Leader."	Same as in "General Leader."	Same as left.

SECTION II ASSUMED PREMISES

SECTION II ASSUMED PREMISES

In preparing this report, the following premises were assumed.

1. Time Schedule

1981	Introduction of loan in foreign capital is to be proposed to IGGI.
1982	Implementation of detailed design
1983, 4	Implementation of construction (2 years)
1985	Commencement

2. System Life

20 years

3. Demand (Traffic) Forecast Points

For 20 years after commencement, as follows.

1985	1990	1995	2000	2005
(Commencement)	(5)	(10)	(15)	(20)

4. Feasibility Judgement Criteria

4-1 Financial Analysis

(1) Cost/income (average) $\leq$ 200%: Feasible

(2) Cost/income (average) > 200%: Doubtful

4-2 Economic Analysis

In the case of Paragraph 4-1, (2), the project is feasible if the cost/benefit $\leq$ 100%.

5. Demand Forecast Method

Demand forecast is to be made on the basis of the data of population and other factors (GDP per capita, social and government needs, etc.).

6. Traffic Forecast Method

Traffic forecast is to be made on the basis of time series data, traffic increase ratio upon change from manual to automatic exchange service and others (such as gravity model).

7. Alternative Plans

Systems using latest technique (labor reducing type), conventional technique (employment maintaining type) and combination of these two are to be discussed also.

8. Design Philosophy

8-1 Basic Policy

In conformity with the basic policy of Repelita III.

8-2 Method of Approach

To be achieved step by step.

First stage: Eradication of non-telephone Kecamatan in Sumatera Utara and eradication of non-telephone Kecamatan in important areas in Sulawesi Selatan.

Second stage: System modification from temporary to ultimate system is to be achieved in consideration of demand supply situation, numbering plan and charging system.

9. Technical Standards

To be in conformity to PERUMTEL standard, CCITT recommendations and/or CCIR recommendations.

10. Introduction of Local Capital and Labor

10-1 Local products

The following service and products available locally are to be used and assembly of automatic exchange and radio equipment is to be considered if applicable.

Civil work, local cables, telephone sets, manual switchboards, poles and towers

10-2 Employment estimation

Employment opportunity to be provided by this project is to be estimated.