7.2.3 Videotex Pilot Project (SPINTEL)

(1) PERUMTEL's Plan

WITEL IV is planning to start the Market Test Trial of videotex (= viewdata = SPINTEL) in 1988. The targets of viewdata pilot implementation are:

- to increase of the traffic of SKDP;
- to increase the number of SKDP subcribers; and
- to improve cooperation with the domestic information provider (IP).

At the initial stage, the following services are planned to be provided with SPINTEL:

- directory assistance (108);
- charging information;
- travel information; and
- games.

(2) Videotex in Other Countries

CCITT Rec. T.101 specifies three types of videotex data syntax, CAPTAIN (Japan), NAPLPS (North America) and CEPT (Europe). However, a subject of forming a universal international standard remains. Therefore the fourth syntax for international communications, IDS (Interworking Data Syntax), is currently being studied by CCITT SG VIII.

The outlines of CAPTAIN and NAPLPS are described below. The characteristics of three types of videotex are shown in Table 7.7.

a) CAPTAIN (Character And Pattern Telephone Access Information Network)

CAPTAIN is a Japanese standard videotex system developed by the Ministry of Posts and Telecommunications and NTT. The commercial service started in November 1984, and by June 1988 the number of terminals has increased to 67,749 in a slow progress. The technical specifications of CAPTAIN are set in accordance with the all layers of the OSI Reference Model. The communication mode is full duplex with bit rates of 75 bps (terminal to center) and 4.8 kbps (center to terminal).

b) NAPLPS (North American Presentation Level Protocol Syntax)

NAPLPS is a North American standard videotex system developed by AT&T based on the development of Canada's TELIDON.

NAPLPS specifies the presentation layer of the OSI Reference Model.

It employs the alphageometric method which creates picture by combining picture description elements such as points, lines, arcs and quadrilaterals. The users can designate the sequence of picture presentation. NAPLPS is mainly used for visual services on the streets and for the business.

Since layers 1 to 5 are not specified, this protocol is likely to be adopted commercially for picture transfer services in personal computer-to-computer communications.

7.2.4 Expansion Plan for SKDP

(1) Nationwide Expansion of SKDP

POSTEL and PERUMTEL have formed expansion plan on SKDP (packet switched public data network in Indonesia) as shown in Fig. 5.4 (2/2).

In planning nationwide expansion of the service areas of SKDP;

a) The packet switches (EDX-P), identical with that operating in Jakarta are planned to be installed in Medan and Surabaya exchanges.

b) Concentrators are planned to be installed in other major cities.

(2) Consideration of Videotex Services

As for videotex mentioned in Section 7.2.3, there are two ways to expand its service areas.

a) Simply expanding SPINTEL
b) Interconnecting SPINTEL and SKDP

The latter is recommendable because nationwide services might be realized more economically and quickly.

Table 7.7 Data Syntax of Videotex

Item	System CAPTAIN	NAPLPS	CEPT
Display Technique	Alphaphotographic	Alphageometric	Alphamosaic
Character	Alphanumerics Japanese characters	Alphanumerics	Alphanumerics
Display Functions			
Photographic graphic	CAPTAIN original MH code	No	ADCT code
Geometric graphic	Comply with NAPLPS	NAPLPS original	GDS(A subset of GKS)
Mosaic graphic	CAPTAIN original and part of CEPT Mosaic	Part of CEPT Mosaic	CEPT original
DRCS (dynamically redefinable character set)	CAPTAIN original	NAPLPS original	CEPT original
Coloring	Block coloring	Dot coloring	Block coloring
Coloring Unit	4x4 dots	1 dot	Character or mosaic
Character Size	Alphanumerics 8x12 dots Japanese characters 16x24 dots	6x10 dots	6x10 dots
Number of Characters in a Frame (column x line)	Alphanumerics 31x16 dots Japanese characters 15x8 dots	40x20 dots	40x24/25 dots
Display Resolution	248x192 dots	256x200 dots	240x240 dots
Color	16	16	8
Supplementary Functions			
Melody	Yes	No	No
Simple animated moving display	Yes	No	No

7.2.5 ISDN Implementation Schedule

(1) Current Schedule

The following schedule has been considered for ISDN implementation in Indonesia.

Pelita IV			Repelita V		
1988	1989	1990	1991	1992	1993
Study for Introduction					
		Field Trial/Pilot Project			
			ISDN Implementation		

(2) ISDN Implementation Strategy

The long-term schedule for ISDN implementation in Indonesia is shown in Table 1.3. The targets of each five-year plan centering around Jabotabek area are described below.

Repelita V : a) ISDN Field Trial
b) ISDN implementation in Metropolitan Jakarta area
c) Nationwide SKDP expansion

Repelita VI : Implementation of narrowband ISDN in major cities in Indonesia (expansion of ISDN service area)

Repelita VII: Integration of narrowband and broadband ISDNs (toward full-scale ISDN)

In making the long-term ISDN implementation plan, following are taken into account:

a) Full-scale ISDN is implemented in the year 2000[1/].

b) CSPDN (Circuit Switched Public Data Network) is not introduced. Circuit switched data communication services are provided by ISDN, starting from major cities[1/].

c) Video communication services are provided through dedicated circuits. Provision of switched video communication services is launched after implementation of broadband ISDN in 2000[1/].

d) The digital transmission projects, such as Jawa-Bali second route, Jakarta-Surabaya optical fiber transmission and Trans-Sumatera digital microwave, are completed by the end of Repelita V.

e) Next three existing plans should be given a priority:

- Study for ISDN introduction (up to 1989);
- ISDN field trial (1990 - 1991); and
- Expansion of SKDP.

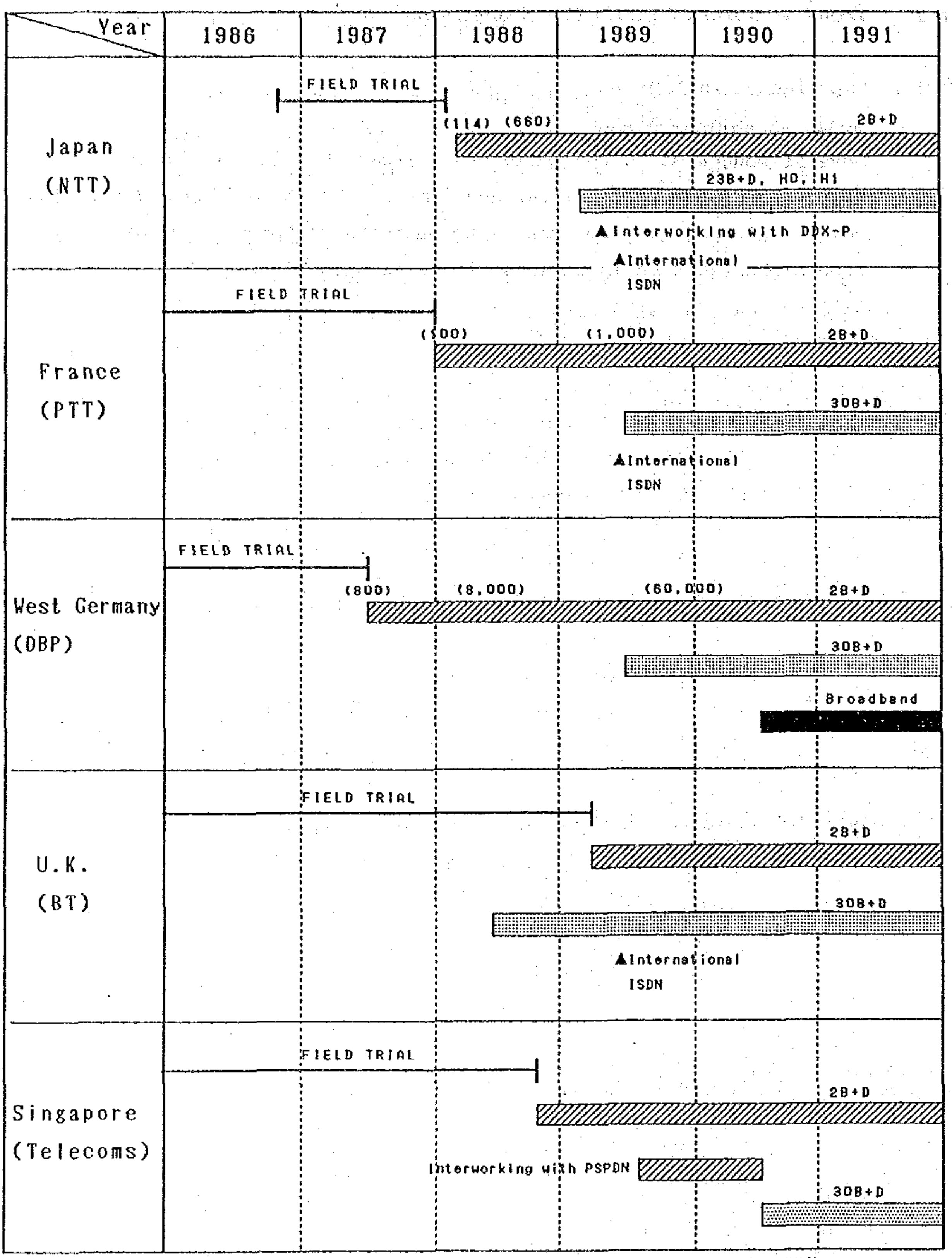
f) The international standard concerning broadband ISDN reaches a level of practical and commercial use within a decade.

1/ Study Report on Long Term Planning for Development of Telecommunications System, JICA, 1987.

7.3 Trend of International ISDN Standards

7.3.1 Experiences in ISDN

Several countries in the world have already carried out their respective ISDN field trials, and some of them have launched offering commercial ISDN services mostly to business customers. Progress of ISDN implementation in some countries is shown in Fig. 7.5.



Notes 1/ Figures in brackets indicate the actual numbers of ISDN users.

2/ NTT's Hierarchy: H_0 = 384k bps

H_1 = 1.536M bps

Fig. 7.5 World's Trend of ISDN Implementation

From Fig. 7.5, the following steps seem to be taken in implementing ISDN services in most of the countries.

Step 1: Execution of field trials for two to three years.
Step 2: Introduction of basic access (2B+D) services.
Step 3: Introduction of primary rate access (30B or 23B+D) services.
Step 4: Introduction of broadband ISDN.

U.K. is exceptional in a way that primary rate access services were initiated prior to the introduction of basic access services. This is because IDA (Integrated Digital Access), a commercial service unique to the U.K., had already been provided since June 1985, and the specifications on basic access services are different significantly from the international standards.

(1) ISDN Services In Japan

In April 1988, NTT of Japan introduced an ISDN called "INS-net" and launched its first basic access services (2B+D) with a total of 114 users in Tokyo, Nagoya and Osaka. Packet switched services, which utilize the D-channel, are expected to start in July 1989. INS-net, after that, is scheduled to interwork with both international ISDN through KDD and the existing DDX-P (domestic PSPDN). Interworking with DDX-C (domestic CSPDN) is not planned.

The basic access services provided with INS-net include the following supplementary services unique to ISDN:

- calling number display;
- call charge notification;
- sub-addressing; and
- direct dialling-in.

a) Calling Number Display

This service informs the called party of the calling party's number. A calling number is transmitted from the calling party's terminal. For terminals without this capability, however, the INS-net performs this function upon prior request of the user. The calling party could disable this function.

b) Call Charge Notification

With this supplementary service, the subscriber is notified of the call charge upon completion of a call.

c) Sub-Addressing

A sub-address is used to call a specific terminal out of all the terminals accommodated on a single subscriber bus line. A sub-address is added after the subscriber number. However, sub-addressing is not available to the users in the PSTN.

d) Direct Dialling-In

In this service, a distinct subscriber number is assigned to each terminal. A subscriber can select a specific terminal on the bus line by using the last few digits of the ISDN subscriber number. This service is accessible from PSTN.

(2) The Case in Singapore

Singapore is one of the most developed countries in Asia on ISDN implementation. Telecommunications development in Singapore as of 1988 is shown below.

Population	:	2.5 million
Area	:	620 km^2
Number of Telephone Subscribers	:	852,000

Number of Telex Subscribers : 18,000

Digitalization Rate of Exchanges

- International: 100% (two exchanges)
- Trunk : 100% (two exchanges)
- Local Transit: 100% (six exchanges)
- Local : 25% (twenty-six exchanges, full digitalization by 2000)

There are four stages[1/] that Singapore took in the field trial period. Recognizing the importance of the ISDN concept, which was formulated in CCITT I.120-series Recommendations, Singapore seems to be taking appropriate steps toward nationwide ISDN.

Stage I (Apr. '85)

a) Digital telephone with built-in adaptor for V.24 data terminals and Group III facsimile terminals

b) An "Imagephone" that utilizes two channels to provide simultaneous voice, text and telewriting capabilities within the ISDN

c) Telex Terminal Adaptor providing telex communication within the ISDN

Stage II (Oct. '85)

a) Packet Network Interface providing V.24 data terminal access to the packet switched data network

Stage III (Jan. '86)

a) Telex Network Interface providing telex communication from the ISDN to the telex network

b) X.21 terminal adapter providing teletex communication within the ISDN

Stage IV (May '87)

a) X.25 terminal adaptor (TA[2/]) providing packet data terminal access to the packet switched data network on the D-channel

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1/ "Nationwide ISDN Service in Singapore" - B.L. Lian Telecom '87 Geneva

2/ Terminal Adaptor

General functions of a TA are;

- converting existing protocols into the ISDN D-channel protocol;
- converting the transmission rates of the existing terminals to the rates of 8, 16, 32, or 64 kbps;
- multiplexing and demultiplexing of the B-channel subrate signals;
- interfacing electrical and mechanical characteristics.

7.3.2 CCITT I-Series Recommendations

While digitalization of telecommunications network is progressing, ISDN has been recognized as the most expected telecommunications network through studies by CCITT and other institutes.

ISDN was initially regarded as an integrated digital network which interconnects various types of services, such as telephone and data, by using a common digital switching and transmission systems from the viewpoint of network structure. However, placed (much importance) are the aspects from the user's points of view as well as interworking different networks these days.

During the 1980s, international standardization of the user-network interface had been studied actively giving rise to the stipulation of CCITT I-series Recommendations to comprise:

I.100-series	:	Terminology
I.200-series	:	Service Capability
I.300-series	:	Overall Network Aspects and Functions
I.400-series	:	ISDN User-Network Interface
I.500-series	:	Interworking between Networks
I.600-series	:	Applications of Maintenance Principles

In the IXth Plenary Assembly of CCITT, which was held in Melbourne in November 1988, final reports on the questions submitted during VIIIth period and new questions for this period were approved. Since the previous session, the core of studies concerning I-series

Recommendations has been standardization of DSS1[1/] and No. 7 ISUP[2/]. As a result, the protocols were adopted considering practical use for ISDN basic access services based on circuit switched mode at 64 kbps. In addition, protocols for a part of supplementary services were specified.

1/ DSS1 : ISDN subscriber line digital signalling system

2/ No. 7 ISUP: ISDN interexchange signalling system (ISDN User Part)

7.3.3 Subscriber Transmission System

One of the most important features of ISDN is that the user has an access to a variety of services through the standardized user-network interface. This is reflected in CCITT I-series Recommendations. (Refer to Section 7.3.2.)

Advantages of ISDN from the user's point of view are described below:

a) The user can arbitrarily make an access to various types of services.

b) A number of TEs can share a single pair of subscriber cable.

c) TEs have portability so that TEs can be transported to anywhere to be used without any modification and difficulty.

For the common carrier, it is an important what kind of subscriber transmission systems to be adopted. It has been a common practice that each country selects the optimum digital subscriber transmission system fit for its implementation requirements, such as those for transmission distance, line loss, and noise. As a result of the latest CCITT study (1985 to 1988), six subscriber transmission systems for basic access services proposed by six respective countries were appended in Annex of Rec. G.961.

As shown in Table 7.8, one country proposed the time compression multiplex (TCM), and five others echo cancellor (EC) systems of line codes different from each other.

Table 7.8 Subscriber Transmission System Listed in Annex of Rec. G.961

Transmission Method	Line Code	Country
TCM	AMI	Japan
EC	Bi-phase 3B2T	U.K.
	AMI	Italy
	4B3T	West Germany
	2B1Q	USA Canada

The principles of the two subscriber transmission systems are summarized below.

(1) TCM (Time Compression Multiplexing)

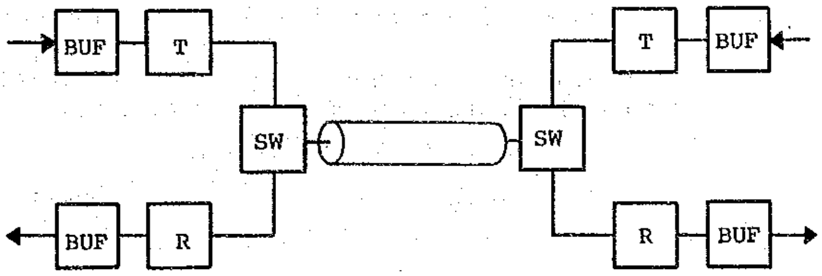
In the TCM method, digital signals are compressed into burst and are transmitted in both directions. This method is also referred to as burst mode transmission. Bursts are transmitted in one direction at a time by synchronizing burst timing in all systems involved. This effectively eliminates the near-end crosstalk, which severely limits transmission distance in a two-wire subscriber loop. The penalty to be paid is the use of higher frequencies. TCM is also called "Ping Pong" mode transmission system.

(2) EC (Echo Cancellor)

The EC method enables full duplex transmission by the use of a hybrid circuit, which separates a transmitting signal from a receiving signal. Echo cancellation system is also employed to improve the performance. An advantage of the EC method is the narrowband transmission in comparison to the TCM method, which requires relatively wide bandwidth. However, in the EC method circuit configurations are more complex than TCM, and the inherent near-end crosstalk remains.

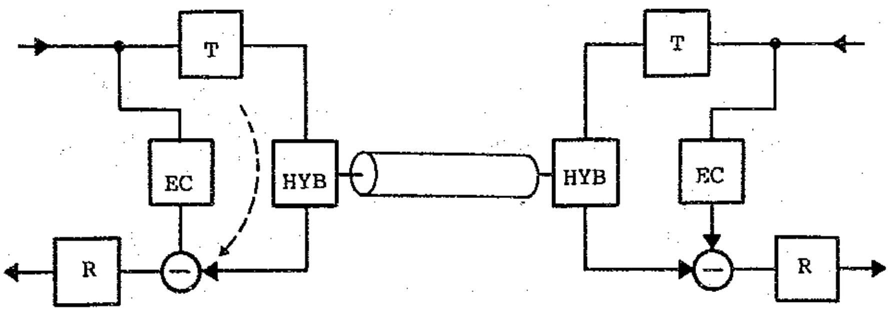
Fig. 7.6 below shows block diagrams of the two systems.

A) TCM



T : Transmit
R : Receive
BUF: Buffer
SW : Switch

B) EC



T : Transmit
R : Receive
EC : Echo Cancellor
HYB: Hybrid

Fig. 7.6 Two-Wire Full Duplex Subscriber Transmission Systems

Comparison of the TCM and EC methods appears in Table 7.9 in the next page.

Table 7.9 Comparison of TCM and EC

	TCM	EC
Transmission Rate	Twice as fast as the data transmission rate.	Equal to the data transmission rate.
Burst Timing	Synchronization necessary to eliminate the effect of the near-end crosstalk.	Synchronization not necessary.
Transmission Delay within a Subscriber Loop	Large	Small
Effect of a Bridge Tap	Remarkable waveform distortion	Smaller waveform distortion. Waveform of an echo signal can be distorted significantly
Complexity of Hardware	Simple	Complex
Loss	Large	Medium
Effect of Impulse Noise from Analog Circuits	Large	Medium
Near-end Crosstalk in the Same Systems	Non-existent	Large
Near-end Crosstalk between Different Systems	Susceptible to effects from fast transmission systems	Susceptible to effects from slow transmission systems
Far-end Crosstalk	Small	Small
Self-induced Feedback	Non-existent	Decent echo cancellors necessary
Noise Interference from Subscriber Loop	Bandwidth is large, but noise power per freq. unit is small.	Bandwidth is small, and the noise interference is small.
Noise Induced from Radio Broadcasting	Susceptible due to broad bandwidth.	Less susceptible because of small bandwidth.

7.3.4 Broadband ISDN

(1) Features of Broadband ISDN

For the expected demand for broadband ISDN in the 21st century, studies on broadband ISDN are ongoing.

The features of broadband ISDN expected to be of practical use in the middle of the 1990s, are:

- to support a wide range of services such as telephone, personal computer communications, high quality video conference and file transfer at a rate of some 10s Mbps with a single user-network interface;
- flexible choice of transmission rates;
- very short transmission delay.

(2) Requirements for Broadband ISDN

Broadband ISDN has to support a variety of communications with different traffic characteristics and of different connection types. Since service aspects of broadband ISDN are not clear at present, flexibility of network is required to accommodate a wide range of services.

(3) Standardization Trend of Broadband ISDN

The broadband ISDN has to adopt various transmission rates and communication types to support multi-media services.

Studies for the broadband ISDN had started during the period of 1985 to 1988; SG XVIII is responsible for the framework of broadband ISDN services, interface structures and transfer modes.

ATM[1/] is considered the most desirable transfer mode for broadband ISDN. It holds a number of advantages inherent to both circuit switched and packet switched modes, such as high speed transfer capability and connectivity between different transfer rates. It is especially suitable for video communications. Standardization of broadband ISDN based on ATM is being studied aiming at commercialization by the middle of the 1990s.

The general consent among nations on broadband ISDN is as follows:

a) The B-UNI[2/] specifies the bit rates of 156 Mbps and 620 Mbps based on ATM.

b) ATM will be used in one or two decades. During the transition period combinations of STM[3/] and ATM technique may be adopted.

1/ Asynchronous Transfer Mode

2/ Broadband User-Network Interface

3/ Synchronous Transfer Mode

c) ATM will also be adapted to the existing digital hierarchies based on NNI (Network Node Interface).

(4) Establishment of Broadband ISDN

a) Requirements for Broadband ISDN Configuration

At present, only basic concepts of broadband ISDN are found in CCITT Rec. I.121, and a definition of broadband ISDN is still ambiguous.

In the early stage of the evolution of broadband ISDN, the services will be limited to business users. However, stimulating demands for residential use will also be necessary in order to spread the broadband services from the long-term viewpoint by lowering the prices of TEs and tariff.

Broadband ISDN will be developed based on conventional ISDN, and require optical fiber for subscriber cables to support a variety of customer applications.

Broadband ISDN may be implemented in a variety of configurations according to specific national situations. The standardization of broadband ISDN is a prerequisite for achievement of global broadband telecommunications.

b) Broadband ISDN Applications

The following applications are considered suitable for broadband ISDN based on the current B-UNI specifications:

- file transfer in the distributed data processing network;
- high speed and large volume data transmission;
- interworking of local area networks (LAN) at raised transmission rates;
- program down-loading; and
- computer-aided design and computer-aided manufacturing.

c) Implementation of Broadband ISDN

There are several ways for implementing broadband ISDN as explained below.

- The broadband ISDN is implemented to overlay existing networks such as PSTN, PDN and CATV. In this configuration, the business users will be the main customers of broadband services. Demands of residential users will be fulfilled by the CATV network. In the early stages of the configuration above the cost per subscriber will be relatively high since the separate lines other than existing ones are installed to each subscriber.

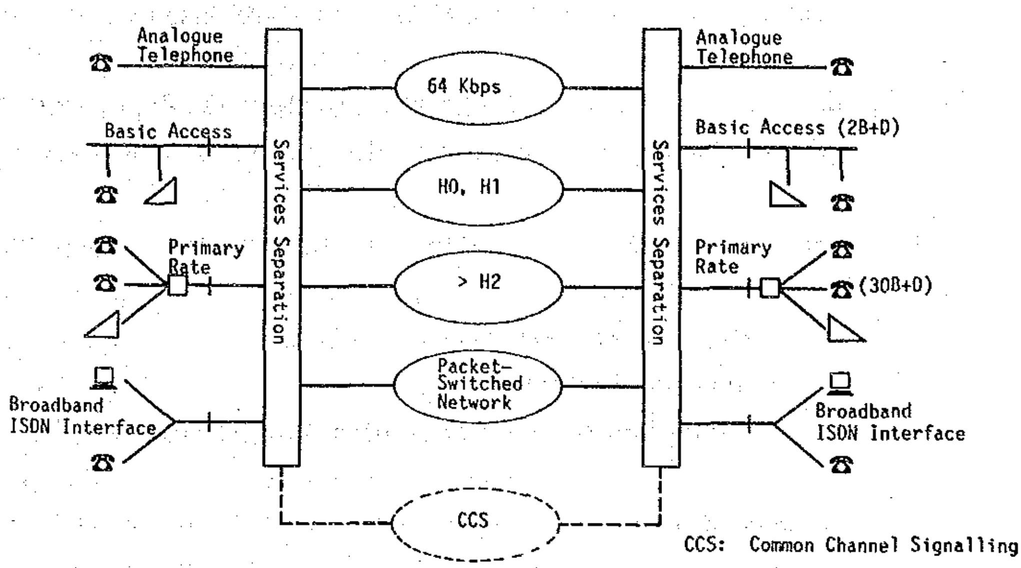
- MAN (Metropolitan Area Network) and WAN (Wide Area Network) are established to form a basis for broadband ISDN by interconnecting LANs with the optical fiber networks as well as satellite networks.
- Islands of CATV of tree and/or star network architectures are gradually installed and expanded. An integrated broadband network to accommodate telecommunications services is formed thenafter by interconnecting these islands.
- Installation of optical fibers for subscriber cables is preceded not only to business customers' premises but also to residential customers' premises even though narrowband ISDN services may be required for the time being.
- Broadband ISDN is formed by enhancing narrowband ISDN over two steps. In the first step, STM (Synchronous Transfer Mode)1/ will handle appropriately the users' various kinds of information of both narrowband and wideband. (See Fig. 7.7 (A).) In the second step, narrowband ISDN is integrated with broadband ISDN by incorporating STM/ATM conversion. (See Fig. 7.7 (B).)

1/ STM utilizes the well-matured technology, i.e., circuit switching, fit for the services where difference of data transmission rates is comparatively small.

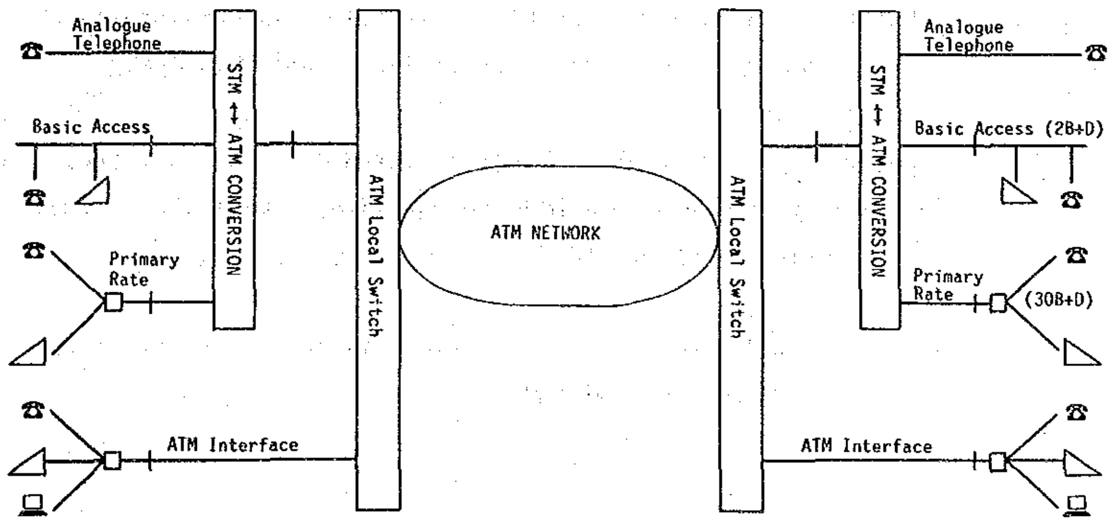
The last way of implementing broadband ISDN is recommended for Indonesia according to the time schedule given in Section 7.2.5, carefully taking the progress of CCITT's standardization into account.

Those ways of implementing broadband ISDN other than the last one are expensive and the market for broadband ISDN is not matured.

(A) First Step



(B) Second Step



(Source: ISDN Handbook, Nikkei Communications 1988)

Fig. 7.7 Integration of Narrowband and Broadband ISDNs

7.4 Interworking between ISDN and Data Communications Network

The criteria for implementing ISDN are set forth:

a) Attention shall be paid to the trend of **CCITT's standardization,** one of the key factors for proliferation of ISDN services.

b) The prerequisites for full-scale ISDN shall be cleared:

- **digitalization;**
- **synchronization;**
- **introduction of CCITT signalling system No. 7.**

c) **Broadband ISDN** shall be interworked with narrowband ISDN stage by stage as detailed in Section 7.3.4 Broadband ISDN.

d) The practical way of **interworking ISDN and existing public data network** (=SKDP) shall be adopted.

e) ISDN to be implemented **initially in Metropolitan Jakarta** shall be expanded gradually to major cities other than Jakarta.

f) The use of X-series data terminals, telex terminals, etc, shall be considered employing **terminal adaptors (TAs)** at the initial introduction stage of ISDN.

g) **Prior field trials** shall be carried out whenever new ISDN technologies are introduced.

7.4.1 Alternatives (Cases A & B)

CCITT used to recommend "Maximum Integration" and "Minimum Integration" scenarios to be employed for interworking the packet switched public data network and narrowband ISDN (64 kbps) from the viewpoint of network structuring. (CCITT Rec. X.31)

Those scenarios described in CCITT Rec. X.31 had been reviewed from the access-oriented viewpoint by CCITT study groups during this study period (1985 - 1988) to conclude as follows:

Case A, access to a PSPDN (PSPDN services);
Case B, use of an ISDN virtual circuit service.

In **Case A** an ISDN transparent circuit connection, either permanent (i.e., non-switched) or demand (i.e., switched), is used. The corresponding ISDN bearer service is a 64 kbps service as described in CCITT Rec. I.231. The service available to the user is that of the PSPDN described in Rec. X.25 (permanent access) and Rec. X.32 (demand access), as well as in other X-series Recommendations (e.g., X.2, X.121).

In **Case B** an ISDN virtual circuit service is used, as described in CCITT Rec. I.231, Section 3.2.1. The service available is described in I-series Recommendations.

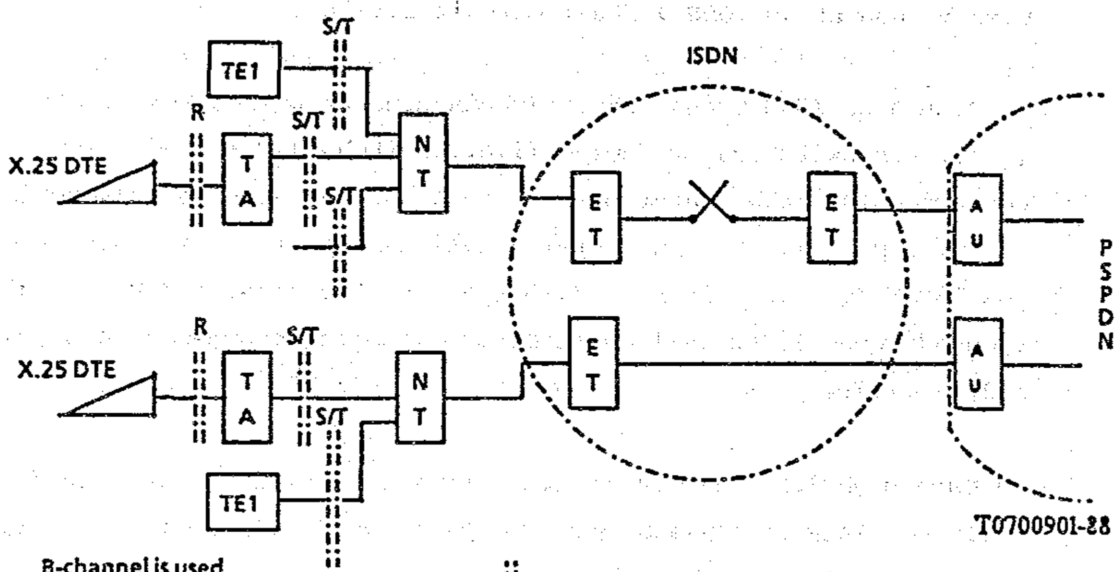
In **Case A** only B-channel can be used to access the packet switched service at the user-network interface, while in **Case B** both B- and D-channels can be used.

Source: CCITT Rec. X.31 (Melbourne, 1988)

System configurations for cases A and B are depicted as under:

a) Case A

Only access via the B-channel is possible. In this context, the only support that an ISDN gives to packet calls is a physical 64 kbps circuit-mode semi-permanent or demand transparent network connection type between the appropriate PSPDN port and the X.25 DTE + TA or TE1 at the customer premises.



—— B-channel is used

Reference points (see Recommendation I.411)

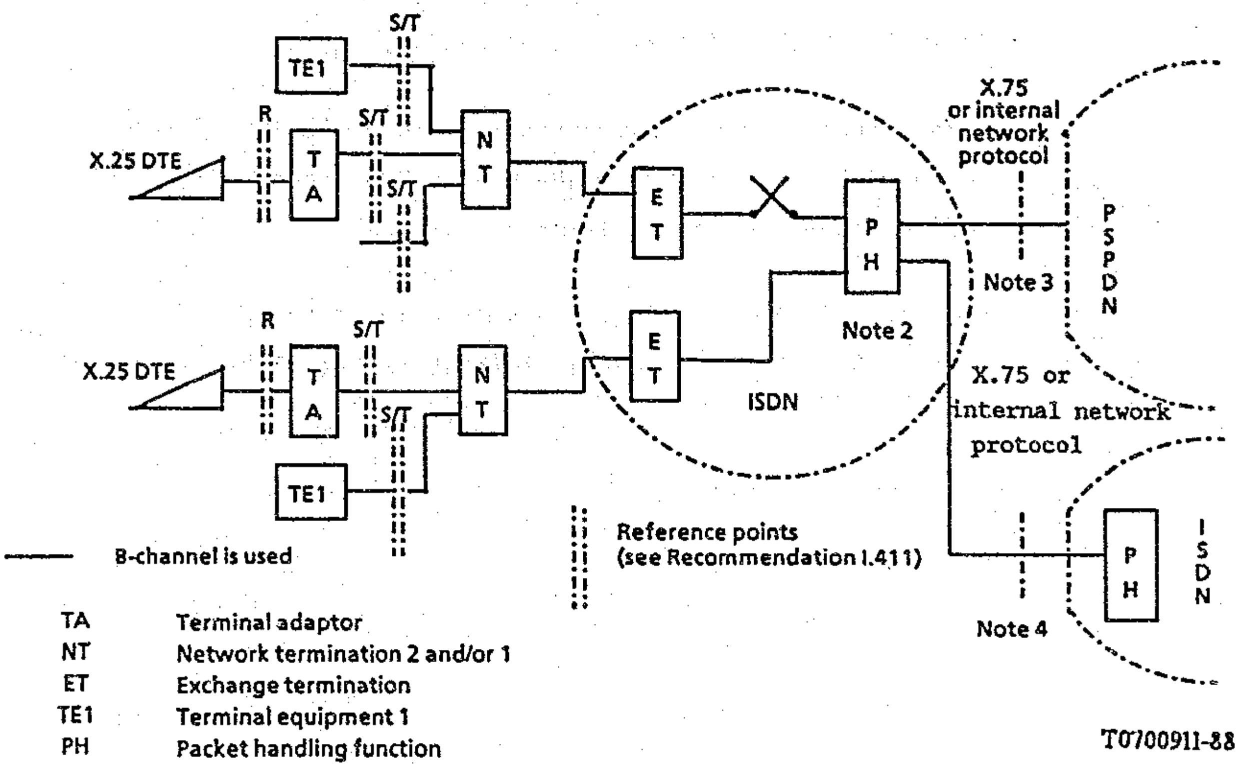
AU	ISDN access unit ports
TA	Terminal adaptor
NT	Network termination 2 and/or 1
ET	Exchange termination
TE1	Terminal equipment 1

Note 1 - This figure is only an example of many possible configurations and is included as an aid to the text describing the various interface functions.
Note 2 - See Recommendation X.325 for interworking guidelines.

Fig. 7.8 (1/2) Interworking PSPDN with ISDN (Case A)

b) Case B

This configuration refers to the case where a packet handling (PH) function is provided within the ISDN. The configuration in the figure below relates to the case of X.25 link and packet layer procedures conveyed through the B-channel. In this case, the packet call is routed, within an ISDN, to some PH function where the complete processing of the X.25 can be carried out.



Note 1 - This figure is only an example of many possible configurations and is included as an aid to the text describing the various interface functions.

Note 2 - In some implementations the PH functions logically belonging to the ISDN may reside physically in a node of the PSPDN. The service provided is still the ISDN virtual circuit service.

Note 3 - See Recommendation X.325.

Note 4 - See Recommendation X.320.

Fig. 7.8 (2/2) Interworking PSPDN with ISDN (CASE B)

7.4.2 Scenario for Interworking

It is recommended that the packet switched public data network (=SKDP) be interworked with ISDN to be initially introduced in Metropolitan Jakarta at the beginning of Repelita VI because of the following reasons:

a) It might take full period of Repelita V to digitalize trunk circuits among major cities.

b) International standardization of terminal adaptors (TAs) may make progress in 5 years.

c) International data communications services will be offered through SKDP for the time being during the transition period toward worldwide ISDN services.

Case A described in Section 7.4.1 is much more preferable for Indonesia to interwork SKDP (packet switched public data network) and ISDN.

7.4.3 VSAT

As described in Section 8.2.7 (2), nationwide digitalization of trunk circuits is delayed in comparison with the progress of expansion program for data communications network; extension of digitalized trunk circuits is indispensable for proliferation of data communications.

In the meantime, the contract of VSAT1/ was signed by the government in January 1989; VSAT is expected to deploy the data communications network throughout the country supplementing SKDP services that are, at this moment, confined to Jakarta area due to the lack of digital trunk circuits.

At an initial stage of introducing VSAT, 100 - 150 terminals are expected to be supplied2/; interworking between VSAT and SKDP is realized on X.75 basis.

1/ VSAT: Very Small Aperture Terminal
Contracted with the national company on revenue sharing basis (25% of profits) in January 1989.

The hub (control) station is operated by PERUMTEL, terminals by the national company; X.25 terminals could be accommodated in VSAT.

2/ Assignment of transponders will be arranged so as to inaugurate VSAT services:

	Current	Future
SCPC	5	7
FDMA/FM	6	9
TDMA	1	4
VSAT/data	-	1
TV	7	9

(Source: BINPROSATTEL, Feb. 9, 1989)

8. MEDIUM-TERM PLAN

8. MEDIUM-TERM PLAN

The expansion of telephone network is planned based on the demand/traffic forecast and long-term network planning in Chapters 4 and 5 respectively as summarized in the following table:

Table 8.1 Expansion Plan for Telephone Services (Jabotabek Area)

	Pelita IV (1989)	Repelita V (1994)	Repelita VI (1999)	Repelita VII (2004)
Telephone Demand	530,040 1/	1,034,300	1,558,600	2,191,400
No. of New Exchange Area	-	20 -1	6	8
Total Exchange Area	39	58	64	72
Expansion of Switching Capacity (l.u.)	-	622,300 -67,100	531,900 -200	862,600 -208,500
Total Switching Capacity (l.u.)	449,900	1,005,100	1,536,800	2,191,400
Expansion of Primary Cable (pairs)	-	1,097,800 -87,600	702,600 -200	889,300
Total Primary Cable (pairs)	672,000	1,682,200	2,384,600	3,273,900
Investment Cost (Million US$) 2/	-	976	818	1,326

1/ Expressed demand as of May 1988.

2/ Following per-line costs are assumed to estimate the investment costs in the table above.

- US$ 2,060/line ...... land acquisition;
  building;
  switching facilities; and
  subscriber cable network.
- US$ 1,500/line ...... same as above except for land
  acquisition.

8.1 Essential Projects of Respective Five-Year Plans

The essential development projects mainly for telephone services in Jabotabek area are as follows: (Refer to Chapter 7 as for non-voice services and ISDN.)

8.1.1 Repelita V

a) Expansion of 600 k l.u. out of 1,400 k l.u. (national planning figure) shall be implemented in Jabotabek area.

b) Expansion of Jakarta multi-exchange area up to 30 km-zone from the center of DKI Jakarta.

c) Bogor area shall be transformed into a multi-exchange area incorporating present suburban area and neighboring areas (CAA, CSA and CWI).

d) To meet the demand of waiting applicants.

e) To promote digitalization of junction networks.

f) To raise the "call completion ratio".

8.1.2 Repelita VI

a) Expansion of telephone services network in suburban areas.

b) Full-automatization (not necessarily digitalization) of exchanges in Jabotabek area.

8.1.3 Repelita VII

a) Full-accessibility to telephone services in any kind of villages within Jabotabek area.

b) Full-digitalization of local junction networks.

8.2 Expansion Plan

8.2.1 Exchange Areas

The network expansion plan is prepared so as to secure "full-accessibility to telephone services in any kind of villages within Jabotabek area."

Exchange area boundaries are drawn based on the study on optimum exchange size in Section 5.3.1 taking into account administrative boundaries, geographical conditions and regional development as shown in Table 8.2.

Table 8.2 Establishment Program of Exchange Areas

Area		Existing	Repelita V		Repelita VI		Repelita VII	
			No. of Exchange Areas					
			Expansion	Total	Expansion	Total	Expansion	Total
Jakarta	Multi-exchange	34[1/]	-1[2/] 17	50	4	54	1	55
	Suburban	0	2	2	2	4	6	10
	Total	34	-1 19	52	6	58	7	65
Bogor	Multi-exchange	1	3	4	0	4	1	5
	Suburban	4	-2[3/]	2	0	2	0	2
	Total	5	-2 3	6	0	6	1	7
Jabotabek	Total	39	-3 22	58	6	64	8	72

1/ Jakarta multi-exchange area was announced to incorporate TAN, BEK, DEP and CIB exchange areas on Dec. 2, 1988.

2/ Relocation of JT1 exchange.

3/ Expansion of Bogor multi-exchange area. (CAA and CSA)

8.2.2 Switches

(1) Local Switch

The target years for expansion of local switches are set forth as follows in order to cater for the telephone services demand:

Repelita V 1994
Repelita VI 1999
Repelita VII 2004

The following strategies are taken into consideration:

a) All EMD switches will be replaced with digital ones during the period of Repelita V aiming at establishing the full-scale digital network; N230 switches of 1,000 l.u. in GAN and CSA will be replaced with the digital ones.

b) There will be existing three manual switchboards at CAA, LWL and JSG at the end of Pelita IV; CAA exchange will be automatized to be incorporated in Bogor multi-exchange area during the period of Repelita V; LWL and JSG exchanges are to be automatized during the period of Repelita VI.

c) Existing analog exchanges, i.e., PRX and MC-10C will be replaced with digital ones considering their economic service life (25 years).

The expansion plans for respective Repelitas appear in Table 8.3.

As for Jakarta multi-exchange area, subscriber numbering plan in respective Repelitas is proposed by the Study as shown in ANNEX 8-1.

Detailed expansion plan for local switches by exchange area is shown in Table 8.4.

Table 8.3 Expansion Program of Local Switches in Jabotabek Area

Area		Existing	Switching Capacity (x1,000 l.u.)					
			Repelita V		Repelita VI		Repelita VII	
			Expansion	Total	Expansion	Total	Expansion	Total
Jakarta	Multi-exchange	434.6	-66.0 585.6	954.2	474.4	1,431.6	-198.0 760.2	1,993.8
	Suburban	0	10.2	10.2	22.2	32.4	54.2	86.6
	Total	434.6	-66.0 595.8	964.4	499.6	1,464.0	-198.0 814.4	2,080.4
Bogor	Multi-exchange	15.1	-1.1 26.5	40.5	23.4	63.9	-10.0 42.9	96.8
	Suburban	0.2	0	0.2	-0.2 8.9	8.9	5.3	14.2
	Total	15.3	-1.1 26.5	40.7	-0.2 32.3	72.8	-10.0 48.2	111.0
Jabotabek Total		449.9	-67.1 622.3	1,005.1	-0.2 531.9	1,536.8	-208.0 862.6	2,191.4

Table 8.4 Expansion Plan for Local Switch and Outside Plant (1/5)

(Expanded Jakarta Multi-Exchange Area - 1/3)

No.	Ex. Area	Expressed Demand (May, 1988) Existing Sub.	Waiting Lists	Total	Telephone Demand Estimates (x 1,000) Repelita V 1992	Repelita V 1994	Repelita VI 1997	Repelita VI 1999	Repelita VII 2002	Repelita VII 2004	Rep. VIII 2007	Exchange Capacity Expansion (x 1,000 lu) Existing	Rep. V	Rep. VI	Rep. VII	Total	Subscriber Cable Expansion (x 1,000 pairs) Existing	Rep. V	Rep. VI	Rep. VII	Total	Remarks
1	KT1	10,495	6,117	16,612	14.6	16.0	17.7	18.9	20.7	21.8	23.3	19.8	-10.0 6.2	2.9	2.9	21.8	22.0	-12.6 19.6	0	0.2	29.2	
2	KT2	38,769	18,982	57,751	41.7	46.5	54.4	60.5	70.2	77.5	88.8	52.6	0	7.9	-31.0 48.0	77.5	58.2	-1.8 53.6	6.0	23.2	111.0	
3	KT3				51.3	54.9	59.4	62.9	67.8	71.8	75.8	0	54.9	8.0	8.9	71.8	0	-28.2 80.6	4.2	10.0	94.8	Kota 2 Cable removal
4	PLT	11,459	14,784	26,243	33.4	37.4	42.5	45.8	49.3	52.0	55.3	11.5	25.9	8.4	-11.5 17.7	52.0	22.8	-2.4 31.4	9.9	7.5	69.2	
5	CKG	5,605	13,065	18,670	22.0	26.5	34.0	38.9	48.4	55.0	63.8	7.9	18.6	12.4	-10.0 26.1	55.0	8.8	33.7	18.0	19.2	79.7	
6	ANC	6,249	4,061	10,310	16.5	21.9	29.6	36.5	47.2	54.8	67.6	6.7	13.2	14.6	-10.2 28.5	54.8	7.8	29.2	22.1	25.4	84.5	
7	GB1	40,943	12,607	53,550	51.9	54.1	56.1	57.5	59.0	60.0	61.0	47.4	-20.0 26.7	3.4	-16.4 18.9	60.0	89.3	-16.5	1.0	2.5	76.3	Cable arrangement
8	GB2	18,976	9,307	28,283	35.5	41.6	51.8	59.2	71.3	80.2	92.4	23.6	18.0	17.6	-8.2 29.2	80.2	44.9	19.9	24.4	26.4	115.6	
9	SLP	12,986	9,836	22,822	28.7	33.6	41.5	47.6	57.5	64.9	76.4	24.0	-7.5 17.1	14.0	17.3	64.9	31.9	-6.5 30.8	15.8	23.6	95.6	
10	SM1	9,438	2,205	11,643	24.7	30.5	40.4	47.1	57.4	64.0	72.7	14.8	-7.0 22.7	16.6	16.9	64.0	14.6	-2.3 38.2	21.2	19.3	91.0	
11	SM2	9,938	6,830	16,768	35.7	44.2	60.1	71.0	86.5	96.0	109.1	23.2	21.0	26.8	-8.4 33.4	96.0	11.5	76.8	19.8	28.3	136.4	
12	PLM	9,407	15,172	24,579	27.2	33.3	42.7	49.2	60.3	67.5	78.0	17.0	16.3	15.9	-7.7 26.0	67.5	24.8	30.6	20.0	22.1	97.5	
13	KEO				10.4	13.6	20.6	25.0	33.6	39.0	47.3	0	13.8	11.2	14.0	39.0	10.2	15.6	16.3	17.0	59.1	
14	MER				5.5	8.2	13.1	17.1	23.5	28.1	34.4	0	8.2	8.9	11.0	28.1	10.4	6.0	13.0	13.6	43.0	
15	TGA				4.6	5.3	6.5	7.4	9.1	10.2	12.5	0	5.3	2.1	2.8	10.2	3.2	5.0	3.2	4.3	15.7	
16	JIA	1,675	0	1,675	2.3	2.5	2.8	3.0	3.3	3.5	3.7	1.8	0.7	0.5	0.5	3.5	8.0	0	0	0	8.0	
17	CPP	13,855	5,075	18,930	27.7	32.7	41.2	47.7	58.7	65.8	79.4	23.2	9.5	15.0	-10.2 28.3	65.8	26.6	28.8	18.0	25.9	99.3	
18	RMG	14,412	5,572	19,984	31.6	37.6	48.2	54.0	62.8	67.4	74.2	20.3	17.3	16.4	-12.3 25.7	67.4	31.6	24.8	22.1	14.3	92.8	
19	KGD	0	6,672	6,672	15.7	19.8	26.1	20.0	34.3	36.6	39.2	0	19.8	9.2	7.6	36.6	5.8	26.9	10.2	6.1	49.0	
20	KGP	2,277	0	2,277	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0	0	0	3.0	3.5	0	0	0	3.5	
Subtotal		206,484	130,285	336,769	484.0	563.4	691.7	781.3	923.9	1,019.1	1,157.9	298.8	-44.5 315.2	0 211.8	-125.9 363.7	1,019.1	435.9	-70.3 551.5	0 245.2	0 288.9	1,451.2	

Table 8.4 Expansion Plan for Local Switch and Outside Plant (2/5)

(Expanded Jakarta Multi-Exchange Area - 2/3)

No.	Ex. Area	Expressed Demand (May, 1988) Existing Sub.	Waiting Lists	Total	Telephone Demand Estimates (x 1,000) Repelita V 1992	Repelita V 1994	Repelita VI 1997	Repelita VI 1999	Repelita VII 2002	Repelita VII 2004	Rep. VIII 2007	Exchange Capacity Expansion (x 1,000 lu) Existing	Rep. V	Rep. VI	Rep. VII	Total	Subscriber Cable Expansion (x 1,000 pairs) Existing	Rep. V	Rep. VI	Rep. VII	Total	Remarks
21	PGG				7.0	9.8	15.4	20.9	31.9	41.4	62.6	0	9.8	11.1	20.5	41.4	7.2	12.1	20.6	38.4	78.3	
22	TPR	7,857	4,391	12,248	15.1	18.0	23.3	27.5	34.1	39.0	47.0	9.2	8.8	9.5	-9.2 20.7	39.0	26.0	-1.0 4.2	13.4	16.2	58.8	
23	CIL				4.9	7.0	10.9	14.0	20.5	25.0	32.7	0	7.0	7.0	11.0	25.0	4.8	8.9	11.9	15.3	40.9	
24	KB	23,056	8,080	31,136	37.2	41.6	47.7	52.1	58.9	65.2	73.5	26.4	-4.0 19.2	10.5	-8.2 21.3	65.2	46.0	-11.0 23.4	16.5	17.0	91.9	
25	KBB				10.3	14.2	20.8	26.0	35.4	42.0	52.2	0	14.2	11.8	16.0	42.0	0	28.8	15.4	21.1	65.3	
26	CDG				2.0	2.8	4.2	5.7	7.8	9.5	12.3	0	2.8	2.9	3.8	9.5	0	5.3	4.5	5.6	15.4	
27	CPE	10,891	9,123	20,014	24.2	28.6	35.4	40.2	48.7	54.0	63.3	15.7	12.9	11.6	-8.4 22.2	54.0	14.9	30.0	16.1	18.2	79.2	
28	CNE				8.3	11.4	15.8	17.0	17.6	18.3	18.9	0	11.4	5.6	1.3	18.3	0	20.6	1.4	1.7	23.7	
29	CPA	2,845	3,570	6,415	7.7	9.0	13.0	16.0	21.4	25.0	31.3	3.5	-2.0 7.5	7.0	9.0	25.0	3.6	12.7	10.5	12.4	39.2	
30	KL1	9,685	4,684	14,369	20.1	24.9	32.8	39.4	48.2	56.4	68.0	13.8	11.1	14.5	-13.8 30.8	56.4	12.0	32.2	17.3	23.5	85.0	
31	KL2				7.2	8.8	11.6	13.5	17.2	19.8	23.8	0	8.8	4.7	6.3	19.8	0	15.7	5.8	8.3	29.8	
32	PSM	3,485	3,384	6,869	10.0	12.0	15.8	18.4	23.1	26.2	31.3	6.8	-3.0 8.2	6.4	7.8	26.2	5.0	14.8	9.1	10.3	39.2	
33	JAG	107	0	107	2.2	2.7	4.4	5.6	8.1	10.0	13.6	0.2	2.5	2.9	4.4	10.0	4.3	1.2	4.7	6.8	17.0	
34	SER				3.8	5.4	8.8	11.6	16.6	20.3	27.0	0	5.4	6.2	8.7	20.3	0	11.0	9.8	13.0	33.8	
35	SRU				3.0	4.2	6.7	8.7	12.2	15.0	20.0	0	4.2	4.5	6.3	15.0	0	8.4	6.9	9.7	25.0	
36	SRB				2.0	3.3	5.9	7.2	10.3	12.6	15.4	0	0	7.2	5.4	12.6	0	0	12.9	6.4	19.3	
37	JT1	4,050	2,985	7,035								4.5	-4.5 0	0	0	0	5.2	-5.2 0	0	0	0	
38	JT2	9,654	4,954	14,608	32.0	37.0	45.5	51.8	62.2	70.0	81.5	18.8	18.2	14.8	-10.2 28.4	70.0	22.0	40.8	15.0	24.1	101.9	
39	CV	4,073	3,589	7,662	9.9	12.2	15.8	18.9	23.9	27.5	34.0	6.1	6.1	6.7	-9.2 17.8	27.5	6.8	18.4	4.7	12.6	42.5	
40	PSR	1,804	1,340	3,144	7.7	10.8	15.7	20.5	28.9	34.9	47.0	3.9	6.9	9.7	14.4	34.9	5.0	14.7	16.4	22.6	58.7	
Subtotal		77,507	46,100	123,607	214.0	263.7	349.5	415.0	528.8	612.1	755.4	108.9	-13.5 165.0	0 154.6	-59.0 256.1	612.1	162.8	-17.2 303.2	0 212.9	0 283.2	944.9	

Table 8.4 Expansion Plan for Local Switch and Outside Plant (3/5)

(Expanded Jakarta Multi-Exchange Area - 3/3)

No.	Ex. Area	Expressed Demand (May, 1988)			Telephone Demand Estimates (x 1,000)							Exchange Capacity Expansion (x 1,000 lu)					Subscriber Cable Expansion (x 1,000 pairs)					Remarks
		Existing Sub.	Waiting Lists	Total	Repelita V		Repelita VI		Repelita VII		Rep. VIII	Existing	Rep. V	Rep. VI	Rep. VII	Total	Existing	Rep. V	Rep. VI	Rep. VII	Total	
					1992	1994	1997	1999	2002	2004	2007											
41	KLD	2,340	9,171	11,511	8.6	11.4	18.1	22.9	31.6	37.4	48.8	3.3	15.2	17.9	1.0	37.4	17.7	18.3	26.3	0	62.3	
42	PDK				5.4	7.1	10.7	13.5	18.2	21.6	28.2	0	0	0	21.6	21.6	0	0	0	35.3	35.3	
43	TB	10,723	4,406	15,129	22.9	27.6	35.0	41.0	51.2	58.5	71.3	13.1	14.5	13.4	-13.1 30.6	58.5	17.2	34.2	12.6	25.1	89.1	
44	GAN	952	1,471	2,423	5.2	6.2	9.0	11.5	16.0	18.9	26.2	1.0	-1.0 6.2	5.3	7.4	18.9	2.3	9.0	8.7	12.8	32.8	
45	PDG				5.3	6.8	10.2	13.0	17.8	21.1	27.7	0	6.8	6.2	8.1	21.1	0	12.8	9.5	12.4	34.7	
46	BEK	1,877	6,379	8,256	3.8	4.4	6.2	7.6	9.8	11.6	14.6	2.0	-3.0 5.4	3.2	4.0	11.6	3.2	4.6	4.5	6.0	18.3	EMD REALOXASI (+ 1,000)
47	BKB				10.0	12.6	17.8	21.6	27.9	32.7	40.5	0	12.6	9.0	11.1	32.7	0	22.3	12.6	15.8	50.7	
48	BGG				4.0	5.1	8.0	9.4	12.6	14.9	19.1	0	0	9.4	5.5	14.9	0	0	15.8	8.1	23.9	
49	CL				3.5	4.3	6.8	8.2	11.2	13.4	17.2	0	4.3	3.9	5.2	13.4	0	8.5	5.5	7.5	21.5	
50	TAN	2,927	7,184	10,111	17.0	20.3	29.0	35.5	46.6	54.6	67.0	4.0	-4.0 20.3	15.2	19.1	54.6	10.2	26.1	22.0	25.5	83.8	
51	JUG				1.0	1.7	3.0	3.8	5.4	6.6	8.4	0	1.7	2.1	2.8	6.6	0	3.8	3.0	3.7	10.5	
52	CPD				1.9	2.4	3.4	4.1	5.4	6.4	7.9	0	0	4.1	2.3	6.4	0	0	6.8	3.1	9.9	
53	DEP	1,772	2,451	4,223	7.0	8.1	11.3	13.6	17.3	20.3	25.6	2.0	6.1	5.5	6.7	20.3	2.4	11.8	7.5	10.3	32.0	
54	SKJ				8.5	10.5	14.2	17.4	22.2	25.7	32.0	0	10.5	6.9	8.3	25.7	0	17.8	10.0	12.2	40.0	
55	CIB	1,318	779	2,097	2.9	3.3	4.5	5.1	6.5	7.2	8.8	1.5	1.8	1.8	2.1	7.2	1.8	3.9	2.5	2.8	11.0	
56	SVG				2.2	3.6	5.5	7.1	9.8	11.7	14.2	0	0	7.1	4.6	11.7	0	0	12.3	5.5	17.8	
Subtotal		21,909	31,841	53,750	109.2	135.4	182.7	235.3	309.5	362.6	457.5	26.8	-8.0 105.4	0 111.0	-13.1 140.4	362.6	54.8	0 173.1	0 159.6	0 186.1	573.6	
Total		305,900	208,226	514,126	807.8	962.5	1,233.9	1,431.6	1,762.2	1,993.8	2,370.7	434.6	-66.0 585.6	0 477.4	-196.0 760.2	1,993.8	653.5	-87.5 1,027.8	0 617.7	0 758.2	2,969.7	

Table 8.4 Expansion Plan for Local Switch and Outside Plant (4/5)

(Jakarta Suburban Area)

No.	Ex. Area	Expressed Demand (May, 1988)			Telephone Demand Estimates (x 1,000)							Exchange Capacity Expansion (x 1,000 lu)					Subscriber Cable Expansion (x 1,000 pairs)					Remarks
		Existing Sub.	Waiting Lists	Total	Repelita V		Repelita VI		Repelita VII		Rep. VIII	Existing	Rep. V	Rep. VI	Rep. VII	Total	Existing	Rep. V	Rep. VI	Rep. VII	Total	
					1992	1994	1997	1999	2002	2004	2007											
1	CX				6.2	8.8	14.2	18.5	26.0	31.8	41.0	0	8.8	9.7	13.3	31.8	0	17.8	14.7	18.8	51.3	
2	STN				0.9	1.1	1.8	2.4	3.4	4.3	6.5	0	0	0	4.3	4.3	0	0	0	8.2	8.2	
3	SRG				0.5	0.7	1.1	1.4	1.9	2.4	3.2	0	0	0	2.4	2.4	0	0	0	4.0	4.0	
4	JGL				1.5	2.0	3.2	4.0	4.7	6.6	8.3	0	0	0	6.6	6.6	0	0	0	10.4	10.4	
5	CKP				1.1	1.4	2.3	3.1	4.5	5.4	7.0	0	1.4	1.7	2.3	5.4	0	2.9	2.8	3.1	8.8	
6	TGS				1.8	2.7	4.2	6.0	8.8	10.6	13.5	0	0	6.0	4.6	10.6	0	0	11.0	5.9	15.9	
7	PSK				1.8	2.4	3.7	4.8	6.8	8.1	10.0	0	0	4.8	3.3	8.1	0	0	8.5	4.0	12.5	
8	BLJ				1.2	1.7	2.8	3.5	5.0	6.0	7.8	0	0	0	6.0	6.0	0	0	0	9.8	9.8	
9	CUG				1.3	1.6	2.8	3.5	5.0	6.1	8.0	0	0	0	6.1	6.1	0	0	0	10.0	10.0	
10	PPG				1.2	1.5	2.5	3.1	4.5	5.3	6.8	0	0	0	5.3	5.3	0	0	0	8.5	8.5	
Total					17.5	23.9	38.6	50.3	70.6	86.6	112.1	0	10.2	22.2	54.2	86.6	0	20.7	37.0	82.7	140.4	

Table 8.4 Expansion Plan for Local Switch and Outside Plant (5/5)

(Bogor Multi-Exchange Area and Bogor Suburban Area)

No.	Ex. Area	Expressed Demand (May, 1988)			Telephone Demand Estimates (x 1,000)							Exchange Capacity Expansion (x 1,000 lu)					Subscriber Cable Expansion (x 1,000 pairs)					Remarks
		Existing Sub.	Waiting Lists	Total	Repelita V		Repelita VI		Repelita VII		Rep. VIII	Existing	Rep. V	Rep. VI	Rep. VII	Total	Existing	Rep. V	Rep. VI	Rep. VII	Total	
					1992	1994	1997	1999	2002	2004	2007											
1	BOO	7,950	6,407	14,357	25.5	31.9	42.9	50.5	63.2	72.1	87.0	14.0	17.9	18.6	-10.0 31.6	72.1	16.1	37.6	25.3	29.8	108.8	
2	CVI				2.6	3.2	4.0	4.9	6.0	6.9	7.0	0	3.2	1.7	2.0	6.9	0	5.0	2.5	1.3	8.8	
3	CAA	56	0	56	2.4	3.0	4.0	4.8	6.0	6.9	7.0	(M/B) 0.1	-0.1 3.0	1.8	2.1	6.9	0.1	-0.1 5.0	2.5	1.3	8.8	
4	SPL				2.0	2.5	3.0	3.9	4.8	5.6	6.9	0	0	0	5.6	5.6	0	0	0	8.7	8.7	
5	CSA	913	506	1,419	2.2	2.4	3.0	3.7	4.8	5.3	6.0	1.0	-1.0 2.4	1.3	1.6	5.3	2.1	1.7	2.2	1.5	7.5	
6	LVL	45	4	49	2.7	3.4	4.0	5.8	7.9	8.9	10.0	(M/B) 0.1	0	-0.1 5.8	3.1	8.9	0.1	0	-0.1 9.9	2.6	12.5	
7	JSG	33	0	33	1.1	1.5	2.4	3.1	4.4	5.3	6.9	(M/D) 0.1	0	-0.1 3.1	2.2	5.3	0.1	0	-0.1 5.5	3.2	8.7	
Total		8,997	6,017	15,914	38.5	47.9	63.9	76.7	97.1	111.0	130.8	15.3	-1.1 26.5	-0.2 32.3	-10.0 48.2	111.0	18.5	-0.1 49.3	-0.2 47.9	0 48.4	153.8	

(2) Local Transit Switch

Expansion of local transit switches is planned in accordance with the development planning for telecommunications network in Chapter 5.

a) Jakarta Multi-Exchange Area

New local transit switches combined with local switching function are established in TAN, BEK, DEP and SER in parallel to the expansion of Jakarta multi-exchange area.

Existing analog local transit switches[1/] are to be replaced during the period of Repelita VII in consideration of their economic service life.

1/ There exist five (5) analog and six (6) digital local transit switches currently in Jakarta multi-exchange area.

b) Jakarta Suburban Area

CKP (western suburb of Jakarta) and CK (east) will be transformed into the combined local/transit exchanges by the ends of Repelita VI and VII respectively since many exchange areas are planned to be newly established in each suburban area.

c) Bogor Multi-Exchange Area

Bogor will become a multi-exchange area during Repelita V incorporating its three surrounding exchanges so that local transit function be added at that time.

d) Bogor Suburban Area

LWL and JSG exchanges will be automatized during Repelita VI. No local transit exchange will be required up to the end of Repelita VII.

Shown in Table 8.5 is the expansion program of local transit switches in Jabotabek area.

Table 8.5 Expansion Program of Local Transit Switches in Jabotabek Area

Exchange Name	Type of Switch	Switching Capacity (circuits)		
		Repelita V	Repelita VI	Repelita VII
KT2	PRX	1,351	1,351	0
	Digital	9,646	11,489	13,560
GB1	PRX	1,625	1,625	0
	Digital	6,801	6,295	7,800
SLP	Digital	10,136	11,130	11,070
CPP	PRX	768	768	0
	Digital	9,041	10,152	9,870
KB	PRX	1,276	1,276	0
	Digital	12,522	15,374	18,000
JT	PRX	810	810	0
	Digital	9,471	9,690	10,350
TAN	Digital		(Combined)	
BEK	Digital		(Combined)	
DEP	Digital		(Combined)	
SER	Digital		(Combined)	

(3) Suburban Transit Switch

a) Jakarta Suburban Area

Jakarta suburban area is established adjacent to the expanded Jakarta multi-exchange area in the east as well as in the west during Repelita V.

The suburban analog exchange in GB1 (CIT-JANUS) will be replaced with the digital ones to be located in CKP and CK.

b) Bogor Suburban Area

During Repelita VI, LWL and JSG manual switchboards are transformed into automatic exchanges; LWL exchange will have the function of suburban transit.

(4) Digitalization of Switches

Analog switches of about 70,000 l.u. will remain at the end of Repelita VII even though digitalization of switches is being intended by the administration.

It is recommended that such analog switches as above shall be subordinated to digital switches to be introduced in the same exchange so as to realize full-digitalization of the local junction network.

The progress of digitalization of local switches is as shown in Table 8.6.

Table 8.6 Digitalization of Local Switches in Jabotabek Area

Service Area		Item	Repelita			
			IV	V	VI	VII
Jakarta	Multi-Exchange Area	Digital 1/	125.5	687.6	1,165.0	1,925.1
		Analog 1/	309.1	266.6	266.6	68.7
		Digitalization	**29%**	**72%**	**81%**	**97%**
	Suburban Area	Digital	0	10.2	32.4	86.6
		Analog	0	0	0	0
		Digitalization	**0%**	**100%**	**100%**	**100%**
	Total	Digital	125.5	697.8	1,197.4	2,011.7
		Analog	309.1	266.6	266.6	68.7
		Digitalization	**29%**	**72%**	**82%**	**97%**
Bogor	Multi-Exchange Area	Digital	4.0	30.5	53.9	96.8
		Analog	11.1	10.0	10.0	0
		Digitalization	**26%**	**75%**	**84%**	**100%**
	Suburban Area	Digital	0	0	8.9	14.2
		Analog	0.2	0.2	0	0
		Digitalization	**0%**	**0%**	**100%**	**100%**
	Total	Digital	4.0	30.5	62.8	111.0
		Analog	11.3	10.2	10.0	0
		Digitalization	**26%**	**75%**	**86%**	**100%**
Jabotabek Area		Digital	129.5	728.3	1,260.2	2,122.7
		Analog	320.4	276.8	276.6	68.7
		Digitalization	**29%**	**72%**	**82%**	**97%**

1/ x 1,000 l.u.

8.2.3 Local Subscriber Network

(1) Subscriber Cable Network

Expansion of subscriber cable networks (primary cables) is planned exchange-by-exchange as under:

Expansion Period	No. of Cable Pairs to be Expanded
Repelita V	(Demand for 1997 1/ x1.25 2/)-(Existing)
Repelita VI	(Demand for 2002 ")-(Existing)
Repelita VII	(Demand for 2007 ")-(Existing)

1/ The planning period for the subscriber network is stipulated in PERUMTEL's guideline as 5 years.

2/ In accordance with the figure given in PERUMTEL's guideline ("Guidelines of Local Cable Network Planning").

Expansion of subscriber cable networks is indicated in Table 8.7.

Preceding Table 8.4 shows detailed expansion plan for OSP by exchange area.

Table 8.7 **Expansion Program of Subscriber Cable in Jabotabek Area**

Area		Existing	Switching Capacity (x1,000 pairs)					
			Repelita V		Repelita VI		Repelita VII	
			Expansion	Total	Expansion	Total	Expansion	Total
Jakarta	Multi-exchange	653.5	-87.5 1,027.8	1,593.8	617.7	2,211.5	758.2	2,969.7
	Suburban	0	20.7	20.7	37.0	57.7	82.7	140.4
	Total	653.5	-87.5 1,048.5	1,614.5	654.7	2,269.2	840.9	3,110.1
Bogor	Multi-exchange	18.3	-0.1 49.3	67.5	32.5	100.0	42.6	142.6
	Suburban	0.2	0	0.2	-0.2 15.4	15.4	5.8	21.2
	Total	18.5	-0.1 49.3	67.7	-0.2 47.9	115.4	48.4	163.8
Jabotabek Total		672.0	-87.6 1,097.8	1,682.2	-0.2 702.6	2,384.6	889.3	3,273.9

(2) Digital Microwave Subscriber System

Another JICA study1/ recommends to provide the important subscribers especially those in high-rise office buildings with telephone services by means of digital microwave subscriber systems in order to relief the demand urgently in DKI Jakarta. The figures for the year 1994 are given in the final report of that study as follows:

Subscriber stations: 189
Line units : 14,420

1/ Feasibility Study on Implementation of Intra-City Digital Microwave Subscriber System, January 1989, JICA (GTA-96B)

8.2.4 Local and Suburban Junction Networks

Required numbers of circuits for local and suburban junction network are estimated based on the demand/traffic forecast and long-term network planning given in Chapters 4 and 5 taking into account:

a) Expanded junction network shall employ fiber optics and/or digital radio transmission.

b) Route diversity of the junction network shall be considered from the viewpoint of "network security" to cope with the increasing traffic volume.

c) Existing metallic cables shall be removed gradually.

Number of sections of the junction network to be newly constructed during respective Repelitas follows. (Refer to Fig. 8.1 for details.)

Repelita	No. of Sections
V	19
VI	10
VII	12

8.2.5 Trunk Junction Circuits between Jakarta and Bogor

The digital trunk system linking Jakarta, Bogor, Depok and Cibinong is under construction using radio transmission (over 6 GHz upper band, 140 Mbps, 1+1). Schematic diagram of JKT-BOO transmission system appears in ANNEX 8-2.

Rearrangement of the transmission systems between JKT and BOO will be required due to the expansion of Jakarta multi-exchange area incorporating DEP and CIB.

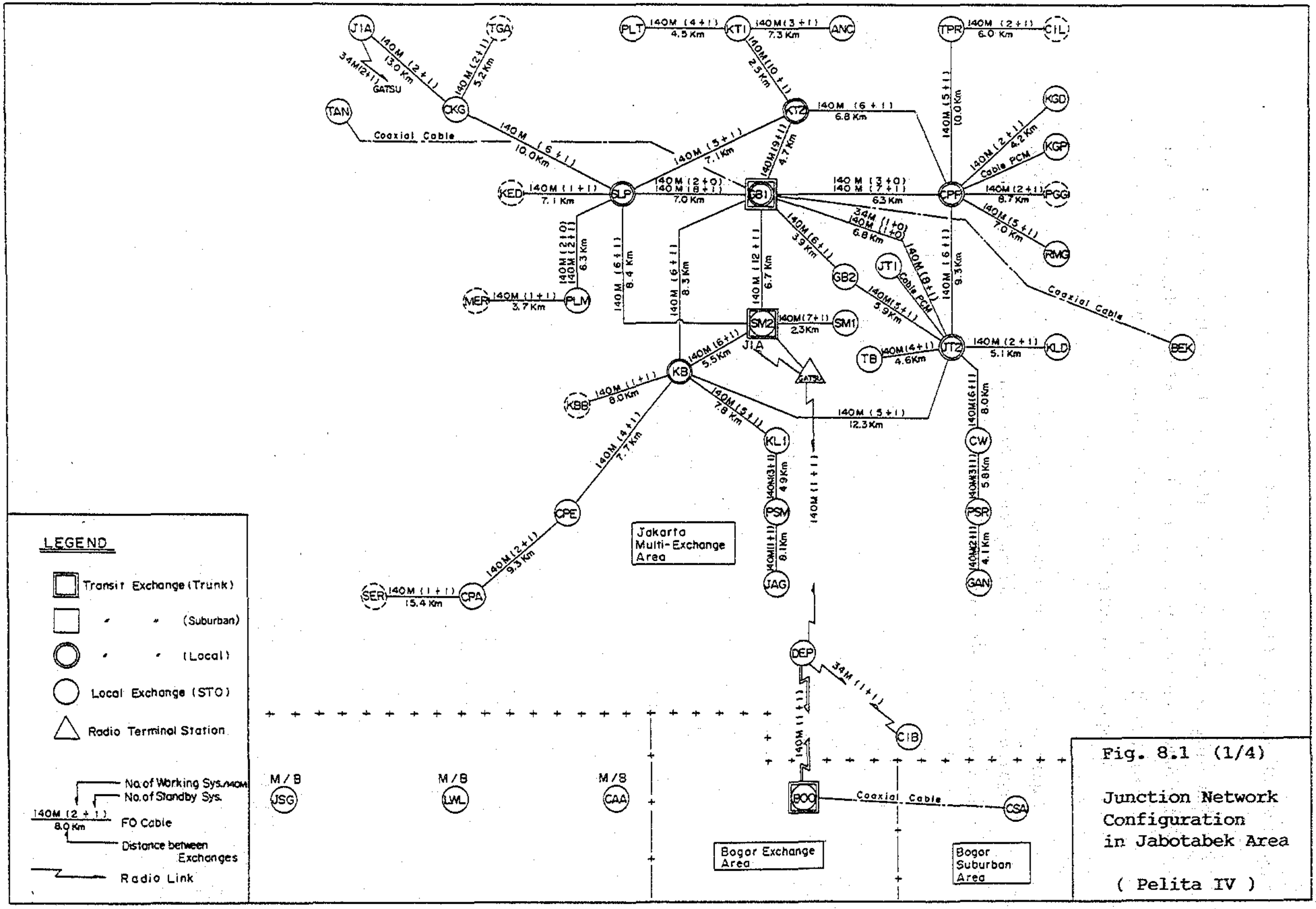


Fig. 8.1 (1/4)

Junction Network Configuration in Jabotabek Area

(Pelita IV)

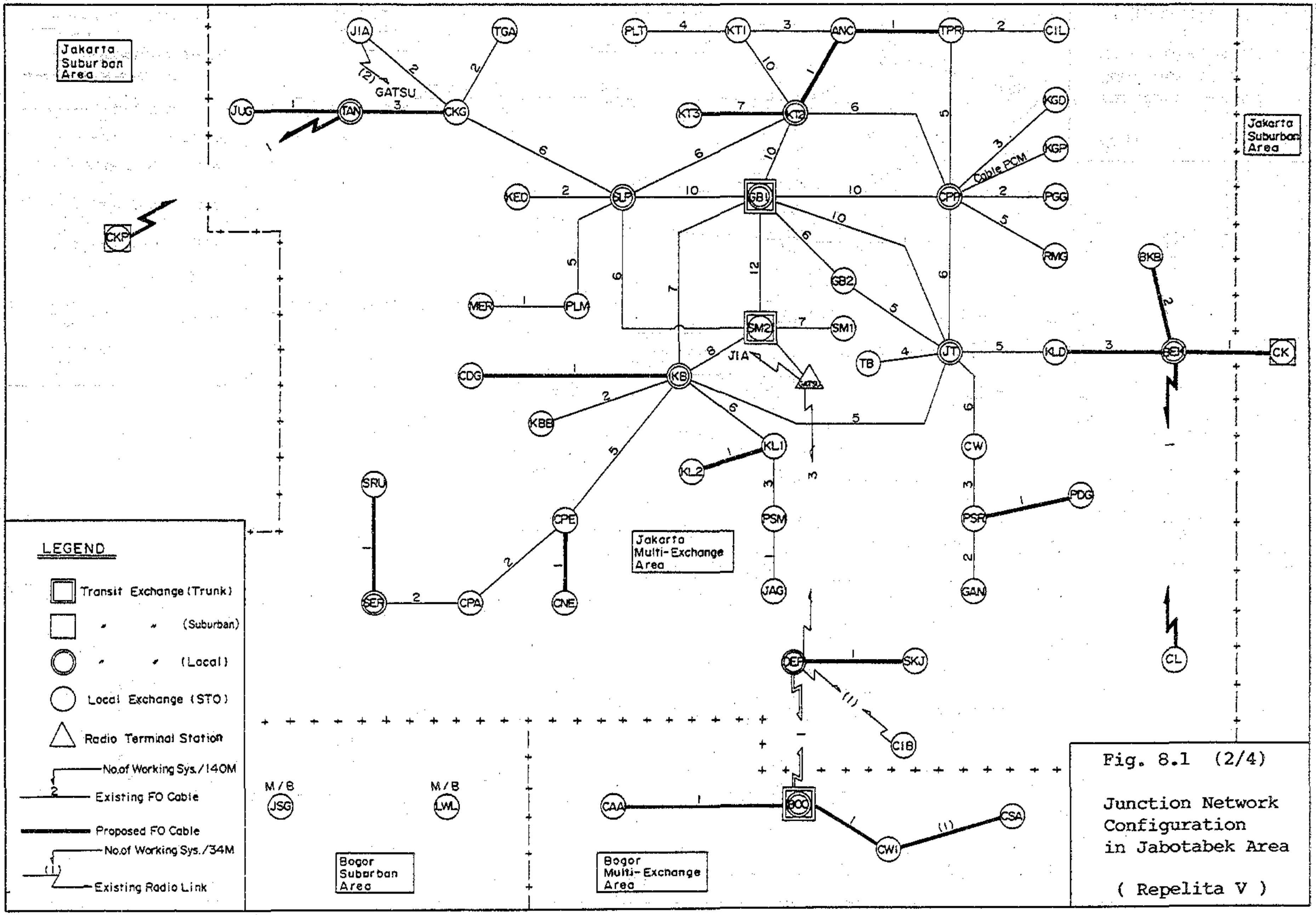


Fig. 8.1 (2/4)

Junction Network Configuration in Jabotabek Area

(Repelita V)

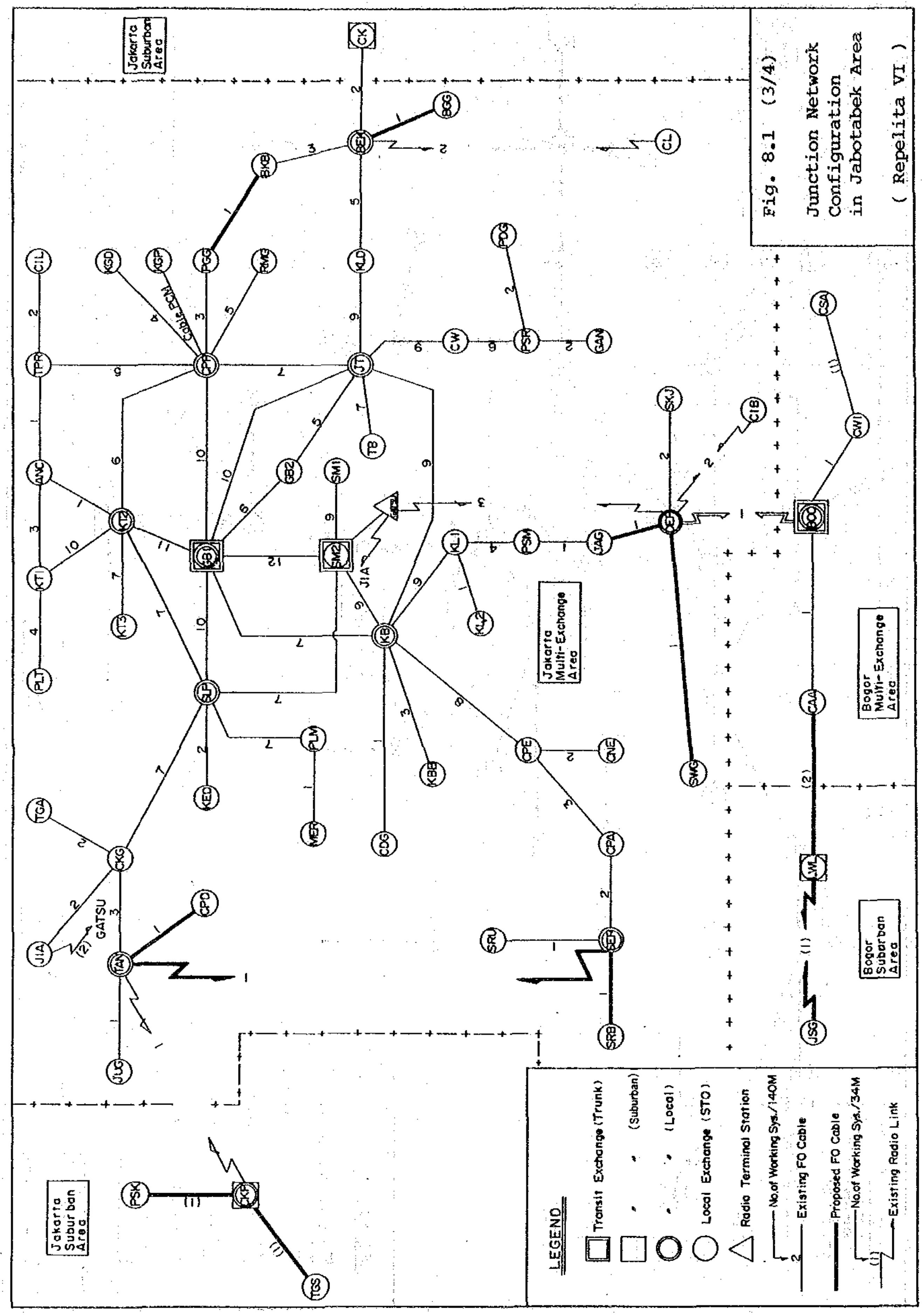


Fig. 8.1 (3/4) Junction Network Configuration in Jabotabek Area (Repelita VI)

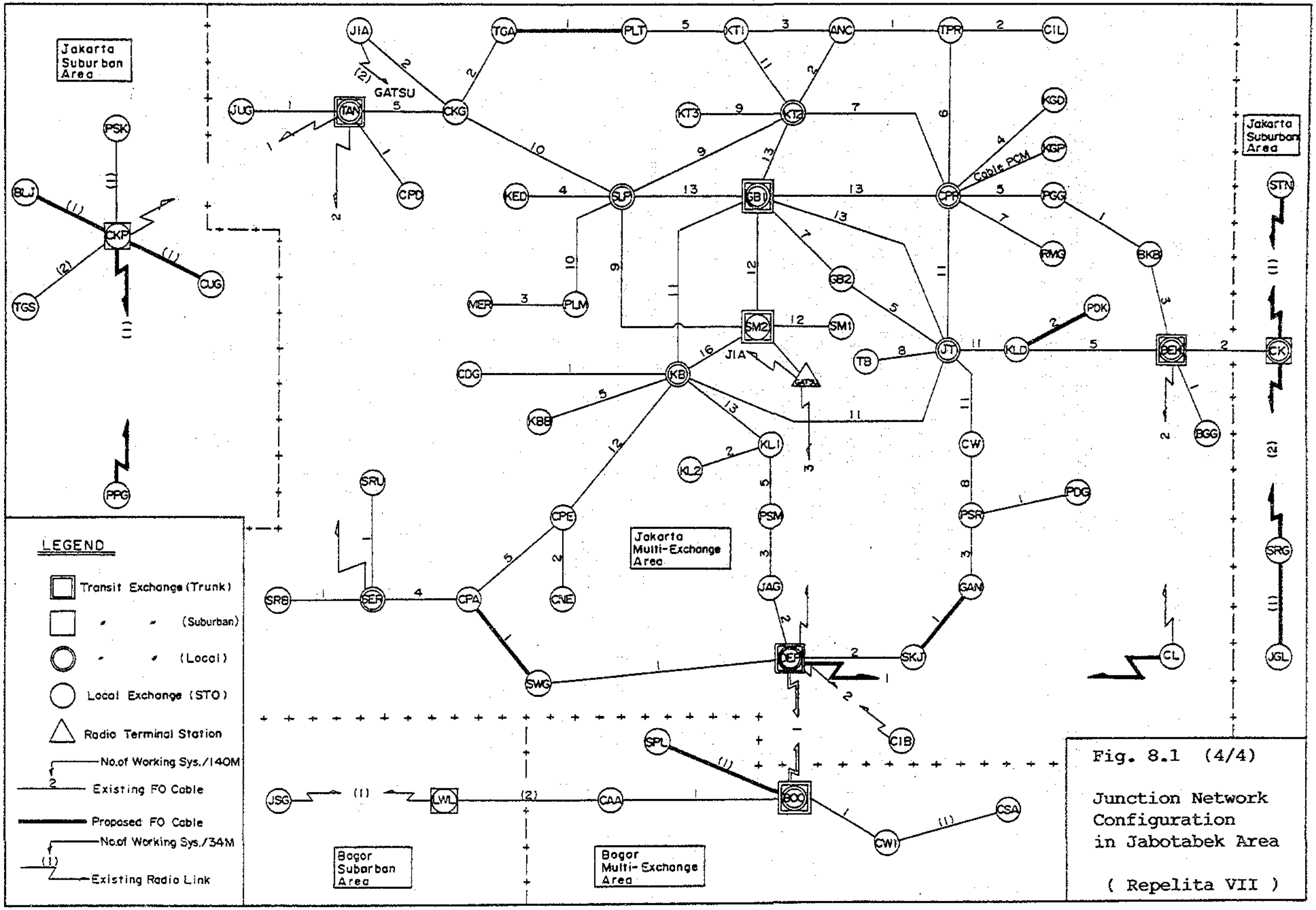


Fig. 8.1 (4/4)

Junction Network Configuration in Jabotabek Area

(Repelita VII)

8.2.6 Space Limitation for Expansion

It was found out that one of the major constraints for implementing the network expansion set force in the Study was space limitation for expansion.

The expansibility of telecommunications facilities to cater for rapidly increasing telephone demand was examined and summarized as a whole in Table 8.8.

In this table, additionally required room space was obtained on the basis of telephone demand forecasts up to the end of Repelita VII and on condition that the demand would be fully met within a period of each Repelita. That is, the room space presented as additional requirement in this table gives minimum requirement to meet merely the telephone demand up to the end of Repelita VII. In the case of actual building construction, therefore, its capacity is to be designed as to meet the further demand after Repelita VII.

Furthermore, the Study took into account the following general and/or specific conditions for room space examination of each sub-system, i.e., switch, outside plant and transmission equipment.

Table 8.8 Telecommunications System Expansibility (1/2)

	Ex.	Demand (x 1,000)			Expansibility for Equipment			Necessitated Room Space (In m²)								
								Repelita V			Repelita VI			Repelita VII		
No.	Name	Rep.V	Rep.VI	Rep.VII	Rep.V	Rep.VI	Rep.VII	SW	TRF	MDF	SW	TRF	MDF	SW	TRF	MDF
1	KT1	16.0	18.9	21.8	◎	◎	◎									
2	KT2	46.5	60.5	77.5	△	◎	△		6*12					9*12		
3	KT3	54.9	62.9	71.8	▲	◎	◎	27*15	6*6	6*15						
4	PLT	37.4	45.8	52.0	△	▲	◎	6*15			9*15					4.5*9
5	CKG	26.5	38.9	55.0	◎	◎	▲							6*15		
6	ANC	21.9	36.5	54.8	◎	○	▲							6*15		
7	GB1	54.1	57.5	60.0	△	◎	◎	16*12	6*12							
8	GB2	41.6	59.2	80.2	△	◎	▲	170						6*15		6*9
9	SLP	33.6	47.6	64.9	△	◎	▲	6*17	6*9							6*9
10	SM1	30.5	47.1	64.0	△	◎	△	6*15							6*12	
11	SM2	44.2	71.0	96.0	▲	◎	◎	24*15	6*9							
12	PLM	33.3	49.2	67.5	○	▲	◎				9*15					6*9
13	KED	13.8	25.0	39.0	△	▲	○		3*6		9*15					
14	MER	8.2	17.1	28.1	◎	◎	▲							6*12		
15	TGA	5.3	7.4	10.2	◎	◎	◎									
16	JIA	2.5	3.0	3.5	◎	◎	◎									
17	CPP	32.7	47.7	65.8	▲	◎	◎	12*15								4.5*9
18	RMG	37.6	54.0	67.4	◎	▲	◎				12*5					4.5*9
19	KGD	19.8	29.0	36.6	◎	○	◎									
20	KGP	3.0	3.0	3.0	◎	◎	◎									
21	PGG	9.8	20.9	41.4	◎	◎	▲							9*15		4.5*9
22	TPR	18.0	27.5	39.0	◎	○	▲							9*15		
23	CIL	7.0	14.0	25.0	◎	◎	▲							6*12		
24	KB	41.6	52.1	65.2	△	◎	△		6*9							2*18
25	KBB	14.2	26.0	42.0	◎	◎	▲							3*12		6*9
26	CDG	2.8	5.7	9.5	▲	◎	◎	6*12	6*6	4.5*9						
27	CPE	28.6	40.2	54.0	○	◎	▲							6*15		4.5*9
28	CNE	11.4	17.0	18.3	▲	◎	◎	9*15	6*6	4.5*9						
29	CPA	9.0	16.0	25.0	◎	◎	◎									
30	KL1	24.9	39.4	56.4	▲	◎	▲		6*9					6*15		
31	KL2	8.8	13.5	19.8	▲	◎	◎	9*15	6*6	6*9						
32	PSM	12.0	18.4	26.2	◎	◎	◎									
33	JAG	2.7	5.6	10.0	◎	◎	△								3*3	
34	SER	5.4	11.6	20.3	▲	◎	◎	9*15								
35	SRU	4.2	8.7	15.0	▲	◎	◎	6*15	6*6	4.5*9						
36	SRB	3.3	7.2	12.6		▲	◎				6*15	6*6	4.5*9			
37	JT1															
38	JT2	37.0	51.8	70.0	△	◎	◎		6*9							
39	CW	12.2	18.9	27.5	◎	◎	○									
40	PSR	10.8	20.5	34.9	◎	◎	○									
41	KLD	11.4	22.9	37.4	◎	○	◎									
42	PDK	7.1	13.5	21.6			▲							12*12	6*6	6*9
43	TB	27.6	41.0	58.5	○	◎	▲							6*15		
44	GAN	6.2	11.5	18.9	◎	◎	▲							6*12		
45	PDG	6.8	13.0	21.1	▲	◎	◎	9*15	6*6	6*9						
46	BEK	4.4	7.6	11.6	◎	△	◎					3*6				
47	BKB	12.6	21.6	32.7	▲	◎	◎	12*15	6*6	6*9						
48	BGG	5.1	9.4	14.9		▲	◎				6*15	6*6	4.5*9			
49	CL	4.3	8.2	13.4	▲	◎	◎	6*15	6*6	4.5*9						
50	TAN	20.3	35.5	54.6	○	◎	▲							9*15	6*6	4.5*6
51	JUG	1.7	3.8	6.6	▲	◎	◎	6*9	6*6	4.5*6						
52	CPD	2.4	4.1	6.4		▲	◎				6*9	6*6	4.5*6			
53	DEP	8.1	13.6	20.3	◎	△	○				5*9					
54	SKJ	10.5	17.4	25.7	▲	◎	◎	9*15	6*6	6*9						
55	CIB	3.3	5.1	7.2	▲	◎	◎	6*9	6*6							4.5*6
56	SWG	3.6	7.1	11.7		▲	◎				6*12	6*6	4.5*9			

◎:Available using existing dedicated room space without modification
○:Available using existing dedicated room space with modification
▲:Available with additional building construction
△:Available using additional room with modification

Table 8.8 Telecommunications System Expansibility (2/2)

No.	Ex. Name	Demand (x 1,000)			Expansibility for Equipment			Necessitated Room Space (in m²)								
								Repelita V			Repelita VI			Repelita VII		
		Rep.V	Rep.VI	Rep.VII	Rep.V	Rep.VI	Rep.VII	SW	TRF	MDF	SW	TRF	MDF	SW	TRF	MDF
57	CK	8.8	18.5	31.8	▲	◎	◎	12*15	6*6	6*9						
58	STN			4.3			▲							6*9	8*6	4.5*6
59	SRG			2.4			▲							6*9	6*6	4.5*6
60	JGL			6.6			▲							6*9	6*6	4.5*6
61	CKP	1.4	3.1	5.4	▲	◎	◎	6*9	6*6	4.5*6						
62	TGS		6.0	10.6		▲	◎				6*12	6*6	4.5*6			
63	PSK		4.8	8.1		▲	◎				6*12	6*6	4.5*6			
64	BLJ			6.0			▲							6*9	6*6	4.5*6
65	CUG			6.1			▲							6*9	6*6	4.5*6
66	PPG			5.3			▲							6*9	6*6	4.5*6
67	BOO	31.9	50.5	72.1	△	▲	◎	6*6			12*15		3*12			
68	CWI	3.2	4.9	6.9	▲	◎	◎	6*9	6*6	4.5*6						
69	CAA	3.0	4.8	6.9	▲	◎	◎	6*9	6*6	4.5*6						
70	SPL			5.6			▲							6*9	6*6	4.5*6
71	CSA	2.4	3.7	5.3	▲	◎	◎	6*9	6*6							
72	LWL		5.8	8.9		▲	◎				6*12	6*6	4.5*6			
73	JSG		3.1	5.3		▲	◎				6*9	6*6	4.5*6			

◎:Available using existing dedicated room space without modification
○:Available using existing dedicated room space with modification
▲:Available with additional building construction
△:Available using additional room with modification

(1) Switching Room

Regarding expansibility of the existing switching rooms, ANNEX 8-3 gives the detailed information as well as room space additionally required for future expansion and/or for replacement of will-be-expired switching systems.

a) General Conditions

The following conditions are commonly taken into account for all exchanges in the Study.

- All EMD switches are to be entirely replaced with digital ones during Repelita V.

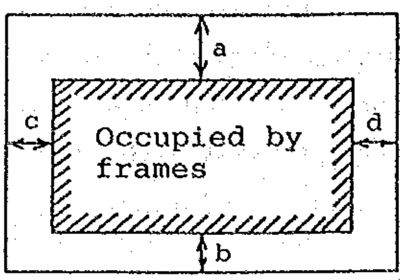
- Some PRX switches are to be expanded according to Packet PRX-5 Program (Contracted date: July, 1988) but further expansion is not expected.

- As for digital switch, the total number of frames required are calculated in the following manner, in due consideration of typical frame combination of the existing EWSD/STDI switch:

commonly required frames: C
C = 12 (CPU type: SSP 103)
C = 8 (CPU type: SSP 112)
subscriber interface frames (LTGA): S
S = (Required Capacity)/512
trunk interface frames (LTGC): T
T = S/2

Then, totally required frames: C + S + T

- Additional space for air-conditioners and O & M activities is as follows:



a + b: 4 m (at least)

c + d: 2 m (approx.)

- Maximum capacity of digital switch

  30,000 l.u. (CPU type: SSP 103)

  12,000 l.u. (CPU type: SSP 112)

b) Specific Conditions

Special attention should be paid to the following exchanges:

- KT1 Exchange

  Around half the subscribers accommodated in EMD switch should be moved to KT2 exchange area prior to EMD replacement, because vacant switching room in KT1 is expected to accommodate approx. 6,000 subscribers only.

- PLT Exchange

  The existing DLU unit and NOKIA-make radio system, which were installed by user's credit, are expected to be handed over to PERUMTEL during Repelita V. The space occupied by the above equipment at present should be reused for digital switch expansion to meet rapidly increasing demand. In this regard, the existing antenna tower is to be demolished during Repelita VI for the new building construction.

- GB1 Exchange

  New digital switches are preferably to be installed in vacant space of the existing switching room (3rd floor of SKKL Building) and additionally on 4th floor of the same building, after removal of International Maintenance

Center (IMC) of PT. INDOSAT. The said switches at first should be used for change-over of subscribers connected to two EMD systems.

The cables from these switches, however, are to be terminated at #2 MDF in old MDF room, for the purpose of EMD replacement. It is noted that MDF in SKKL building has only 5,000 l.u. equivalent space for cable termination on its horizontal side.

- PSM Exchange
  The existing EMD subscribers are preferably to be switched over to PRX system as soon as possible, in order to reserve a room space for digital switch introduction.

- KLD Exchange
  Following the standard calculation method mentioned in general conditions above, the existing building would be facing shortage of switching room during Repelita VII without any vacant site space. When applying more intensive frame-combination, i.e. LTGB plus DLU, this constraint may be cleared. As another alternative, KLD exchange area is proposed to be divided into two, that is, KLD and PDK exchange areas.

(2) MDF Room and Cable Vaults

ANNEX 8-4 summarizes the examination results concerning MDF room space and cable vaults condition in each exchange.

a) General Conditions

PMC Option Services has completed detailed design works for subscriber cable network for 17 exchanges. For these exchanges, the Study intends to follow the results and proposals of PMC Option Services regarding MDF room modification and/or its expansion scenarios in principle.

b) Specific Conditions

Apart from the general conditions above, the Study proposes the following:

- PLT, PLM, CPP and RMG Exchanges
  When new building will be constructed, new room space for MDF is preferably to be reserved on its ground floor. This arrangement may not require the modification of the existing MDF room, although such modification work is scheduled according to the design by PMC Option Services.

- GB1 Exchange
  The most urgent and indispensable work is to remove a large number of old-type cables which are terminated at #1 MDF. This complicated work should be implemented keeping pace with or prior to EMD replacement. Thus, newly installed primary cables will be mainly terminated at #1 MDF. If the present conditions are not improved, another MDF room will be required in the near future and this makes the maintenance work more difficult.

- CIB Exchange
  Although MDF room in the existing building has enough capacity up to the end of Repelita VI, it is recommended that MDF room be reserved at the time of new building construction proposed during Repelita V.

(3) Transmission Room

The expansibility of transmission system in the existing transmission room was examined and the results are summarized in ANNEX 8-5. This annex also gives room space required additionally in the future.

a) General Conditions

The examination on room space was carried out on condition that the transmission systems provided by ongoing project are expansible in the future. Therefore, in the case where different systems will be introduced, much more space would be required than that presented in ANNEX 8-5.

b) Specific Conditions

As for following 9 exchanges, system expansion seems to be very limited or impossible by using the existing transmission room.

- Repelita V ...... BOO, JT[1/], KB[1/], KED[1/], KT2[1/], SLP[1/]
- Repelita VI ..... BEK
- Repelita VII .... JAG, TAN

1/ Vol. II of this report gives concrete idea for the room expansion related to the Priority Project.

In addition to the above, the following arrangements are proposed in the Study.

- GB1 Exchange

  At present, there are two transmission rooms here. Analog systems are installed on the 6th floor of the old building and digital ones, on the 3rd floor of SKKL Building. Both rooms do not have enough expansion space to meet the requirement in future. Proposed in the Study is that additional transmission equipment be installed on the 4th floor of SKKL Building. Though this space are used as IMC of PT. INDOSAT at present, IMC is planned to be relocated to new PT. INDOSAT Building on July, 1989.

- SM1 Exchange

  Since the existing room has been fully occupied by several types of transmission equipment, it is indispensable to provide a new PCM room. Proposed in the Study is the use of a part of the existing administrative building with necessary modifications, instead of new building construction.

- SM2 and KL1 Exchanges

  For both exchanges, new building construction is proposed by PERUMTEL, in relation to Trans-Jawa-Bali Digital Microwave Transmission Project and Trans-Sumatera Digital Microwave Transmission Project. Therefore, additional room space in both buildings should be maintained for junction transmission systems.

- CIB Exchange

  New building construction is required during Repelita V, due to the lack of expansion space in present PCM room.

8.2.7 Non-Voice Communications Network

(1) Prerequisites for Data Communications

Currently accessible data communications network though confined to Jakarta intra-city and international uses is SKDP (Packet Switched Public Data Network - PSPDN in Indonesia).

It is quite natural that non-voice communications network will develop in Metropolitan Jakarta area above all and deployed then to other major cities such as Medan, Surabaya judging from available data concerning non-voice communications in Indonesia.

The prerequisites for nationwide deployment of data communications network, to be integrated with ISDN, are those as described in 7.1.2 (3).

- digitalization of switching equipment and interexchange transmission links;
- synchronization of network;
- introduction of CCITT No. 7 signalling system (refer to 5.3.6.); and
- digitalization of subscriber transmission system.

The Study assumes that digitalization of switches and interexchange transmission links will be completed at latest by the end of Repelita V; basic access (2B+D; 144 kbps) and primary rate services (30B+D; 2 Mbps) are assumed to be accommodated in the *ISDN*, without extra circuit requirement, that would develop through:

- telephone network;
- SKDP (data communications network); and
- interworking between SKDP and ISDN.

(2) Planned Digitalization of Trunk Junction Circuits

Even though the Study is confined to the network development in Jabotabek area, it is indispensable for the Study to take into account the digitalization program of trunk junction circuits in order to see the long-term network development plan for data communications; given hereunder are the already contracted projects for major trunk junction circuits:

a) Jakarta-Surabaya FO Cable Transmission System (SKSO)

Contractor	:	NKF
Effective Date of Contract	:	Dec. 17, 1988
Construction Period	:	Within 27 months after E.D.C.1/
No. of Stations	:	39 (20=regerative St.)
Route	:	along the railway (Total: 1,030 km)

Semanggi 2/Jakarta Terminal

: 140M

: (4+1)

Depok/Regenerative

:

Bogor/Terminal

: 140M

: (3+1)

Surabaya/Terminal

1/ Effective Date of Contract

b) Trans-Sumatera Digital Microwave Transmission Systems

Contractor	:	Alcatel Thomson
Contracted	:	Nov. 30, 1988
Effective Date of Contract	:	May 1989
Construction Period	:	Within 27 months after E.D.C.
Route	:	along the existing analog transmission route

Semanggi 2

: FO

: 140M (3+1)

Kalibata 1

: 6 GHz upper

: 140M (3+1)

Gn. Balau

:

:

Medan

: FO

: 140M (2+1)

Trunk Ex. in Medan

c) Trans-Jawa-Bali Digital Microwave Transmission System

Contractor	:	TRT + Alcatel Thomson
Contracted	:	Oct. 15, 1987
Effective Date of Contract	:	March 23, 1988
Construction Period	:	Within 27 months after E.D.C.
Route	:	35 stations (main route)

Semanggi 2

: FO

: 140M (3+1)

Kalibata 1

: 6 GHz upper

: 140M (3+1)

Karawang

:

Surakarta

: 6 GHz upper

: 140M (2+1)

Denpasar