

THE REPUBLIC OF INDONESIA
SURVEY REPORT
ON
IMPROVEMENT OF TELEPHONE NETWORK
IN THE CITY OF JAKARTA

VOLUME I

FEBRUARY 1981

ASIAN DEVELOPMENT BANK
INTERNATIONAL COOPERATION AGENCY

S. D. S.

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THE REPUBLIC OF INDONESIA
SURVEY REPORT
ON
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IN THE CITY OF JAKARTA

VOLUME I

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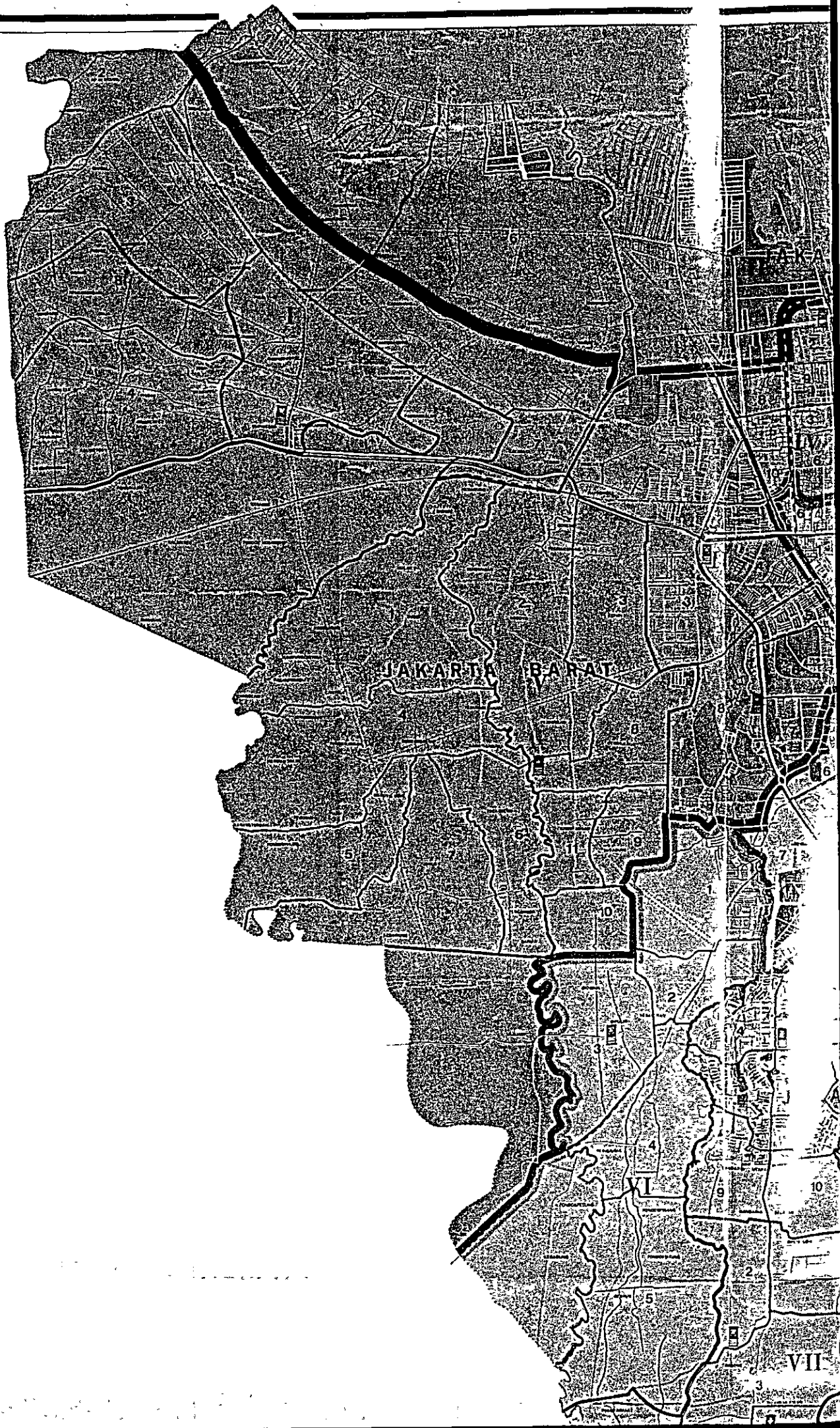
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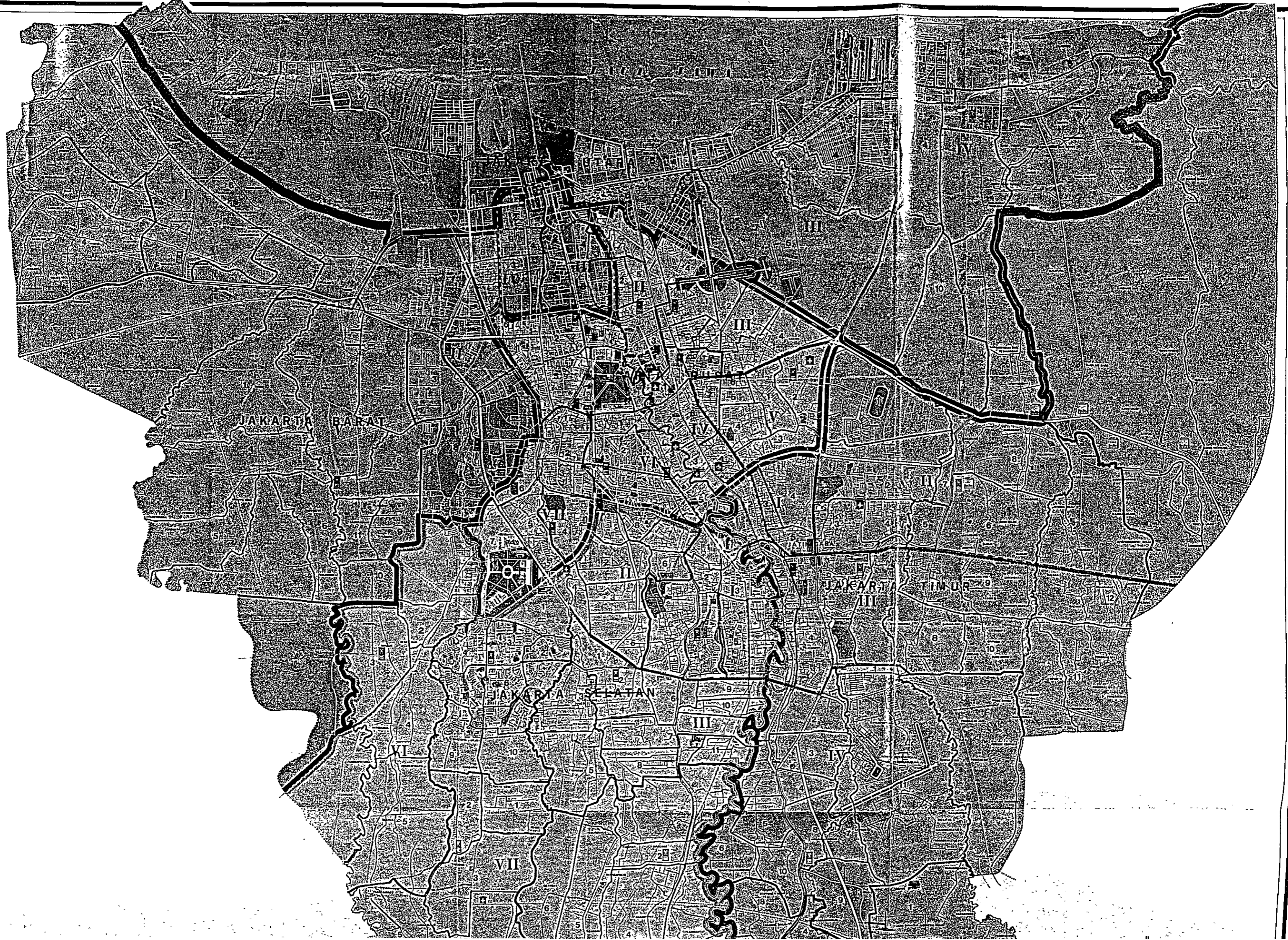
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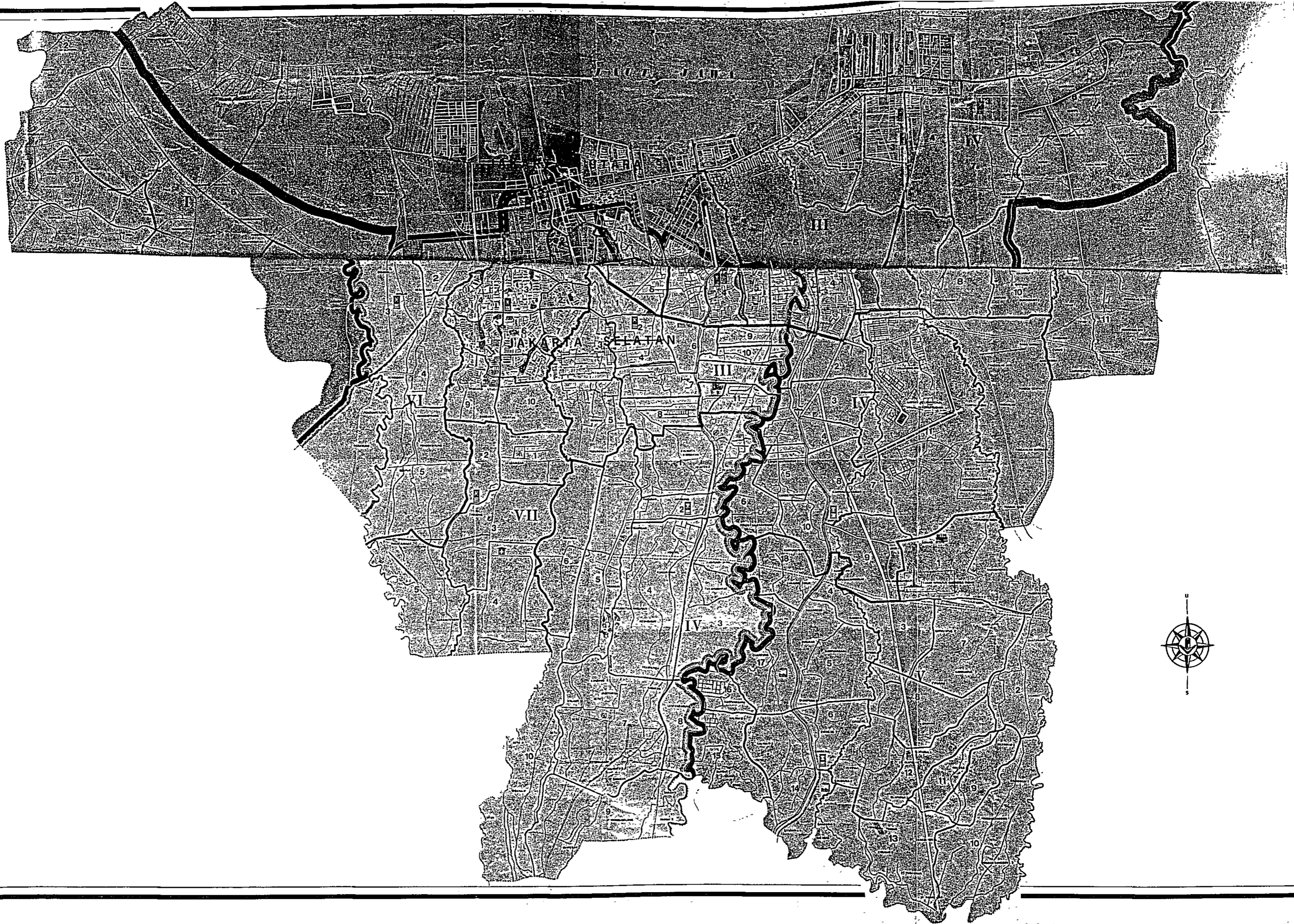
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PREFACE

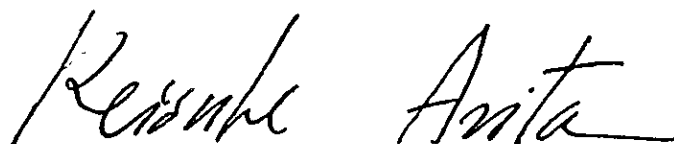
In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a survey on improvement of telephone network in the city of Jakarta which constitutes part of Third Five-Year Plan for telecommunication services, as part of Japan's overseas technical cooperation programme, and this survey was executed by Japan International Cooperation Agency (JICA).

The JICA sent to Jakarta a survey team twice headed by Mr. Hideo SANO, chief engineer, the Nippon Telecommunications Consulting Co., Ltd. from June 16, 1979 to March 3, 1980 and from June 10, 1980 to October 7, 1980. The team conducted a field survey in close cooperation with the officials concerned of the Government of Indonesia and Perusahaan Umum Telekomunikasi (PERUMTEL). After the team returned to Japan, further studies were made and the final 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 Indonesia and Japan.

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

February, 1981



Keisuke Arita

President

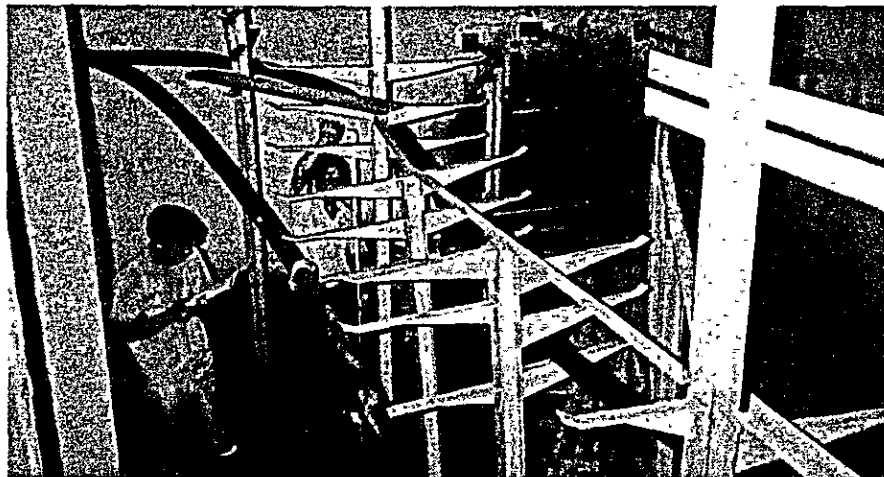
Japan International Cooperation Agency



Discussion at Directorate-General of Post and Telecommunications



Discussion with PERUMTEL Key Persons at PERUMTEL Headquater



Cable Vault Survey

CONTENTS

Volume I

SUMMARY

	<u>Page</u>
1. Background and Objective	3
2. Result of Survey	4
3. Recommendation	20

PART I TELEPHONE DEMAND FORECAST

1. Macroscopic Approach	25
1-1 Establishment of Basic Factors	25
1-2 Telephone Demand Forecast for Indonesia	32
1-3 Telephone Demand Forecast for Jakarta City	51
2. Microscopic Approach	56
2-1 Telephone Demand in 1993	56
2-2 Telephone Demand in 1979 and 1983	59
2-3 Telephone Demand in Each Exchange Area	61

PART II TELEPHONE TRAFFIC FORECAST

1. Traffic Data	69
1-1 PRX Exchange	69
1-2 EMD Exchange	71
1-3 Mobile Cross-bar Exchange	71
2. Estimation of Originating Calling Rate	72
2-1 Present Originating Calling Rate	72
2-2 Estimation of Originating Calling Rate	72
3. Composition of Originating Calling Rate	79
3-1 Present Situation	79
3-2 Calling Rate of Trunk Call	79
3-3 Calling Rate of Special Service Call	81
3-4 Calling Rate of Local Call	81
3-5 Proportion of Originating Calling Rate	82
4. Local Traffic Distribution	82
4-1 Local Traffic Distribution Formula	82
4-2 Number of Subscriber Lines	84
4-3 Data for Calculation	84
4-4 Calculation Result	95

PART III TELEPHONE NETWORK EXPANSION PLAN

	<u>Page</u>
1. Long Term Plan	105
1-1 Long Term Plan	105
1-2 Recent Tendency	111
2. Review of Existing Telephone Network	115
2-1 Exchange Service Area	115
2-2 Switching System	126
2-3 Junction Cable	133
2-4 Subscriber Cable	133
3. Network Expansion Plan	136
3-1 Switching System	136
3-2 Exchange Building	138
3-3 Junction Cable Network	141
3-4 Subscriber Cable Network	141

PART IV TECHNICAL OBJECTIVES

1. Numbering	153
1-1 Present Numbering	153
1-2 Numbering Capacity	156
2. Signalling	159
2-1 Loop Resistance Limit	159
2-2 Inter-Exchange Signalling	160
3. Transmission Loss Objective	167
3-1 Reference Equivalent	167
3-2 Exchange to Exchange Reference Equivalent for Jakarta Telephone Network	169
4. Characteristics of Cable Transmission	171
4-1 Attenuation	171
4-2 Impedance	175
5. Circuit Calculation	180
5-1 Traffic Routing	180
5-2 Calculation Formula	185
5-3 Calculation Result	189
6. Choice of Standard PCM System	197
6-1 Technical Comparison	197
6-2 Adoption of 30 ch PCM System	199

PART V JUNCTION CABLE NETWORK PLAN

	<u>Page</u>
1. Circuit Grouping	203
1-1 Number of Junction Circuits	204
1-2 Study of Optimum Transmission System	212
1-3 Junction Cable Network Plan	217
2. Design Standard	232
2-1 Underground Duct System	232
2-2 Cable Specifications	235
2-3 Impedance Matching	236
2-4 Loading Design	237
2-5 PCM Line Engineering	240
2-6 PCM Inside Plant Engineering	250
3. Basic Design	254
3-1 Design Policy	254
3-2 Outline of Basic Design	257
3-3 Amount of Main Works	259

PART VI SUBSCRIBER CABLE NETWORK PLAN

1. Design Standard	271
1-1 Structure of Subscriber Cable Network	271
1-2 Cabinet Area	272
1-3 Underground Duct System	273
1-4 Subscriber Cable Specifications	281
1-5 Determination of Conductor Diameter	283
1-6 Cable Distribution Design	285
1-7 Cable Entrance	286
2. Design Policy for Five Local Exchanges	288
2-1 Primary Cable Network	288
2-2 Secondary Cable Network	288
2-3 Underground Duct System	288
3. Basic Design of Five Local Exchanges	290
3-1 Kota I Exchange	290
3-2 Kota II Exchange	295
3-3 Pluit Exchange	297
3-4 Gambir I Exchange	299
3-5 Jatinegara I Exchange	301

PART VII CONSTRUCTION COST ESTIMATES

	<u>Page</u>
1. Unit Cost of Construction	313
1-1 Exchange Building	313
1-2 Switching System	314
1-3 Cable	314
1-4 Underground Duct System	316
1-5 PCM Transmission System	316
2. Amount of Work	318
2-1 Exchange Building	318
2-2 Switching System	318
2-3 Junction Cable Network	318
2-4 Subscriber Cable Network	319
3. Total Construction Work Cost	322

APPENDICES

Appendix 1. Members of JICA Team and Service Period	333
Appendix 2. Work Itinerary	335
Appendix 3. Supporting Document	338

Volume II

PART VIII TELEPHONE EXCHANGE DESCRIPTION IN JAKARTA CITY

Kota I	1
Kota II	17
Cengkareng	41
Pluit	55
Ancol	71
Tegal Alur	85
Gambir I	95
Gambir II	131
Semanggi I	149
Semanggi II	165
Slipi	179
Pal Merah	195
Kedoya	209

	<u>Page</u>
Meruya	219
Cempaka Putih	229
Rawa Mangun	245
Tanjung Priok	261
Kelapa Gading	277
Cilincing	289
Penggilingan	299
Kebayoran	309
Kebayoran Lama	331
Cipete	337
Pasar Minggu	351
Kalibata	365
Jagakarsa	379
Jatinegara I	389
Jatinegara II	403
Cawang	419
Pasar Rebo	433
Tebet	447
Gandaria	461
Klender	473

Contents

1. Area & Characteristics
2. Tandem Exchanges
3. Switching System
4. Originating Calling Rate per Subscriber in Erlang
5. Number of Subscribers
6. Recent Trend of Subscriber Number
7. Existing Subscriber Cable Facilities
8. Building Layout
9. Equipment Room Layout
10. Demand Map in 1993
11. Demand in 1983 and 1993
12. Switching System Expansion Plan
13. Implementation Schedule
14. Amount of Subscriber Cable Expansion Work

ANNEXES

ANNEX I CIRCUIT GROUPING

- I-1 Transmission System by Destination
- I-2 Transmission System by Section
- I-3 Summary of Junction Cable

ANNEX II JUNCTION CABLE NETWORK BASIC DESIGN

- II-1 Junction Cable Network Plan
- II-2 PCM Network Plan for the year of 1987
- II-3 PCM Network Plan for the year of 1993
- II-4 Loading System and PCM System Plan
- II-5 Junction Cable Route Plan
- II-6 MDF Terminating and Cable Vault Plan

ANNEX III SUBSCRIBER CABLE NETWORK BASIC DESIGN

- III-1 Kota I - Kota II Exchange Cutover Plan
- III-2 Kota I Exchange Subscriber Cable Network Basic Design
- III-3 Kota II Exchange Subscriber Cable Network Basic Design
- III-4 Pluit Exchange Subscriber Cable Network Basic Design
- III-5 Gambir I Exchange Subscriber Cable Network Basic Design
- III-6 Jatinegara I Exchange Subscriber Cable Network Basic Design

Contents

- 1) Key Map
- 2) Primary Cable Plan
- 3) Duct System Plan
- 4) MDF Terminating and Cable Vault Plan
- 5) Secondary Cable Plan

ANNEX IV SUBSCRIBER CABLE NETWORK EXPANSION PLAN
FOR COST ESTIMATES BY EXCHANGES

- 1) Key Map
- 2) Primary Cable Plan
- 3) Duct System Plan

Abbreviations

Abbreviations of exchange names used in this report are as follows:

KT1	Kota I Exchange
KT2	Kota II Exchange
CKG	Cengkareng Exchange
PLT	Pluit Exchange
ANC	Ancol Exchange
TGL	Tegal Alur Exchange
GB1	Gambir I Exchange
GB2	Gambir II Exchange
SM1	Semanggi I Exchange
SM2	Semanggi II Exchange
SLP	Slipi Exchange
PLM	Pal Merah Exchange
KED	Kedoya Exchange
MER	Meruya Exchange
CPP	Cempaka Putih Exchange
RMG	Rawa Mangun Exchange
TPR	Tanjung Priok Exchange
KPG*	Klapa Gading Exchange
CLC	Cilincing Exchange
PGG	Penggilingan Exchange
KBY*	Kebayoran Exchange
KBL*	Kebayoran Lama Exchange
CPA	Ciputat Exchange
CPE	Cipete Exchange
PSM	Pasar Minggu Exchange
KBL	Kalibata Exchange
JGA	Jagakarsa Exchange
JTG	Jatinegara Exchange
CAW	Cawang Exchange
PSR	Pasar Rebo Exchange
TBT	Tebet Exchange
GAN	Gandaria Exchange
KLD	Klender Exchange
KTT	Kota Tandem Exchange
GBT	Gambir Tandem Exchange
CPT	Cempaka Putih Tandem Exchange
KBT	Kebayoran Tandem Exchange
JTT	Jatinegara Tandem Exchange
SLDD	Subscriber Long Distance Exchange
SUBT	Suburban Tandem Exchange

*Note: The names of the following three exchanges will be changed as follows:

KPG --- PLD (Pulo Gadung)
KBY --- KB1 (Kebayoran I)
KBL --- KB2 (Kebayoran II)

SUMMARY

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the implementation of data-driven decision-making processes. It provides a detailed overview of the steps involved in identifying key performance indicators, setting targets, and monitoring progress to ensure that the organization is on track to achieve its strategic objectives.

4. The fourth part of the document discusses the challenges and risks associated with data management and analysis. It identifies common pitfalls such as data quality issues, privacy concerns, and the potential for misinterpretation of data, and offers strategies to mitigate these risks.

5. The fifth part of the document explores the role of technology in enhancing data management and analysis capabilities. It discusses the benefits of using cloud-based solutions, data visualization tools, and artificial intelligence to streamline data processing and improve the accuracy of insights.

6. The sixth part of the document addresses the importance of data security and compliance. It outlines the necessary measures to protect sensitive data from unauthorized access and ensure that the organization adheres to relevant data protection regulations.

7. The seventh part of the document discusses the role of data in fostering innovation and growth. It highlights how data-driven insights can be used to identify new market opportunities, develop innovative products, and optimize existing business processes.

8. The eighth part of the document provides a summary of the key findings and recommendations. It emphasizes the need for a data-driven culture and the importance of ongoing monitoring and evaluation to ensure that the organization remains competitive in a rapidly changing market environment.

SUMMARY

1. Background and Objective

The Perusahaan Umum Telekomunikasi of Indonesia (PERUMTEL) is now carrying out the Third Five-Year Plan (Repelita III) based on the Third National Five-Year Development Plan (1979 - 1984) of the Government of Indonesia. Repelita III for Telecommunication Services aims, as first priority, to complete the Repelita II project and to consolidate the achievements of Repelita II, and, as second priority, to implement the new development projects.

The Government of Indonesia requested the Government of Japan to arrange the survey for Improvement of Telephone Network in the City of Jakarta. The purpose of the survey was to make outside plant expansion program for the Third Five-Year Plan including the review of the long term planning prepared by JICA mission in March, 1976 and to make a fundamental designing of telecommunication network in certain Jakarta areas.

The survey was carried out for a period of six and half months in 1979 and four months in 1980.

The main contents of the report describing in the scope of work are as follows:

- (1) Fundamental Planning
 - 1) Demand forecast by telephone exchanges for the years 1979, 1983 and 1993
 - 2) Originating traffic estimate classified by telephone exchanges for the years 1979, 1983 and 1993
 - 3) Traffic flow estimate among telephone exchanges for the years 1979, 1983 and 1993
 - 4) Junction cable network expansion plan
- (2) Outside Plant Expansion Program for Third Five-Year Plan
 - 1) Supply plan
 - 2) Outside plant construction cost estimate
- (3) Basic Design of Junction Cable Network
- (4) Basic Design of Subscriber Cable Network for Five Exchange Areas

2. Result of Survey

Result of survey for the Jakarta Telephone Network expansion is summarized below.

2-1 Demand Forecast

2-1-1 Macroscopic Approach

(1) Telephone Demand in Indonesia

Demand forecast by macroscopic approach is conducted by the following formula which is the function of GDP per capita by correlation model from the data of 92 countries:

$$Y = 0.000311X^{1.398}$$

where

Y = Telephone demand density

X = GDP per capita (US\$)

For the demand forecast, the following variables are assumed:

- 1) Annual growth rate of GDP per capita is 4.5%.
- 2) Population increase figures are adopted from the Statistical Year Book of Indonesia 1977.

Therefore, the telephone demand in Indonesia is calculated as follows:

<u>Year</u>	<u>Telephone Demand</u>
1979	557,500
1983	770,000
1993	1,738,100

(2) Telephone Demand in Jakarta

Telephone demand distribution for Jakarta City out of the whole telephone demand in Indonesia is calculated by the following formula which is obtained by correlation model from the data of various countries:

$$Y = 39.131 + 1.28827X_1 - 7.6458X_2 \times 10^{-3}$$

where

Y = Telephone distribution rate (%)

X₁ = Population concentration rate (%)

X₂ = GDP per capita (US\$)

Number of telephone stations for Jakarta City is calculated as follows:

<u>Year</u>	<u>Number of Telephone Stations</u>	<u>Telephone Distribution Rate (%)</u>
1979	241,000	43.14
1983	332,000	43.09
1993	739,000	42.50

On the basis of chronological data concerning the difference in number between telephone stations and main telephone stations in Indonesia, the number of main telephone stations is assumed to be 68.9% of the number of telephone stations. Therefore, the number of main telephone stations for Jakarta City is calculated as follows:

<u>Year</u>	<u>Number of Main Telephone Stations</u>
1979	166,000
1983	228,000
1993	509,200

2-1-2 Microscopic Approach

Demand forecast by microscopic approach was conducted for the whole of Jakarta City in July, August and September 1979 by the on-the-spot survey. In the microscopic demand forecast, area characteristics are classified into the following categories: Residential, Business Office, Commercial, Industrial, Others and No-Demand Areas. A map of a scale of 1:5,000 is used in the survey to identify the area category.

Total telephone demand is estimated as follows in consideration of Jakarta city planning:

<u>Year</u>	<u>Telephone Demand</u>
1979	168,400
1983	222,100
1993	529,700

Difference between demand forecasts by macroscopic and microscopic approaches is less than 5%.

Figure by macroscopic approach is adopted as a telephone demand in Jakarta for the subsequent work of telephone network expansion planning.

2-2 Telephone Traffic Forecast

2-2-1 Originating Calling Rate Estimate

Originating calling rate (CR) is estimated by the following formula:

$$CR = A/N \quad (\text{Erlang})$$

$$A = N_p \times C_p + N_o \times C_o + N_s \times C_s + N_r \times C_r$$

$$N = N_p + N_o + N_s + N_r$$

where

N = Number of subscribers in each service/area category, i.e.:

N_p : PBX

N_o : Business

N_s : Commercial

N_r : Residential

C = Originating calling rate per subscriber in each service/area category, i.e.:

C_p : PBX 0.20 Erl.

C_o : Business 0.06 Erl.

C_s : Commercial 0.06 Erl.

C_r : Residential 0.02 Erl.

Estimated average originating calling rate per subscriber in Jakarta Telephone Network is summarized below:

<u>Year</u>	<u>Average Originating Calling Rate in Erlang</u>
1979	0.0670
1983	0.0533
1987	0.0512
1993	0.0474

2-2-2 Local Traffic Distribution

Local traffic distribution between two local exchanges is calculated by the following formula:

$$A_{ij} = A_i \times \frac{A_j \times e^{-aL_{ij}}}{A_1 \times e^{-aL_{i1}} + A_2 \times e^{-aL_{i2}} + \dots + A_i + \dots + A_n \times e^{-aL_{in}}}$$

$$= A_i \times \frac{A_j \times e^{-aL_{ij}}}{\sum_{x=1}^n A_x \times e^{-aL_{ix}}}$$

where

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

A_i : Local originating traffic from exchange i

A_j : Local originating traffic from exchange j

L_{ij} : Distance in Km between exchange i and exchange j

a : Constant for multi-exchange area concerned

2-2-3 Summary of Traffic Forecast

Calculation of traffic distribution is carried out by use of computer.

The calculation result as follows:

Item	Year			
	1979	1983	1987	1993
1) Weighted Average Originating Calling Rate in Erlang	0.0680	0.0552	0.0535	0.0495
2) Number of Line Units	93,511*	271,700	376,200	569,200
3) Originating Traffic in Erlang				
a) Local	6490.08	13,188.82	17,290.40	23,810.11
b) Trunk	369.48	1,512.39	2,428.66	3,735.64
c) Special	99.84	287.79	402.43	605.25
Total	6959.40	14,989.00	20,121.49	28,151.00
4) Number of Telephone Exchanges	26	32	32	33
5) Number of Switching System Units	33	54	58	63

*Note: Number of working lines (for December, 1979)

2-3 Telephone Network Expansion Plan

2-3-1 Long Term Plan

Long term plan for the Jakarta Telephone Network expansion, which aims at gradual fulfillment of telephone facilities expansion to meet the demand as of 1987, is formulated after careful examination of the existing telephone facilities and the capacity of installation work. Thus the complete fulfillment of telephone installation to the demand will be realized after 1987. The telephone demand and the workable subscriber number are shown below in chronological order:

<u>Year</u>	<u>Telephone Demand</u>	<u>Workable Subscribers</u>
1979	168,400	91,850
1980	180,500	115,650
1981	193,400	137,700
1982	207,300	161,100
1983	222,100	185,400
1984	240,100	211,550
1985	259,400	239,200
1986	280,300	269,200
1987	302,900	302,900
1988	330,200	330,200
1990	395,200	395,200
1993	529,700	529,700

2-3-2 Review of Existing Telephone Network

- 1) 32 telephone exchanges are supposed to be established in Jakarta Telephone Network. Out of this number, 24 exchanges are now in service.
- 2) Number of line units in the existing switching systems in Jakarta Telephone Network is 223,000, while the number of working subscribers is 111,883 in September, 1980.

- 3) Number of existing junction cables is 98. Total number of cable pairs is 56,200. Out of this figure, 29,430 pairs are non-loaded and 26,770 pairs loaded.

- 4) Total number of primary cable pairs of 24 existing telephone exchanges is 363,887 pairs. Out of this number, 69,487 pairs are direct buried cable and 294,400 pairs are duct cable. 16,200 subscribers are currently connected to other exchange area. Cut-over work for these subscribers is to be executed.

2-3-3 Network Expansion Plan

In accordance with the practical telephone growth, the installation plan for switching system, exchange building as well as junction and subscriber cable expansions is formulated in due consideration of existing telephone facilities.

Implementation schedule of network expansion is presented in the next pages.

IMPLEMENTATION SCHEDULE (1/2)

- - - - - Building Construction
 ----- Switching System Installation
 ===== Cable Installation

Unit: Thousand

No.	Exchange	Third Five-Year Plan			Fourth Five-Year Plan				Fifth Five-Year Plan				Total L.U		
		Existing L.U	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990		1991	1992
1	Kota I	10				*A	12(-10)						3		15
2	Kota II	32	Cut-over			5		3					3		43
3	Cengkareng	4			4					10					18
4	Pluit	4		4				4		5					17
5	Ancol	4		2			3		3				5		17
6	Tegar Alur	0			*B	2			1				2		5
7	Gambir I	36								*C	24(-20)				40
8	Gambir II	16		*C	23			5		4					48
9	Semanggi I	6		*C	3			4					6		19
10	Semanggi II	8		3			4						6		26
11	Slipi	5		*C	10				5				7		27
12	Pal Merah	4		2			2			4			4		16
13	Kedoya	0		*B	4			2					5		11
14	Meruya	0		*B	3				1				4		8
15	Cempaka Putih	8	*C	7				4		5				8	32
16	Rawa Mangun	8			3			3		6					20
17	Tanjung Priok	6		5					2				3		16
18	Kelapa Gading	0			5				3				5		13

*Note: A. Building reconstruction
 B. Building construction
 C. Building expansion
 D. Cut-over to Jatinegara II Exchange
 () Removal

IMPLEMENTATION SCHEDULE (2/2)

--- Building Construction
 ----- Switching System Installation
 ===== Cable Installation

Unit: Thousand

No.	Exchange	Third Five-Year Plan					Fourth Five-Year Plan					Fifth Five-Year Plan					Total L.U	
		Existing L.U	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992				
19	Cilincing	0		*B 3			2				5							10
20	Penggilingan	0		*B 4				3						4				11
21	Kebayoran	26																26
22	Kebayoran Lama	0												*B 7				7
23	Cipete	8									5					6		19
24	Pasar Minggu	2				1						1				3		7
25	Kalibata	8					4										7	24
26	Jagakarsa	0			*B 2							1						5
27	Jatinegara I	4	*D 1															0
28	Jatinegara II	8	*C 7							5							4	28
29	Cawang	4																18
30	Pasar Rebo	1		3(-1)														9
31	Tebet	8																18
32	Gandaria	1		*B 3(-1)														8
33	Klender	0																8
Junction Network																		
Total Line Units		221		36	68	13	364	400	422	446	525	573	612	625	13	404	625	
Expansion Total			257		325	338	364	400	422	446	525	573	612	625				

*Note: A. Building reconstruction
 B. Building construction
 C. Building expansion
 D. Cut-over to Jatinegara II Exchange
 () Removal

2-4 Junction Cable Network Plan

2-4-1 Number of Junction Circuits

Circuits related to junction cable are three fold: Telephone, Telex and Leased circuits.

(1) Telephone

Number of junction circuits in 1987 and 1993 are 37,234 and 49,305, respectively. Both are calculated by computer.

(2) Telex

1) Total number of telex subscribers in 1987 and 1993 are 8,517 and 13,545, respectively.

2) Total number of telex junction circuits in 1987 and 1993 are 1,608 and 2,883, respectively.

(3) Leased Circuits

1) 10% of telephone junction circuits is to be the leased circuits for the junction section between local exchanges.

2) 20% of telephone junction circuits is to be the leased circuits for the junction section between tandem exchanges.

2-4-2 Study of Optimum Transmission System

Three types of transmission systems are assumed to be used for junction cable network. They are non-loaded cable, loaded cable and PCM 30ch systems.

Cost of each transmission system is calculated on per circuit basis as a function of distance in Km. Cost of a 0.6mm non-loaded line, for example, is 74 US\$ per pair Km, while that of a PCM system is 10 US\$ per channel Km plus 700 US\$ fixed price per channel.

Then, the selection chart for optimum transmission system is formulated, based on the category of circuit in accordance with distance. Take up Tandem to Local circuit (4.5 dB), for example: the distance of 6 Km is the application boundary between cable and PCM transmission systems.

2-4-3 Junction Cable Network Plan

(1) Existing Junction Cable Facilities

Number of junction cables to be considered as existing is 123 with 70,300 pairs. The cables, which are under installation or still in design or whose installation has been postponed, are included in the above figure. Out of this figure, 38,930 pairs are non-loaded and 31,370 pairs loaded.

(2) Determination of Transmission System

Transmission system is determined by the selection criteria with top emphasis on full utilization of the existing junction cable facilities.

(3) Junction Cable Network Plan

1) Number of proposed cables by the year 1987 is 20 with 22,200 pairs, and 21 cables with 13,800 pairs by the year 1993 after 1987.

2) Total number of PCM transmission systems for the year 1987 is 457, and 797 for the year 1993.

2-4-4 Junction Cable Network Design

Basic design of junction cable network expansion for the year 1987 is worked out.

The amount of major work for junction cable expansion in conformity with basic design is summarized below:

(1) Cable System

1) Number of cables	20
2) Number of cable pairs	22,200
3) Cable length	115.0 Km
4) Number of loaded pairs	3,000

(2) PCM System

1) Multiplexers	914
2) Office repeaters	1616
3) Line repeater housings	220
4) Line repeater units	4769

(3) Underground Duct System

1) Manholes	185
2) Duct length	28 Km

2-5 Subscriber Cable Network Plan

Basic design of subscriber cable network for five (5) local exchanges is worked out at the request of PERUMTEL. The five exchanges are Kota I, Kota II, Pluit, Gambir I and Jatinegara I.

Introduction of jelly-filled cable for subscriber cable is assumed in this design.

The amount of major work for subscriber cable expansion is summarized below:

Exchange	Number of Manhole	Duct Length (Km)	Primary Cable Length (Km)	Number of C.C. Cabinet	Secondary Cable Length (Km)
Kota I	3	1.3	9.6	16	24.5
Kota II	11	2.3	15.8	6	72.5
Cut over	2	1.4	2.7	4	0.4
Pluit	44	6.6	19.7	15	72.4
Gambir I	5	1.6	13.0	4	13.8
Jatinegara I	40	6.8	23.7	16	43.6
Total	105	20.0	84.5	61	227.2

2-6 Construction Cost Estimate

Construction cost for network expansion is estimated according to individual projects planned for the years from 1981 to 1986.

Unit cost for each installation year during the above period is calculated on the basis of unit cost as of 1980, allowing an increase at a fixed rate for each subsequent year.

In order to estimate the amount of major work for subscriber cable expansion, three kinds of design drawings, i.e., key map, primary cable plan and underground duct system plan, are prepared for all telephone exchanges except the 5 exchanges which are separately designed in detail. The amount of major work during the period mentioned is summarized below:

- (1) Building
 - 1) Reconstruction of building at Kota I Exchange;
 - 2) Construction of building at the following exchanges:
Tegar Alur, Kedoya, Meruya, Cilincing, Penggilingan, Jagakarsa and Gandaria;
 - 3) Expansion of existing building at the following exchanges:
Gambir II, Semanggi I, Slipi, Cempaka Putih and Jatinegara II.

- (2) Switching System
Installation of 179,000 line units in the switching system.

- (3) Subscriber Cable
Installation of subscriber cables at all exchanges except Kebayoran Lama Exchange.

- (4) Junction Network
 - 1) Installation of 457 PCM systems.
 - 2) Installation of 20 junction cables with 22,200 pairs.

Estimated total construction cost for this period is summarized below:

<u>Item</u>	<u>Foreign Currency (Million Japanese Yen)</u>	<u>Local Currency (Million Rupiahs)</u>
1) Building	-	3,447
2) Switching System	17,571	-
3) Subscriber Cable Network	13,968	8,773
4) Junction Cable Network	3,332	2,188
Total	34,871 (158.5 million US\$)	14,408 (23.1 million US\$)

Out of the above figures, the breakdown for the present Third Five-Year Plan period (Replita III: 1979-1983) appears below:

<u>Item</u>	<u>Foreign Currency (Million Japanese Yen)</u>	<u>Local Currency (Million rupiahs)</u>
1) Building	-	3,149
2) Switching System	9,644	-
3) Subscriber Cable Network	8,932	6,212
4) Junction Cable Network	3,332	2,188
Total	21,908 (99.6 million US\$)	11,549 (18.5 million US\$)

2-7 Telephone Exchange Description

Exchange by exchange arrangement of data collected through survey work and study results appear in PART VIII, Volume II of this report.

The book contains the following items for each exchange:

- 1) Area and Characteristics
- 2) Tandem Exchange
- 3) Switching System
- 4) Originating Calling Rate per Subscriber in Erlang
- 5) Number of Subscribers
- 6) Recent Trend of Subscriber Number
- 7) Existing Subscriber Cable Facilities
- 8) Building Layout
- 9) Equipment Room Layout
- 10) Demand Map of 1993
- 11) Demand in 1983 and 1993
- 12) Switching System Expansion Plan
- 13) Implementation Schedule
- 14) Amount of Subscriber Cable Expansion Work