THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

THE FEASIBILITY STUDY REPORT

ON

THE COMMUNICATIONS NETWORK IMPROVEMENT PROJECT

IN

GREATER COLOMBO

NOVEMBER 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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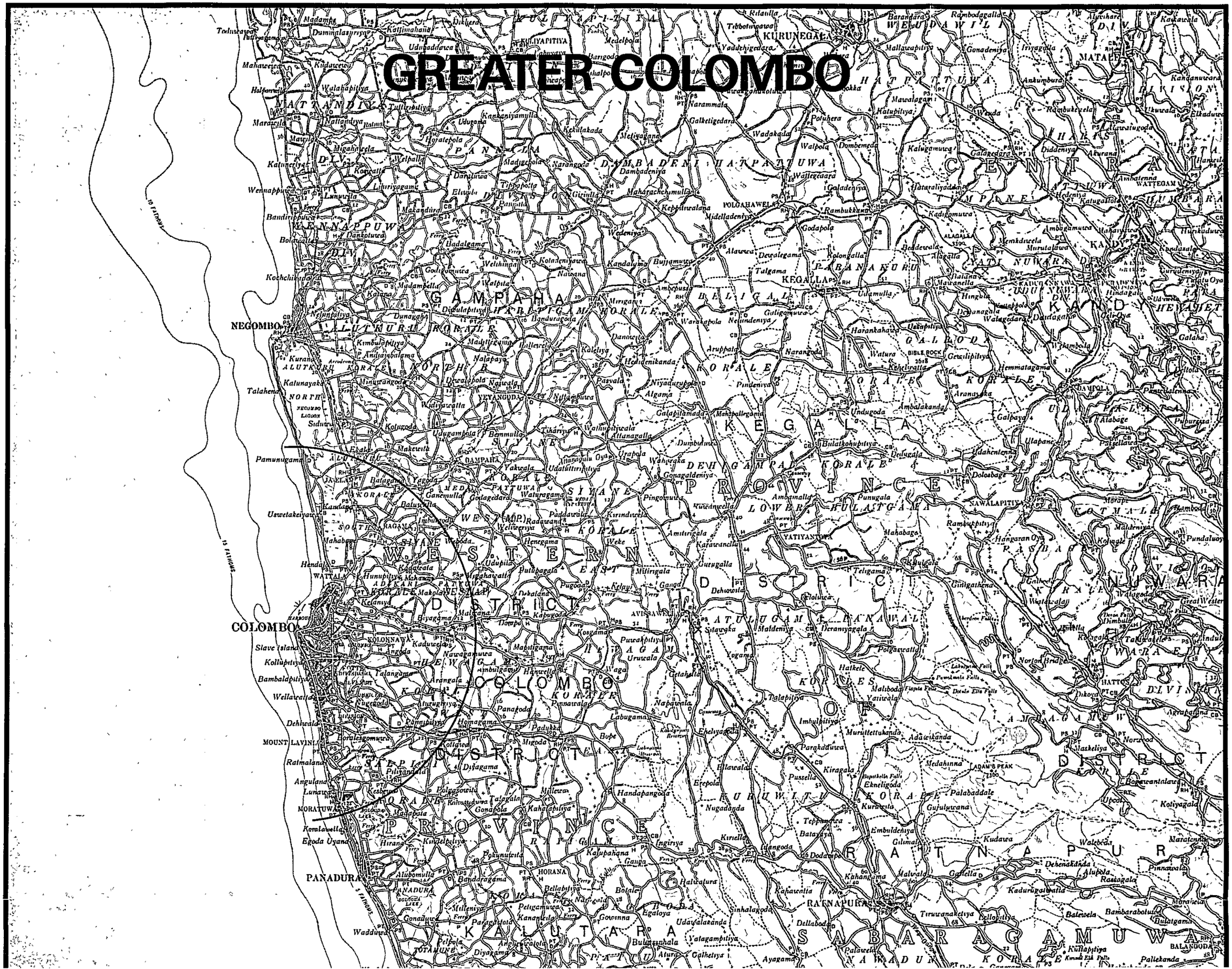

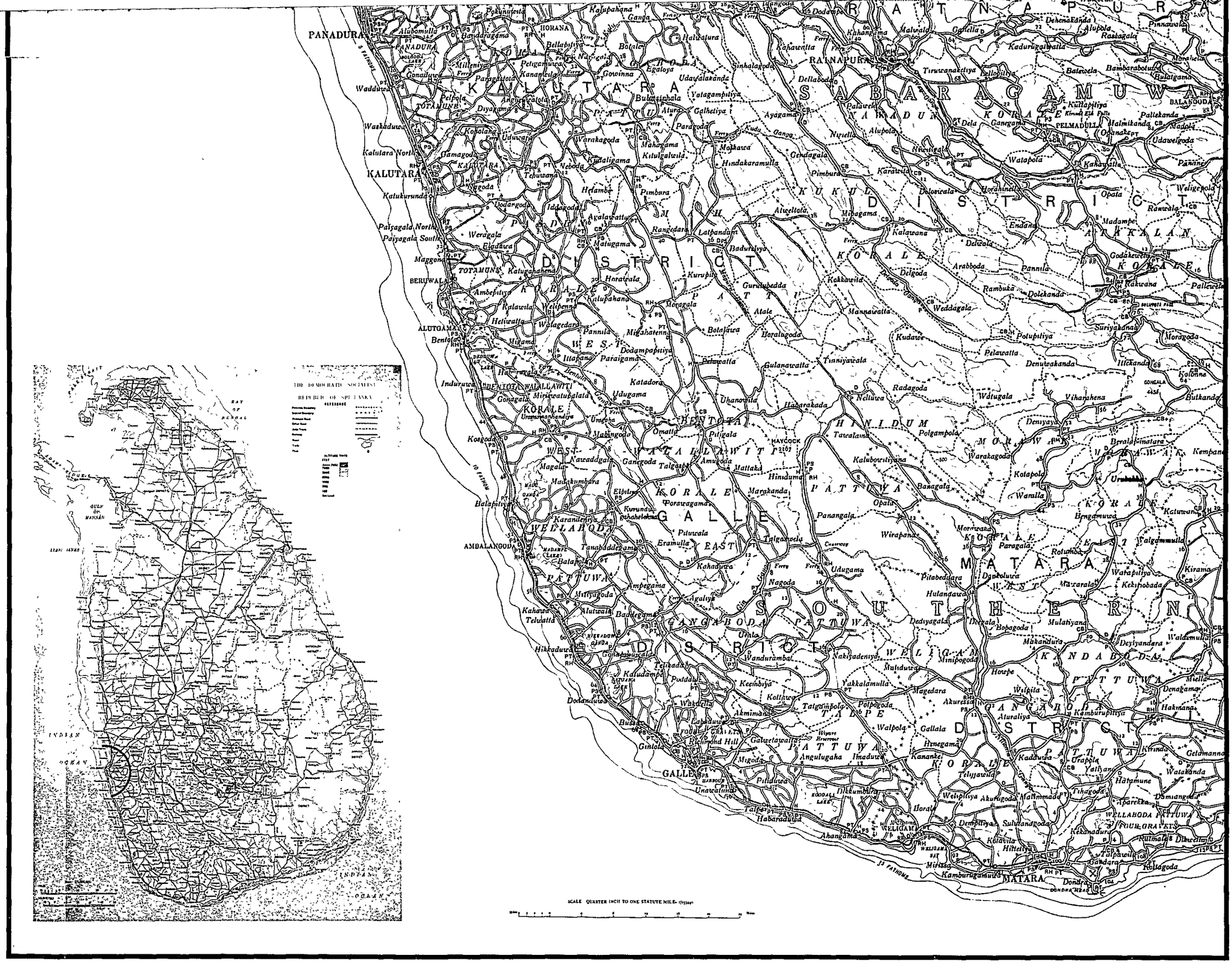
RATNAPURA
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WEST
HENTOTA
HINIDUM
MORAWAKA
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WEST
WALALAWITI
PATTUWA
WELLABODA
EAST
SOUTHERN
MATARA
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GANGABODA
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WELLABODA PATTUWA
FOUR GRAVETS
PANADURA
KALUTARA
BERUWALA
ALUTGAMA
BENTOTA
AMBALANGODA
GALLE
MATARA
BALANGODA
PELMADULLA
HAYCOCK
INDIAN OCEAN
SCALE QUARTER INCH TO ONE STATUTE MILE

PREFACE

It is with great pleasure that I present to the Government of the Democratic Socialist Republic of Sri Lanka a "Feasibility Study Report on Telecommunications Network Improvement Project in Greater Colombo".

This report embodies the results of the study which was carried out from January 1983 to November 1983 by a team organized by the Japan International Cooperation Agency in response to the request of the Government of the Democratic Socialist Republic of Sri Lanka to the Government of Japan.

The study team, headed by Mr. Hiroaki Sogabe, Special Technical Advisor, International Cooperation Division, Minister's Secretariat of Ministry of Posts & Telecommunications, had a series of discussions on the Project with the officials concerned of the Government of Sri Lanka, conducted a wide scope of survey and has now formulated the present report.

I hope that this report will be useful as a basic reference for the development of the Project.

I wish to express my deep appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the study team.

November 1983

Keisuke Arita

Keisuke ARITA
President
Japan International Cooperation Agency

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Abbreviations

Abbreviations of Exchange names are as follows:

1.	Colombo Central	CO
2.	Kollupitiya	KPT
3.	Mattakkuliya	MTK
4.	Maradana	MD
5.	Havelock Town	HK
6.	Nugegoda	ND
7.	Mt. Lavinia	MV
8.	Boralesgamuwa	BS
9.	Wattala	WT
10.	Ragama	RG
11.	Ja-ela	JL
12.	Kelaniya	KI
13.	Kadawata	KDW
14.	Biyagama	BIA
15.	Malwana	MAL
16.	Wellampitiya	WI
17.	Angoda	AN
18.	Kaduwela	KDL
19.	Kotte	KX
20.	Hokandara	HC
21.	Maharagama	MHG
22.	Homagama	HO
23.	Padukka	PK
24.	Moratuwa	MF
25.	Piliyandala	PYL

SUMMARY

SUMMARY

The results of Feasibility Study for improvement and expansion of junction network and subscriber network in the Greater Colombo Area, the objective area of the study, are summarized below.

1. Objective and Outline of Study

For the purposes of meeting the rapid increase of communication demand in the Greater Colombo Area and of improving the level of maintenance service, the demand forecast and the inter-exchange traffic forecast were carried out. And, by the forecast results, the basic plan was formulated for medium term improvement and expansion of junction network among 24 exchanges and subscriber network of seven exchanges. At the same time, the study was made to find the optimum implementation program and assess the implementation feasibility with emphasis on cost performance.

The conclusion reached is that the Project, this time, is economically feasible as the subscriber growth and the traffic increment are to the extent to redeem the financial investment fully, and that the Project is worthwhile to implement from the social viewpoint also.

2. Demand Forecast and Traffic Forecast

In the Feasibility Study, the assumption is made that the Project will be completed at the end of 1987.

The demand forecast and the traffic forecast are made as of 1992, 1997 and 2002, i.e., five years 10 years and 15 years after 1987 as the base year. The forecast results appear in Table 1, Table 2 and Table 3.

3. System Design

(1) Junction Network

Based on the Greater Colombo Area telecommunications network digitalization plan of Sri Lanka Telecommunication Department (SLTD), the cable PCM system is adopted for improvement of the junction network. For the section between Colombo Central and Mt. Lavinia exchanges, the optical communication system is introduced. This is in consideration of communication service diversification in the future and rapid progress of optical communication system, as well as to gain technical experience in optical system hardware and software.

(2) Subscriber Network

For distribution, of subscriber cable network, the cabinet system is adopted. This is because the cabinet system abounds in application flexibility and commands advantages in future maintenace work and demand fulfillment management. In the urban area, the existing open wire system is replaced with cable and drop wire systems.

Table 1 Macroscopic Demand Forecast

Year	1987	1992	1997	2002
Total Demand in Sri Lanka	141,000	219,000	327,300	486,600
Total Demand in Greater Colombo	88,800	138,000	206,200	306,500

Table 2 Demand Forecast (By Exchange Area)

No.	Exchange	1987	1992	1997	2002
1	Colombo Central	23,380	36,050	49,810	68,700
2	Kollupitiya	3,750	4,130	5,950	7,350
3	Mattakkuliya	2,200	3,990	6,700	9,120
4	Maradana	10,660	14,400	20,610	28,910
5	Havelock Town	11,380	15,640	22,370	31,580
6	Nugogoda	5,410	8,450	12,620	15,310
7	Mt. Lavinia	8,780	13,870	18,820	26,410
8	Boralesgamuwa	930	1,200	1,550	2,040
	Sub Total	65,990	97,730	138,430	189,420
9	Wattala	1,810	3,060	4,900	8,290
10	Ragama	530	1,060	1,820	3,440
11	Ja-Ela	1,500	3,100	5,220	9,790
12	Kelaniya	2,320	3,840	6,300	12,190
13	Kadawata	1,200	2,230	4,320	8,000
14	Biyagama				
	Malwana	950	2,060	4,000	7,890
15	Wellampitiya	1,250	2,350	4,110	7,330
16	Angoda	870	1,510	3,170	5,700
17	Kaduwela	500	1,030	1,880	3,640
18	Kotte	4,420	6,700	10,520	15,860
19	Hokandara	430	920	1,730	3,310
20	Maharagama	2,060	3,510	5,450	8,970
21	Homagama	790	1,770	2,880	5,520
22	Padukka	410	1,040	1,680	3,500
23	Moratuwa	3,240	4,970	8,200	12,590
24	Piliyandala	530	1,120	1,650	3,060
	Sub Total	22,810	40,270	67,770	117,080
	Total	88,800	138,000	206,200	306,500

Table 3 Traffice Forecast

Exchange	Originating Traffic (Enl.)			
	1987	1992	1997	2002
Colombo Central 1	1,625.49	1,999.94	1,999.94	1,999.94
" 2	151.39	739.86	1,196.39	967.10
" 3	-	-	589.23	1,999.94
" 4	-	-	-	254.22
Mattakkuliya	140.80	239.40	375.20	474.24
Kolluptiya	208.00	280.84	428.40	558.60
Kelaniya	120.64	168.96	226.80	366.84
Wattala	94.12	134.64	176.40	298.44
Ragama	23.32	38.16	50.96	96.32
Ja - Ela	78.00	136.40	187.92	352.44
Malwana	41.80	74.16	112.00	220.92
Kadawata	62.40	98.12	155.52	288.00
Maradama 1	724.88	921.60	1,236.60	765.35
" 2	-	-	-	853.61
Wellampitiya	65.00	103.40	147.96	263.88
Angoda	45.24	66.44	114.12	205.20
Kaduwela	22.00	37.08	52.64	101.92
Kotte	229.84	294.80	378.72	570.96
Hokandara	18.92	33.12	48.44	92.68
Havelock Town 1	728.32	1,000.96	1,072.02	689.62
" 2	-	-	449.14	1,584.14
Nugegoda	194.76	371.80	605.76	734.88
Maharagama	107.12	154.44	196.20	322.92
Homogama	34.76	63.72	78.96	154.56
Padukka	18.04	37.44	47.04	98.00
Mt. Lavinia 1	382.80	480.00	420.00	432.00
" 2	-	70.40	240.48	511.56
Moratwa	172.64	223.52	300.24	460.44
Piliyandala	23.32	40.32	46.20	85.68
Boralesgamuwa	48.36	52.80	55.80	73.44

4. Installation Design

In the Feasibility Study, installation capacities of main facilities are determined as under.

(1) Junction Network

Cable capacity (number of pairs):
To be commensurate with traffic as of 1997 (10 years after) the base year

PCM transmission equipment:
To be commensurate with traffic as of 1992 (five years after) the base year

(2) Subscriber Network

Primary cable capacity (number of pairs):
To be commensurate with demand as of 1992 (five years after) the base year

Secondary cable capacity (number of pairs):
To be commensurate with demand as of 2002 (15 years after) the base year

(3) Underground Facilities

Manhole capacity and number of ducts:
To meet cable requirement forecast 20 years after the base year

5. Amount of Work

The amount of work required in the Project is as under.

(1) Junction Network

Junction cable installation: (The above includes optical fiber cable installation for 11.7 km.)	109.1 km
PCM system establishment:	781 systems
PCM repeaters:	1,411 pcs
Manhole construction:	327 pcs
Duct installation:	
Installation length	59.7 km
Pipe length	230 km

(2) Subscriber Network

Primary cable installation:	147 km
Secondary cable installation:	950 km
Cross-connecting cabinet establishment:	187 locations
Number of lead-in cable pairs to exchanges:	67,900 pairs
Manhole construction:	450 pcs
Duct installation:	
Installation length	96 km
Pipe length	490 km

6. Cost Estimate

The cost estimate for implementaion of the Project is given in the table below.

Assumptions used for work cost calculation are as under.

1) The work will begin in October 1985.

2) The cost increase rates compared with the cost level as of April 1983 will be 6% annually in the foreign currency portion and 10% annually in the local currency portion, of the project implementation budget.

Project Cost Estimate

(Foreign currency portion in million Japanese yen)

(Local currency portion in million Rupees)

	Foreign Currency Portion	Local Currency Portion
Work cost		
Junction network	1,957.0	28.5
Subscriber network	4,812.0	145.4
Training expense	57.0	0.3
Consultant fee	409.0	5.4
Sub-total	7,235.0	179.6
Cost increase	1,458.0	71.9
Contingency	435.0	12.6
Total	9,128.0	264.1

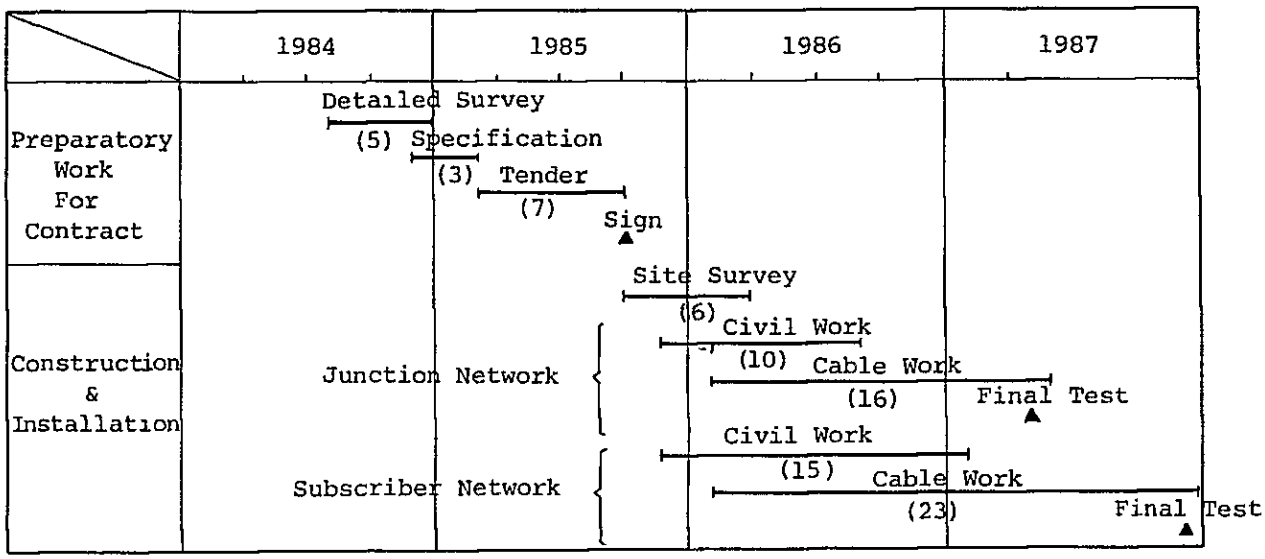
7. Financial and Economic Analysis

The financial internal rate of return (FIRR) of the Project is 15.2%. The sensitivity analysis revealed that FIRR will exceed the opportunity cost of capital even if the amount of initial investment increased by 30% or the revenues decreased by 30%. The funds flow analysis showed that there will be no critical problems for repayments of borrowings for implementation of the Project. The economic internal rate of return (EIRR) is 29.7%, which is high enough to justify project implementation. In addition, unquantitative economic and social benefits will be brought about by the Project.

8. Implementation Schedule

Implementation Schedule for the Project appears below. In this schedule, the requirement of SLTD to have the project implemented as early as possible is duly taken into consideration.

Table 4 Implementation Schedule



Note: Figures in parentheses indicate number of month.

9. Wire Dropping to Subscribers' Premises (Reference)

Wire dropping to subscribers' premises is not included in the Scope of Work as defined in the Feasibility Study Report.

However, according to SLTD requirement, plan and cost to be estimated for the work of wire dropping to all subscribers' premises is appended as reference.

The wire dropping work mentioned comprises wire dropping to the existing subscribers' premises in connection with the cut-over to the newly installed cables, and wire dropping to new subscribers' premises at the time of service-in of the newly completed system.

When wire dropping work is included in this Project, cost of this Project becomes as under.

Foreign currency:	9,478 million Japanese yen
Local currency:	270.1 million Rupees

Expenses required for the aforementioned wire dropping work break down as under.

1) Cut-over of Existing Subscribers

Foreign currency:	250 million Japanese yen
Local currency:	3 million Rupees

2) Service-through for New Subscribers

Foreign currency:	100 million Japanese yen
Local currency:	3 million Rupees

3) Total

Foreign currency:	350 million Japanese yen
Local currency:	6 million Rupees

CHAPTER 1

INTRODUCTION

CHAPTER I INTRODUCTION

1-1 Background of Study

(1) Up to the Request to Japan

The Government of the Democratic Socialist Republic of Sri Lanka is promoting expansion of public utilities and national economic development. The objectives are to elevate the standard of national life, to enhance employment opportunities, and to improve the balance of ineternational payments.

In Sri Lanka, the importance of telecommunications is increasing rapidly: telecommunications perform the role of a lubricant to smoothen the distribution of information which is indispensable for the realization of economic development plans of all kinds.

The Government of Sri Lanka is cognizant of the keen need of expanding telecommunications facilities, and thereby upgrading telephone service, in particular, in the Greater Colombo Area as the center of politics and economy of the country. Thus the Government has decided to carry out large scale improvement and expansion of outside plant which is in the least advanced state among all existing telecommunications facilities. And, for the "Feasibility Study for Greater Colombo Telecommunications Network Improvement Plan," the Government has requested technical cooperation of the Government of Japan.

(2) Dispatch of Preliminary Study Team

In response, the Government of Japan decided to carry out the study on a full scale. First, in December 1982, the Government dispatched, through the Japan International Cooperation Agency, a preliminary study team to Sri Lanka. This was to obtain the understanding of the Govenment of Sri Lanka with regard to the basic reguirements such as the objective area of the study and its scope, period and method, and to collect necessary data and information for the study.

The preliminary study team held a series of consultations with the authorities concerned of Sri Lanka. The conclusion reached was to carry out the main study according to the undermentioned procedure. For further details, refer to the Appendix 1 "Scope of Work."

To formulate the basic plan for improvement and expansion of inter-exchange junctions among 24 telephone exchanges in the Greater Colombo Area and of subscriber lines in the service areas of the seven exchanges out of those 24 where the demand density is especially high; to carry out the feasibility study for the above basic plan and produce the study report by September 1983.

The objective exchanges of the feasibility study are as under.

1) Junction Network

1.	Ja-ela	2.	Ragama
3.	Kadawata	4.	Wattala
5.	Mattakkuliya	6.	Malwana
7.	Colombo Central	8.	Wellampitiya
9.	Angoda	10.	Kaduwela
11.	Maradana	12.	Kotte
13.	Hokandara	14.	Havelock Town
15.	Nugegoda	16.	Maharagama
17.	Homagama	18.	Paduhka
19.	Moratuwa	20.	Piliyandala
21.	Mt. Lavinia	22.	Kelaniya
23.	Kollupitiya	24.	Boralesgamuwa

2) Subscriber Network

1.	Colombo Central	2.	Mattakkuliya
3.	Maradana	4.	Havelock Town
5.	Nugegoda	6.	Mt. Lavinia
7.	Boralesgamuwa		

(3) Dispatch of Feasibility Study Team

Based on the Scope of Work arranged by the preliminary study team, the Government of Japan dispatched the feasibility study team to Colombo, Sri Lanka, for four months from February 1, 1983.

1-2 Objective and Outline of Study

(1) Objective

This feasibility study is for examining the feasibility of the "Greater Colombo Telecommunications Network Improvement Plan" formulated by the Government of Sri Lanka as an integral part of the on-going Public Investment Five-Year Plan (1983-1987).

(2) Outline

1) Junction Network

Exchange by exchange demand forecast was made for 24 exchanges covering the Greater Colombo service area, and, based on this demand forecast, inter-exchange traffic calculation was carried out. Then formulated was the basic plan for junction network with capacity commensurate with traffic density.

The basic plan formulation was preceded by the study of SLTD's project programming, transmission system and design standards, as well as the field survey of existing junction lines and outside plant.

Parallel with those studies, financial and economic analyses were made to evaluate the project eligibility.

2) Subscriber Network

Actual demand survey was carried out in the service areas of the seven exchanges concerned, and the demand distribution map was produced. By this demand distribution map, the basic design for primary cable installation commensurate with the actual demand was formulated.

The basic design formulation was preceded by the study of SLTD's project programming and design standards and the field survey of existing subscriber cables and outside plant.

Parallel with those studies, financial and economic analyses for evaluation of project eligibility were also conducted.

1-3 Study Team Organization and Itinerary

(1) Team Organization

The feasibility study team, this time, was organized with the leader invited from the Ministry of Posts and Telecommunications and the members from the Nippon Telegraph & Telephone Public Corporation and Nippon Telecommunications Consulting Co., Ltd.

The lineup of team members and their main duties appear in the table below.

Table 1-1 Member of Feasibility Study Team

Name	In Charge of	Affiliated to
Hiroaki Sogabe	General Leader	Special Technical Advisor for International Cooperation Minister's Secretariat Ministry of Posts & Telecommunications
Kohji Tochigi	Outside Plant	Senior Staff Engineer International Affairs Bureau Nippon Telegraph & Telephone Public Corporation
Kenichi Terauchi	Outside Plant	Senior Staff Engineer International Affairs Bureau Nippon Telegraph & Telephone Public Corporation
Ryoh Sumida	Traffic & Switch	Staff Engineer International Affairs Bureau Nippon Telegraph & Telepone Public Corporation
Nobuo Yoshida	Survey Team Leader	Assistant Manager Engineering Department International Operation Division The Nippon Telecommunications Consulting Co., Ltd.
Hideyasu Imaizumi	Traffic & Switch	Assistant to General Manager International Operation Division The Nippon Telecommunications Consulting Co., Ltd.
Ryushi Suenaga	Traffic & Switch	Senior Engineer International Operation Division The Nippon Telecommunications Consulting Co., Ltd.

Sumio Shimizu	Subscriber Cable	Senior Engineer International Operation Division The Nippon Telecommunications Consulting Co., Ltd.
Seishiro Fujinami	Civil	Senior Engineer Communication Engineering Division The Nippon Telecommunications Consulting Co., Ltd.
Takenori Inomata	Junction Network	Engineer Communication Engineering Division The Nippon Telecommunications Consulting Co., Ltd.
Masaaki Kubozono	Subscriber Cable	Engineer Communication Engineering Divison The Nippon Telecommunications Consulting Co., Ltd.
Takao Kuriki	Subscriber Cable	Engineer Communication Engineering Division The Nippon Telecommunications Consulting Co., Ltd.
Hirotsugu Hamada	Junction Network	Engineer Communication Engineering Division The Nippon Telecommunications Cosulting Co., Ltd.
Teruyuki Tanabe	Economic Study	Economist Marketing Department International Operation Division The Nippon Telecommunications Consulting Co., Ltd.
Masahito Oyama	Coordinator	Project Officer The Second Development Survey Division Social Development Cooperation Department Japan International Cooperation Agency

(2) Study Itinerary

The feasibility study team carried out the field survey for the period of 120 days from February 1 through May 31, 1983. The study itinerary details are given in Table 1-2.

1-4 Minutes of the Meeting for Feasibility Study

During the field survey period, the feasibility study team carried out the conferences with SLTD on study details, based on "Scope of Work" agreed upon between the preliminary study team and SLTD. The conference minutes are in Appendix 2.

Table 1-2 Itinerary of Feasibility Study

	Date	Subscriber Cable	Junction Network	Financial Analyst
1	Feb. 1	Narita - Colombo		
2	2	Courtesy call to SLTD and Embassy of Japan, Meeting with JICA		
3	3	Meeting with SLTD		
4	4	General Field Survey		
5	5	"		
6	6	Holiday		
7	7	Preparation of Field Survey	Preparation of Field Survey	
8	8	Data Collection, Demand Forecast	Study of Telecommunication Network	
9	9	"	"	
10	10	"	"	
11	11	"	Data Collection of Transmission System	
12	12	"	"	
13	13	Holiday	Holiday	
14	14	Demand Forecast, Field Survey	Data Collection of Junction Network	
15	15	"	"	
16	16	"	"	
17	17	"	"	
18	18	"	Data Collection of Toll Network	
19	19	"	"	
20	20	Holiday	Holiday	
21	21	Field Survey for Demand Forecast	Review of Basic Design Standard	
22	22	"	"	
23	23	"	"	
24	24	"	"	
25	25	"	Study of Basic Transmission Data	
26	26	"	"	
27	27	Holiday	Holiday	
28	28	Field Survey for Demand Forecast	Field and Exchange Office Survey	

	Date	Subscriber Cable	Junction Network	Financial Analyst
29	Mar. 1	Field Survey for Demand Forecast	Field and Exchange Office Survey	
30	2	"	"	
31	3	Forecasting of Survey Demand	"	
32	4	"	"	
33	5	"	"	
34	6	Holiday	Holiday	
35	7	Field Survey, Forecasting of Survey Demand	Field and Exchange Office Survey	
36	8	"	"	
37	9	"	"	
38	10	"	"	
39	11	"	"	
40	12	"	"	
41	13	Holiday	Holiday	
42	14	Forecasting of Survey Demand	Field and Exchange Office Survey	
43	15	"	"	
44	16	Review of Macroscopic Demand	"	
45	17	"	"	
46	18	Distribution of Demand	"	
47	19	"	"	
48	20	Holiday	Holiday	
49	21	Preparation of Basic Design	Arrangement of Survey Results	
50	22	"	"	
51	23	"	"	
52	24	"	Study of Traffic and Junction Network	
53	25	"	"	
54	26	"	"	
55	27	Holiday	Holiday	
56	28	Preparation of Basic Design	Study of Traffic and Junction Network	
57	29	"	"	
58	30	"	"	
59	31	"	"	

	Date	Subscriber Cable	Junction Network	Financial Analyst
60	Apr. 1	Preparation of Basic Design	Collection of Price Data, Study of Calling Rate	
61	2	"	"	Narita - Colombo
62	3	Holiday	Holiday	Holiday
63	4	Preparation of Basic Design	Collection of Price Data, Study of Office Capacity	Courtesy Call to SLTD, Embassy of Japan & JICA
64	5	"	"	Meeting with SLTD
65	6	"	"	Collection of Data & Information
66	7	"	Collection of Price Data, Study of Traffic Distribution	"
67	8	"	"	"
68	9	"	"	"
69	10	Holiday	Holiday	Holiday
70	11	Preparation of Basic Design & Report	Circuit Grouping	Collection of Data & Information
71	12	"	"	"
72	13	"	"	"
73	14	"	"	"
74	15	"	"	Study of Data & Information
75	16	"	"	"
76	17	Holiday	Holiday	Holiday
77	18	Survey of Cabinet Location, Amount of Work	Preparation of Basic Design & Report	Preparation of Study Work
78	19	"	"	"
79	20	"	"	"
80	21	"	"	"
81	22	"	"	Visit to PVC Factory
82	23	"	"	Study of Data & Information
83	24	Holiday	Holiday	Holiday
84	25	Preparation of Price & Amount of Work	Preparation of Basic Design & Report	Cost/Benefit Estimation
85	26	"	"	"
86	27	"	"	"
87	28	"	"	"
88	29	Preparation of Project Cost & Report	"	"
89	30	"	"	"

	Date	General Leader Coordinator	Subscriber Cable	Junction Network	Financial Analyst
90	May 1		Holiday	Holiday	Holiday
91	2		Preparation of Basic Design & Report	Preparation for Amount of Work	Cost/Benefit Estimation
92	3		"	"	"
93	4		"	"	"
94	5		"	"	"
95	6		Preparation of Project Cost & Report	Preparation of Project Cost	"
96	7		"	"	"
97	8		Holiday	Holiday	Holiday
98	9		Preparation of Project Cost & Report	Field Survery for New Route	IRR/Funds Flow Analysis
99	10		"	"	"
100	11		"	"	"
101	12		"	Review of Basic Design	"
102	13		Preparation of Interim Report	"	"
103	14		"	"	"
104	15		Holiday	Holiday	Holiday
105	16		Preparation of Report, Arrangement of Data	Preparation of Report, Arrangement of Data	Preparation of Report, Arrangement of Data
106	17		"	"	"
107	18		"	"	"
108	19		"	"	"
109	20		"	"	"
110	21		Meeting with SLTD, Arrangement of Data	Meeting with SLTD, Arrangement of Data	Meeting with SLTD, Arrangement of Data
111	22		Holiday	Holiday	Holiday
112	23		Arrangement of Data	Arrangement of Data	Arrangement of Data
113	24	Narita-Colombo	Closed Office in SLTD	Closed Office in SLTD	Closed Office in SLTD
114	25	Meeting with SLTD and Department of External Resources, Submission of Interim Report and Drawings			
115	26		Preparation of Departure		
116	27		"		
117	28		Meeting with SLTD		
118	29		Preparation of Departure		
119	30		Meeting with JICA,	Colombo - Singapore	
120	31		Singapore - Narita		

CHAPTER 2

GENERAL

CHAPTER 2 GENERAL

2-1 Overview of Sri Lanka

2-1-1 Topography, Population, and Climate

The Democratic Socialist Republic of Sri Lanka is a tropical island country located in the Indian Ocean south-southeast of India. Geographically, the country occupies a strategic position in sea-borne traffic between East and West, or, more precisely, between Europe, Africa and the Middle and Near East, on one hand, and Southeast and East Asia, on the other. Colombo, the capital city and the principal port, typically performs such important role.

The country's provisional population as of 1981 is approximately 14,990,000. The national territory embraces an area of 65,610 km^2. The population density per km^2 is relatively high at 230.

Up to 78% of the total population inhabit the rural regions and the remainder reside in the urban districts. Cites, each with a population of more than 100,000, number not more than six. Four out of those six, i.e., Colombo, Mt. Lavinia, Moratuwa and Kotte, constitute the nucleus of the Greater Colombo Area.

Up to 73% of the entire population is occupied by the Singhala tribe, 19% by the Tamil tribe.

The climate of Sri Lanka is typically tropical, the whole year being divided into the rainy and dry seasons. The temperature is high during the rainy season that lasts from March through June, but is low in the dry season, i.e., November through January.

In City of Colombo that faces the sea, the annual average temperature is 27°C. The temperature difference for the whole year is relatively small at 6°C. In the Nuwara Eliya area (elevation above sea level: 1,890 m) located in the central part of the country, the average temperature is at a low level of 16°C.

The rainfall is plenty in the southwestern region. The pluviometer reads over 3,000 mm on the most.

In the northern, eastern and southeastern regions, the rainfall is moderate, measuring 1,000 mm at the average. The former is the wet zone and the latter the dry zone.

2-1-2 Economy

According to world development report of the World Bank, per capita GNP of Sri Lanka in 1980 is about US$ 270 which is 21 th from the bottom among 125 countries in the World. However, after introduction of the new liberalized economic policies following the victory of the United National Party (UNP) in the general election held in 1977, the economy of Sri Lnaka experienced an unprecedented growth. During the 1978-1982 period, real GDP rose at the average annual rate of 6.2 percent as compared with 2.9 percent between 1971-1977 and 4.4 percent in the 1960's. As a result, given a relatively low population growth rate of about 1.7 percent, real GDP per capita grew at 4.4 percent which was more than three times of that during the period between 1971-1977. Furthermore, an unemployment rate was brought down from 25.9 percent in 1977 to 13.4 percent in 1982.

In 1981, the agricultural sector accounts for 24.6 percent of GDP and 48.5 percent of the total employment. Paddy production reached almost a self-sufficiency level while the major traditional tree crops such as tea, rubber, and coconnut were stagnant in recent years. The mining and manufacturing sector comprises 17.1 percent of GDP and 14.5 percent of employment. The shares of the construction among GDP and employment are 5.0 percent and 4.9 percent, respectively; those of the services are 53.3 percent and 32.0 percent.

Substantial structural change has been observed in the external trade since the liberalization. The share of agricultural products in exports, which was about 78 percent in 1976, sharply dropped to 60 percent in 1981, while the share of industrial products rose as high as to 34 percent. As for imports, a shift from consumer goods to intermediate and investment goods brought down the share of the former from 43 percent in 1977 to 20 percent in 1982. On the other hand, the share of intermediate and investment goods increased from 42 percent to 52 percent and 12 percent to 28 percent, respectively.

Thus, the economy of Sri Lanka is now in the process of transition from heavy reliance on traditional agricultural products to industrial goods, and it appears that the goverment policies to accelerate such development have been so far working well. However, the costs for such a rapid change were not insignificant. The external current account balance was in surplus in 1977, but it turned to deficit in 1978 and was further worsened afterwards.

Table 2-1 Economic Growth of Sri Lanka

	Average Growth Rate (%)		Share in GDP (%)			Share in Employment (%)	
	1971-1977	1978-1982	1970	1977	1981	1971	1981
GDP	2.9	6.2	100.0	100.0	100.0	-	-
GDP per capita	1.3	4.4	-	-	-	-	-
Agriculture	2.1	4.4*	28.3	26.7	24.6	54.8	48.5
Mining & Manufacturing	3.3	5.3*	17.4	17.8	17.1	10.5	14.5
Construction	-2.6	13.7*	5.6	3.8	5.0	3.1	4.9
Services	3.8	7.4*	48.7	51.5	53.3	31.5	32.0

Note : Figures with * is those between 1978-1981.

Source : Ministry of Finance and Planning

Table 2-2 Inflation and Exchange Rate

(Unit: Percent)

	1978	1979	1980	1981	1982
1. Colombo Consumers' Price Index	12.1	10.8	26.1	18.0	10.8
2. Central Bank Cost of Living Index	9.1	19.0	37.8	23.7	11.0
3. Central Bank Wholesale Price Index	15.8	9.5	33.7	17.0	1.0
4. GDP deflator	8.3	15.3	20.0	21.4	11.0
5. Exchange Rate (end of the year, Rs. per US$ 1.00)	15.52	15.46	18.02	20.57	21.33

Source: Ministry of Finance & Planning; Central Bank of Ceylon

The rate of inflation was also accelerated and recorded 26.1 percent increase in 1980 in terms of the Colombo Consumers' Price Index. Accordingly, the exchange rate of Sri Lanka Rupee, which was allowed to float in November 1977, contineud to depreciate from Rs. 16.03 for US$ 1.00 to Rs. 20.57 in December 1981.

The Goverment was quick to respond to these unfavorable circumstances and employed contractionaly monetary and fiscal policy in 1980 and 1981. The result was remarkable. The Colombo Consumers' Price Index rose only 10.8 percent in 1982 and the growing trend of the current account deficit was almost ceased in 1981 and 1982.

2-1-3 Public Investment Program

Sri Lanka launched the "rolling Five-Year Public Investment Program" in 1979. This program is prepared for five year period, however, it is to be revised every year in order to ensure flexibilities for taking into consideration changes in resource availability of both domestic and foreign.

The current 5 year program for 1983-1987 places an emphasis on:

- quick yielding production oriented projects
- export oriented projects
- infrastructure projects such as communications.

According to the program, the share of the Mahaweli Development Project is expected to decline from 34 percent in 1983 to 22 percent in 1987.

On the other hand, more funds will be poured into agricultural projects other than the Mahaweli and, as a result, the agricultural sector will continue to have the largest allocation of about 45 percent of the total Rs. 1.1 billion investment. The economic overhead sector of telecommunications, transport, and power come next with the allocation of 26 percent for the period. The housing and urban development, which used up about 7 percent of the budget in 1980 and 1981, will be reduced to the level of 5 percent over the next five years. On the other hand, expenditures on health and education will be increased to 9 percent from below 5 percent level in 1980 and 1981.

Reflecting the Government's attempts to shift a greater share of investment activities to private sector, the share of public sector investment, which stood at 60 percent of the economy's total investment in 1982, will deline to 50 percent in 1987, which will be 12 percent of the projected GDP for that year. In spite of this modesty, needs for foreign finance for public investment is still large. It is projected that about 69 percent of the current programed investments will have to be financed by foreign sources. Accordingly, the debt-service ratio is expected to rise from around 10 percent in 1982 to 18 percent in 1988.

2-2 Telecommunications Services in Sri Lanka

2-2-1 Organization and Management

Telecommunications services in Sri Lanka including international services are being provided by the Telecommunications Department (hereafter referred to as SLTD) that belongs to the Ministry of Posts and Telecommunications.

SLTD was inaugurated in August 1980. Before that time, the Posts and Telecommunications Department was in charge of both postal and telecommunications services. However, in view of the ever-growing telecommunications services and realizing needs for effective management and operation, SLTD was established as a separate department within the Ministry to take care of telecommunications services exclusively.

The present organization of SLTD, headed by the Director, consists of four Deputy Directors and the Chief Administrative Officer. The four Deputy Directors are respectively in charge of planning, international and Greater Colombo Area telecommunications services, rural telecommunications services, and financial and training affairs. Under them, there are 12 Chief Engineers, each with his own duty assignment.

The organization chart of SLTD appears in Table 2-1.

As of 1982, the number of SLTD's employees is 9,549. The breakdowns are as follows:

Administration	:	734
Accounting	:	206
Engineering	:	5,911
Traffic	:	2,154
Transport	:	247
Stores	:	297
Total		9,549

Table 2-3 Public Investment 1983 - 1987

(Unit: Million US$)

	1983		1984		1985		1986		1987		1983 - 1987			
	T	FA	T	FA	T	FA	T	FA	T	FA	F	L	T	FA
1. Total Public Investment	21917	-	22895	-	25093	-	27363	-	27738	-	-	-	125006	-
2. Add adjustment for Capital Transfers	694	-	587	-	509	-	519	-	512	-	-	-	2821	-
3. Total Capital Expenditure (Public Sector) of which	22611	-	23432	-	25602	-	27882	-	28250	-	-	-	127827	-
(i) Extra Budgetary Resources	4663	-	4800	-	4950	-	5100	-	5250	-	-	-	24763	-
(ii) Non Expansionary Resources available to Govt. Budget	16587	-	18782	-	20818	-	22982	-	23249	-	-	-	102413	-
(iii) Supplementary financing required for investment programme	1361	-	100	-	-166	-	-200	-	-249	-	-	-	646	-
4. Total Budgetary Provision	17948	-	18682	-	20652	-	22782	-	23000	-	-	-	103064	-
5. Total Budgetary Provision gross of under expenditure	19914	-	20307	-	21900	-	24200	-	24450	-	-	-	110771	-
(i) Agriculture	9234	6233	10619	6412	9827	5096	10100	3181	10188	1688	24450	25518	49968	22610
(1) Mahaweli Development	6773	4886	7271	4779	5788	3444	4753	1940	5315	936	17574	12328	29900	15985
(2) Other Irrigation	618	339	831	505	982	531	1280	518	1174	210	1803	3082	4885	2103
(3) Field & Minor Export Crops	634	325	955	358	1206	399	1678	317	1502	255	1850	4125	5975	1654
(4) Forestry & Lands	237	89	270	107	320	106	381	88	406	97	464	1150	1614	487
(5) Plantations	758	493	969	540	1081	465	1468	200	1214	77	1590	3900	5490	1775
(6) Animal Husbandry	81	38	147	81	248	130	318	118	330	113	644	480	1124	480
(7) Fishenes	133	63	176	42	202	21	222	-	247	-	525	455	980	126
(ii) Industry	103	59	177	88	505	27	732	-	734	-	1141	1110	2251	174
(iii) Housing, Water Supply and Urban Development	2432	884	2887	796	2232	347	2398	78	2396	32	5627	6718	12345	2137
(1) Housing	648	2	674	3	590	6	628	9	668	11	678	2530	3208	31
(2) Other Construction	366	78	498	90	483	48	479	-	472	-	646	1652	2298	216
(3) Water Supply	1380	804	1282	703	1159	293	1291	69	1256	21	4003	2365	6368	1890
(4) Urban Development	38	-	433	-	-	-	-	-	-	-	300	171	471	-
(iv) Economic Overheads	4458	2425	4369	2058	5467	2126	7010	2034	7218	1816	18129	10393	28522	10459
(1) Transport	1162	601	880	260	1100	17	1391	-	1509	-	4110	1932	6042	878
(2) Power	789	715	897	605	1406	900	2196	862	2269	704	6424	1133	7557	3786
(3) Telecommunications	560	280	698	305	955	365	1138	120	1042	70	3333	1060	4393	1140
(4) Administrative and Others	1947	829	1894	888	2006	844	2285	1052	2398	1042	4262	6268	10530	4655
(v) Social Overheads	1302	765	1255	194	2369	243	2460	171	2414	59	3705	6095	9800	1432
(1) Education	424	24	826	80	1451	175	1344	100	1112	17	1490	3667	5157	396
(2) Health	830	715	369	89	860	44	1069	57	1246	26	2094	2280	4374	931
(3) Others	48	26	60	25	58	24	47	14	56	16	121	148	269	105
(vi) Miscellaneous	2385	-	1000	-	1500	-	1500	-	1500	-	-	7885	7885	-
6.(i) 1 as % of G.D.P.	17.6		15.5		14.6		13.8		12.3					
(ii) 4 as % of G.D.P.	14.4		12.7		11.9		11.5		10.2					

Note: T = Total Cost FA = Foreign Aid F = Foreign Cost L = Local Cost

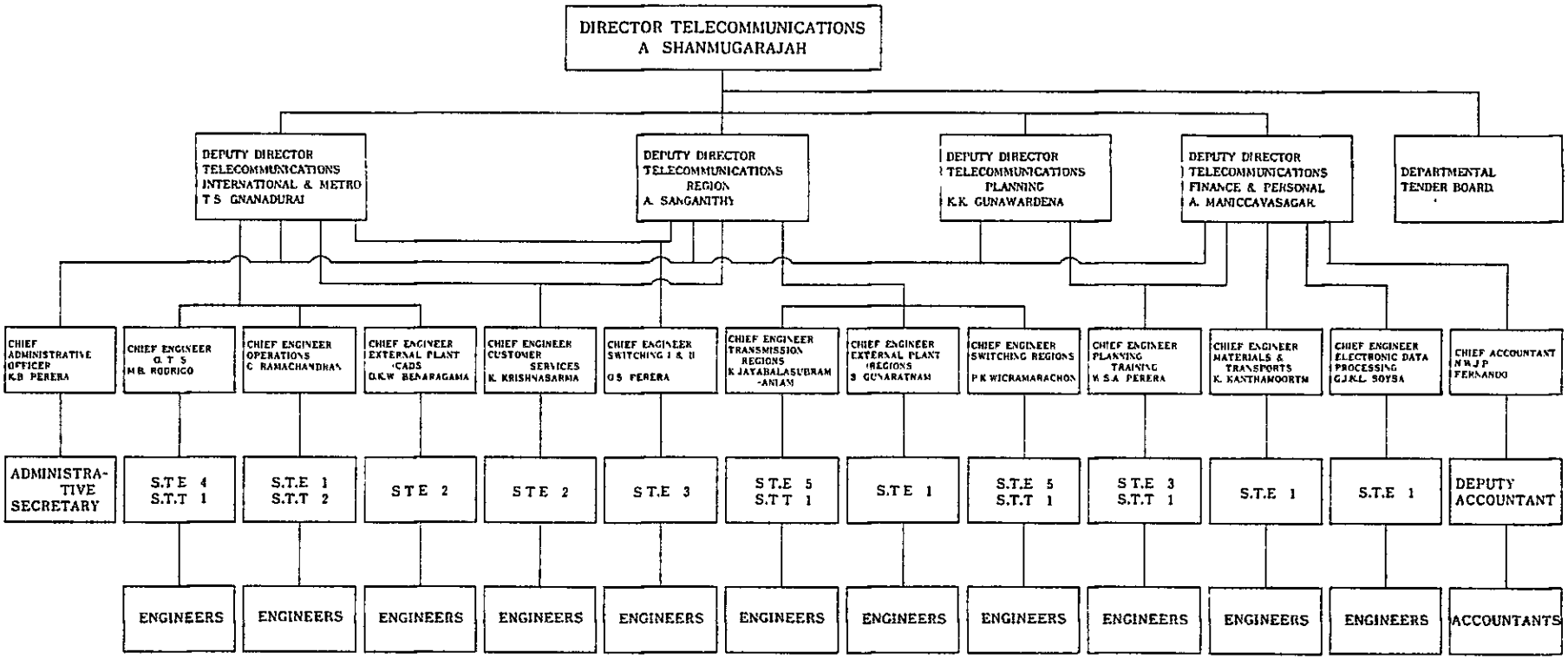
Source: Ministry of Finance & Planning

Table 2-4 Projected Debt-Service Payments

(Unit: Million US$)

	1983	1985	1990	1995
1. Debt servicing on debts incurred up to end of 1982				
(a) Amortization	72.8	130.2	105.9	80.5
(b) Interest	101.6	107.5	47.4	33.6
2. Debt servicing on debts incurred during 1983 - 1987				
(a) Amortization	-	45.4	114.4	68.4
(b) Interest	7.2	48.9	78.8	45.1
3. Total debt servicing on debts incurred up to end of 1987				
(a) Amortization	72.8	175.6	220.3	148.9
(b) Interest	108.8	156.4	126.2	78.7
4. Projected earnings on exports of goods and services	1506	1874	3320	6117
5. Debt service ratio: percent	12.1	17.7	10.4	3.7

Source: Ministry of Finance & Planning



REFERENCE S.T.E. - SUPERINTENDING TELECOMMUNICATIONS ENGINEER.
S.T.T. - SUPERINTENDENT OF TELECOMMUNICATIONS TRAFFIC
O.T.S. - OVERSEAS TELECOMMUNICATIONS SERVICES
CADS - GREATER COLOMBO AREAS DEVELOPMENT SCHEMES

Figure 2-1 Organization of SLTD

2-2-2 Present State of Telecommunications Services

Indicators to show the state of telecommunications services as of the end of 1982 are as under:

	Whole of Sri Lanka	Gereater Colombo Area	Rural Area
Working Subscriber	65,905	41,157	24,748
Telephone sets	105,771	65,900	39,871
Switches	95,300	54,620	40,680
Demand	94,200	58,200	36,000
Waiting subscribers	28,300	17,000	11,200
STD rate	90%	100%	70%
Population	15,200,000	1,800,000	13,400,000
Telephone density			
subscriber lines	0.43	2.30	0.18
Telephone sets	0.69	3.66	0.30
Telex			
Working subscribers	853	-	-
Waiting subscribers	(200)	-	-

The telephone density (telephone sets) for the entire Sri Lanka is at a low level of 0.69. In the Greater Colombo Area, it stands at 3.66. This rate is lower than Thailand, Malaysia, and the Philippines but higher than Indonesia, Burma, and Bangladesh. Compared with India and Pakistan, the rate is at practically the same level.

Judging from the density and demand size, Sri Lanka at present is at an initial stage of the telephone expansion period. The telephone demand, mostly for business telephones (including government office telephones) is rapidly increasing with the visible waiting subscribers of not less than 17,000 in the Greater Colombo Area.

Maintenance is not satisfactory. This can be known from the failure rates as of 1982 at major exchanges in the Greater Colombo Area, with which the Project is concerned, as tabulated below:

Table 2-5 Telephone Failure Rates
(monthly average)

	Type of Telephone	No. of Subscribers	No. of Failures	Breakdown: Inside Exchange	Breakdown: Outside Exchange/ Subscriber Premises	Breakdown: Spontaneous Recovery
Colombo Central	SxS E-10	15,202	8,054 (53%)	426	5,290	2,338
Havelock Town	SxS E-10	7,810	2,068 (26.5)	180	1,422	466
Maradana	SxS E-10	6,548	1,417 (21.6)	105	1,028	284
Mt. Lavinia	XB	4,397	1,712 (38.9)	5	1,650	57
Nugegoda	E-10	1,896	7,131 (37.6)	116	539	58
Total		35,853	13,964 (100%) (38.9)	832 (6%)	9,929 (71%)	3,203 (23%)

The failure rate per 100 subscribers per month is as high as 38.9%, attesting to the insatisfactory state of maintenance. Out of all failures, those in outside plants and in subscriber's premises account for 71%. This percentage further increases when it is considered that the most part of failures that recover spontaneously are presumably due to defective outside plant.

The fact that the failures due to defective outside plants are numerous is mainly attributable to old lead-sheathed cables, paper insulated cables, and open-wire distribution system.

2-2-3 Financial Operation and Performance of SLTD

(1) Tarriff Rate and Billing System

In the past, tariffs were somewhat low given the large demand for connection and the traffic congestion. Therefore, they have been raised broadly during the past three years. The present tariffs, compared with those of January 1980, are about 75 percent higher for domestic calls and about 30-40 percent higher for international calls. For the latter, a further tariff increase is expected in the near future. Due to introduction of the front-end-loading principle, the present level of installation fees in STD areas is more than 10 times higher than three years ago.

Table 2-6 shows the tariff rates effective as of April 1, 1983. In addition to those tariffs, a minimum deposit of Rs. 5,000 and of Rs. 500 are required for international STD calls and international operator-assisted calls, respectively.

Table 2-6 Telecommunication Tariffs (As of April, 1983)

A. Telephone

1. Connection Fees

Central Colombo STD exchanges	:	Minimum - Rs. 10,000
Other STD exchanges	:	Minimum - Rs. 7,000
Exchanges other than STD	:	Minimum - Rs. 2,500

2. Annual Rentals

Business	:	Rs. 600
Residence	:	Rs. 250
Religious institutions	:	Rs. 200

3. Local Call Charges

For every 120 seconds	:	Rs. 0.70

In the Greater Colombo Area, there are several stations within which local calls are charged on an untimed basis; however, they are expected to be converted to a timed basis by 1987.

Any local call from a post office or a sub-post office telephone incurres additional fee of Rs. 0.30.

4. Long Distance Calls

(1) Manual Exchanges

	Every 3 minutes	
	9 a.m. - 6 p.m.	6 p.m. - 9 a.m.
Within the same Group Switching Center	Rs. 1.50	Rs. 0.75
Less than 64 km	2.00	1.00
Between 64 km - 177 km	3.00	1.50
Over 177 km	5.00	2.50

(2) Operator connected STD

	First 3 minutes		Every additional 3 minutes	
	9 a.m.-6 p.m.	6 p.m.-9 a.m.	9 a.m.-6 p.m.	6 p.m.-9 a.m.
With the same Group Switching Center	Rs. 2.30	Rs. 2.30	Rs. 1.30	Rs. 1.30
Less than 32 km	3.60	2.30	2.60	1.30
Between 32 km - 80 km	5.20	3.10	4.20	2.10
Between 80 km - 112 km	8.00	4.50	7.00	3.50
Between 112 km - 193 km	9.40	5.20	8.40	4.20
Over 193 km	13.60	7.30	12.60	6.30

(3) Directly Dialled STD

	Per Rs. 0.70	
	9 a.m. - 6 p.m.	6 p.m. - 9 a.m.
Within the same Group Switching Center	100 seconds	100 seconds
Less than 32 km	50	100
Between 32 km - 80 km	30	60
Between 80 km - 112 km	18	36
Between 112 km - 193 km	15	30
Over 193 km	10	20

(4) International Calls

Station to Station Calls to:	Directly dialled	Operator connected	
	Per minute	First 3 minutes	Every additional 3 minutes
India	Rs. -	Rs. 108	Rs. 36
Japan	42	126	42
Saudi Arabia	49	147	49
Singapore	42	126	42
U.K.	42	126	42
U.S.A.	49	147	49

B. Telex

1. Connection Fees — Rs. 200

2. Annual Rentals

Telex Machines :	Rs. 36,000
Circuits (per mile)	Rs. 15,000

3. Call Charges

	Automatic	Operator connected	
	per minute	First 3 minutes	Every additional minute
India	Rs. 41	Rs. 123	Rs. 41
Japan	48	144	48
Saudi Arabia	54	162	54
Singapore	48	144	48
U.K.	48	144	48
U.S.A.	54	162	54

Preparation and forwarding of telephone bills in the Greater Colombo area are done by the Commercial Section of the Traffic Department and in other areas by the Provincial Telecommunications Billing Centers; billing for telex services is made by OTS. Payments are usually made by bank checks or postal money orders. The Provincial Centers presently cannot accept cash payments, but will be in practice in the near future.

Rental fees are to be paid in advance in yearly lump sum. Bills for call charges are accounted up to the end of a month and reach subscribers around the middle of the succeeding month. In case of no-payment, the amount is included in the next month's bill. If such no-payment continues for about three consecutive months, services are suspended. In case of government offices, the service suspension is not made in view of its ill-effects. About 20-25 percent of the total charges are billed to government offices, and 40-50 percent of such bills are presumed to be overdue.

Installation of computers for billing and collection is under way and they are expected to start operation in 1984.

(2) Financial Performance

As common to other government departments and agencies, funds for capital investment and recurrent expenditures are all provided by the Treasury. On the other hand, a surplus balance, if any at the end of each fiscal year, is to be credited to the Treasury. Hence, SLTD has no internal reserves and, at the same time, it dose not have to repay the funds used for investment activities.

Borrowings for telecommunications projects from foreign gvernment and other sources of finance as well as their repayments are solely managed by the Public Debt Department of Ministry of Finance and Planning.

Reflecting the fact that SLTD is a government department, conventional commercial finacial statements are not formally prepared. In fact, most of the financial transactions are recorded on a cash basis. Such being the case, when the International Development Association (IDA) of the World Band extended a loan to SLTD in 1980, it recommended to establish a sound accounting system, which appropriately books and reports transactions based on standard commercial accounting principles.

Table 2-7 is the notional income statement prepared following the IDA's recommendations. Table 2-8 shows major indicators of financial performance which are generally accepted as desirable for entities rendering telecommunications services. SLTD has not yet composed a complete form of a balance sheet. Therefore, the value of fixed assets used for calculation of the rate of return is provisional. The debt-service ratio and the debt-equity ratio, which were estimated by a IDA staff in 1980, should be regarded only as reference since a lot of assumptions were employed in the process of estimation.

Table 2-7 Income Statement

(Unit: Million Rs.)

Operating Revenues	1981	1982
Rentals	27.8	27.0
Metered Calls	140.4	186.8
Manual Trunk Calls	26.2	-
International Calls	167.9	163.1
Total Telephone Revenue	362.3	376.9
Telex	146.5	278.4
Telegraph	48.3	43.8
Miscellaneous	29.1	30.0
Total Operating Revenues	586.2	729.1
Operating Expenses		
Salaries	78.4	110.4
Maintenance	50.5	45.2
Operation and Administration	164.9	205.1
Depreciation	115.8	133.7
Total Operating Expenses	409.6	444.4
Operating Income	176.6	234.7
Less : Interest	73.0	127.5
Net Income	103.6	107.2

Note: Figures for 1982 are estimated based on the results between April and August.

Table 2-8 Financial Indicators of Telecommunications Department

	1981	1982 1/	Desirable figure 2/
1. Rate of Return (Operating income divided by average net plant in operation)	17.0%	17.4%	About 10%
2. Operating Ratio (Operating expenses divided by operating revenues)	70%	68%	About 60%
3. Debt Service Ratio (Net revenue divided by debt repayments plus interest payments)	1.9	2.1	1.5 - 2.0
4. Debt/Equity Ratio	1.93	1.58	0.67 - 1.50

Notes: 1/ Calculated based on the results between Jan. and Aug., 1982.

2/ Mentioned in the World Bank's Telecommunications Handbook Part II (Jan. 1974).

Subject to such conditions, an analysis of financial statements reveals that SLTD's financial performance is good or satisfactory. It appearars, however, that there is a large room for improving profitability specifically of domestic operations. If the operating ratio is computed seperating domestic and international services, the ratio of the former jumps up to around 80 percent while that of the latter down to 60 percent.

2-2-4 Project Investment Plan

SLTD is planning to invest about 3,557 million Rupees during the 1982-86 five-year period. Out of this, about 75% amounting to 2,677 million Rupees constitutes the foreign currency portion. The project by project and year by year distribution of the whole investment plan appears in Table 2-9.

As is evident in Table 2-9, fund requirements for projects now in progress are to decrease in the fiscal year 1984-85. This fact makes introduction of new project possible.

Major projects currently in progress are as under.

(1) Greater Colombo Area

1) Colombo Area Development Schema - Stage II (CADS II)

This project consists of replacement of over-aged local switching facilities totaling 12,000 line units and additional installation of 16,000 line units. As of present, this project is nearing completion. The system introduced is of CIT Alcatel E-10B, France.

2) Colombo Area Development Scheme - stage III (CADS III)

This project is to supplement the preceding Stage II which alone cannot meet the demand spiral. The Stage III, additional installation of 20,000 line units, mainly covers the Fort area, Pettah, and Kollupitiya. The main part of the project is scheduled to be completed during 1983-84. Planning for Stage IV (CADS IV), aiming at replacement of obsolete Stroger switching equipment, is now under preparation.

3) Mt. Lavinia Exchange

Further to the introduction of crossbar switching equipment of 6,000 line units completed in 1979, additional 6,000 line units are to be installed during 1983. Total project cost amounts to 50 million Rupees.

(2) Outside Greater Colombo Area

1) Outer Colombo Area Project - Stage II (OCADS II)

Major components of this project are replacement and new installation of subscribers lines in Badulla, Anuradhapura, Jaffna, Kurunegala, Ratnapura and Trincomalee areas. Project completion is scheduled during 1983. In addition, works to introduce STD services in Agrapatana and Bogamantalawa areas is to commence shortly.

2) Rural Telephone Network

STD system is to be introduced in 13 areas in the Kandy District. Completion of work is scheduled during 1983.

3) IDA Assisted Project

This project, with the IDA's assistance of around 800 million Rupees, is intended for replacement and additional installation of switching equipment in rural areas, expansion of long distance toll network, introduction of STD service, and overall improvement of local telephone network. Project completion is scheduled toward the end of 1984.

4) Cyclone Affected Area Reconstruction

This project is to reconstruct the cyclone affected areas including Amparai, Kalmunai, Batticaloa, Polonnaruwa, Hingurakgoda, Dambulla, Valaichchenai and Akkaraipattu. The project is also intended for introduction of STD services in those areas. The installation of subscribers' cables was already completed in June 1982. At present, additional installation of trunk cables is being carried out.

(3) International Call Service

Participation in the Indonesia-France submarine cable project is scheduled. The target of the project completion is the end of 1985. Anticipated participants in the project are Singapore, Indonesia, Saudi Arabia, Egypt, Italy, Djibouti and France, besides Sri Lanka.

(4) Other Works

A telecommunication training center is to be constructed at Welisara. Completion is scheduled toward the end of 1983.

Table 2-9 Public Investment for Telecommunications Projects 1983 - 1987

(Unit: Million Rs.)

	1983		1984		1985		1986		1987		1983 - 1987			
	T	FA	T	FA	T	FA	T	FA	T	FA	F	L	T	FA
	560	280	698	305	955	365	1138	120	1042	70	3333	1060	4393	1140
(1) CADS II	30	-	25	-	8	-	-	-	-	-	44	19	63	-
(2) CADS III	80	-	45	-	30	-	-	-	-	-	108	47	155	-
(3) OCADS II	138	100	45	25	23	15	-	-	-	-	161	45	206	140
(4) Rural Exchange	25	-	51	-	59	-	29	-	-	-	128	36	164	-
(5) Training Centre	10	-	5	-	5	-	2	-	-	-	13	9	22	-
(6) IDA Project	205	180	350	250	350	250	86	40	-	-	694	297	991	720
(7) Cyclone Area	6	-	34	30	-	-	-	-	-	-	28	12	40	30
(8) General Development	28	-	20	-	25	-	25	-	20	-	80	38	118	-
(9) O.T.S. Equipment	11	-	20	-	20	-	30	-	30	-	111	-	111	-
(10) I.P.Z. Katunayake & Biyagama	2	-	2	-	2	-	2	-	2	-	7	3	10	-
(11) O.T.S. Capital Contribution	12	-	12	-	13	-	14	-	15	-	66	-	66	-
(12) CADS IV	-	-	4	-	120	100	100	80	75	70	207	92	299	250
(13) SEAMEE (Submarine Cable)	-	-	30	-	35	-	35	-	35	-	115	20	135	-
(14) Annual Programme	13	-	15	-	15	-	15	-	15	-	19	54	73	-
(15) New Projects	-	-	40	-	250	-	800	-	850	-	1552	388	1940	-

Note: T = Total Costs; FA = Foreign Assistance; L = Local Costs; F - Foreign Costs

Source: Ministry of Finance & Planning

2-3 Significance of the Project

The Project is to improve and expand outside plants of the telecommunications system in the Greater Colombo Area, i.e., Colombo, the capital city, and all its environs. In concrete terms, the improvement and expansion are to be carried out for inter-exchange junction network among 24 exchanges (19 of them, remote switching unit) in the Greater Colombo Area and for subscriber line network among seven exchanges in the central part of the Area.

The working subscribers and the waiting subscribers list within the limits of the Project area as of 1982 area given in the Table 2-10. Against the total throughout the country, the former in the Greater Colombo Area accounts for 62.4% and in the service areas of the seven exchanges 54.5% whereas the latter registers 60.2% and 42.1%, respectively. Thus the waiting list percentage occupies nearly one half of the nationwide total.

Table 2-10 Occupancy Rate of the Project

	Working Subscribers	Waiting Subscribers
Throughout Sri Lanka	65,905	28,227
Greater Colombo Area	41,157 (62.4%)	16,997 (60.2%)
Project Area (Seven Exchanges)	35,942 (54.5%)	11,889 (42.1%)

Recently, for the existing state of telephone service in the Greater Colombo Area, complaints are increasing. The complaints are mainly twofold. One is about the shortage of facilities that makes it impossible to respond promptly to new demand. The other is about the low level of service quality with the existing facilities.

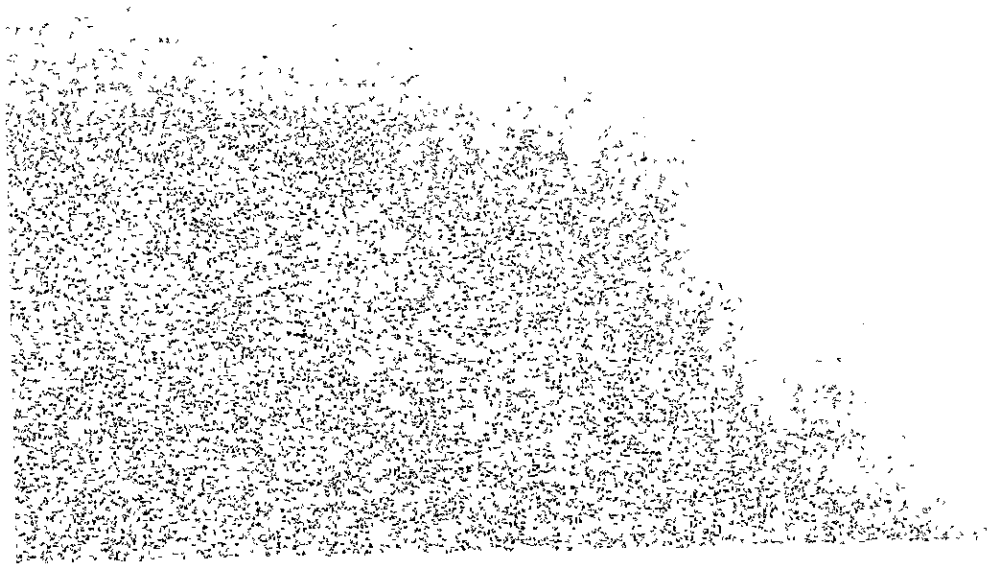
The most part of those complaints apparently originate from the Project area.

In the Greater Colombo Area are concentrated almost all the central organizations in the fields of national politics, economy and finance. Therefore, to upgrade the telecommunication facilities in this area by the current project, i.e., to eliminate the aforementioned quantitative and qualitative implications and provide high-quality telecommunications service, will contribute a great deal to the socio-economic development of Sri Lanka from now forward.

For SLTD also, the Project will prove to be an important technical guideline in regard to the formulation and implementation of facilities improvement and expansion plans for the remaining areas of the country. At the same time, there is much to expect from the Project in terms of revenues to be generated, which will be movilized as a significant source of finance for further improvement and expansion.

CHAPTER 3

DEMAND FORECAST



CHAPTER 3 DEMAND FORECAST

3-1 Outline

In Sri Lanka, economic development plans of many kinds have been prepared. As one of basic requirements for those development plans, telecommunications services hold an important role to play.

In the past, the national telecommunications network improvement and expansion were carried out by the Outside Colombo Area Development Scheme (OCADS) and the Colombo Area Development Scheme (CADS) projects. That is to say, the improvement and expansion were carried out for long distance toll transmission network as well as toll and local switching equipment.

However, for subscriber lines as outside plant, the improvement and expansion were not included in those plans. Hence, the existing subscriber lines consist of cables installed 30 years ago. The service performance is of extremely low level.

The demand for telecommunications services, when viewed for the whole country, will not record a rapid growth, and this is evident from the national income (GNP and GDP) behavior. However, considering that the national development plans, some of them assisted by the introduction of foreign capital, are being promoted for the purpose of national economic advancement, as referred to previously, the growth of demand for telecommunications services will pull up momentum, keeping pace with the growth of national economy.

As of 1982, the waiting subscribers in the Greater Colombo Area total 16,997 against the working subscriber lines of 41,157. In this area centering upon the capital city, the demand for business telephones in the urban sector and for residence telephones in the suburban district is bound to increase in accordance with the progress of national economic development.

In the Greater Colombo Area, the telephone demand density is especially high at seven exchanges (Colombo Central, Mattakkuliya, Havelock Town, Maradana, Nugegoda, Mt. Lavinia and Boralesgamuwa). The improvement and expansion of facilities at these seven exchanges by the Project will realize service performance improvement and, furthermore, will create new demand.

Demand forecast in the Greater Colombo Area is based on the past records and the estimate from the existing conditions. Generally, the long term forecast is difficult because of the possibilities of unforeseen social and economic changes during the forecast period. Therefore, as stated in CCITT Manual, "National Telephone Networks for the Automatic Service," it is important to check and review the plan whenever necessary and make required modifications in order that the plan may not be isolated from the realities.

Demand forecast for telecommunications services is made by the following methods:

1) By time series extrapolation

2) By regression from causal relation

3) By intuitional forecast

4) By normal forecast

For the spread of telephones also, there are four stages. They are the initiatory stage, expansion stage, popularizing stage and popularized stage. (Refer to Table 3-1 and Figure 3-1.) Proper consideration is necessary to have the demand forecast method adapted to the then existing stage of the spread of telephones. Also important for the demand forecast is to consider that even in the same country the spread of telephones stages vary according to the areas. The spread of telephone stage for the whole of Sri Lanka is considered to be the latter half of expansion stage.

The demand forecast in the Project consists of macroscopic forecast and microscopic forecast. The former is based on data collected in the field survey and covers all exchanges. The latter is for the seven exchanges whose subscriber lines are to be improved and expanded and for Kollupitiya Exchange. This microscopic forecast is based on the field survey results, the field survey itself having been made, using 1/1,000 and 1/10,000 scale city maps.

Table 3-1 Telephone Development Stages

Initiatory Stage	In this stage, telephones are installed in military establishments, police and government agencies for purposes of communication and liaison mainly of military and political nature. Telephone demand forecast using a model formula is almost useless in this stage. Counting the number of agencies requiring telephone service or determining the number of telephone lines from the political point of view is more practical.

Expansion Stage (First Half)	In this stage, the usefulness of business telephones begins to be recognized. However, the necessity for residential telephones is not yet broadly recognized. The telephone demand density is still extremely low. The convenience of telephones comes to be recognized in proportion to the increase of the number of telephones installed. Therefore, when considered by time series, the number of telephone subscribers often shows a tendency of increasing in geometrical progression.
Expansion Stage (Latter Half)	In this stage, the convenience of residential telephones is widely recognized so that the demand for residential telephones increases rapidly. This stage covers the period from when the demand for residential telephones begins to come close to the demand for business telephones to when the majority of residences are provided with telephones. By time series, the generation of demand will most possibly be at the rate exceeding the geometrical progression.
Popularizing Stage	In this stage, business telephones are diffused sufficiently and most of additional installations are for residential telephones. The generation of stable demand can be expected until the majority of residences are provided with telephones.

Popularized Stage	In this stage, both business and residential telephones are diffused sufficiently. Even in this stage, the telephone demand for new business establishments and residences can be expected. However, sales promotion efforts on the part of telephone enterprises, including innovation attempts to make telephones more convenient to use, as well as the introduction of new types of services, whereby to explore further demand potentials, are indispensable for the growth of the telephone business.

3-2 Method of Macroscopic Demand Forecast

3-2-1 Method of Macroscopic Demand Forecast in Sri Lanka

The long distance toll transmission network in Sri Lanka, though small in capacity as a nationwide network, is extended to cities in rural areas and in the Greater Colombo Area, with outmatic switching system adapted, as the result of the aforementioned improvement and expansion plan. However, the service quality as a whole is inferior;
furthermore, the main telephone density as of 1982 is as low as 0.43 per 100 out of the population, showing that the absolute quantity of telephones is small. Thus, for the whole country, the spread of telephones is considered to be at the expansion stage.

For demand forecast in such cases, the following three methods are proposed in CCITT GAS-5 Manual:

1) Time series extrapolation;

2) Elastic regression from the relationship with GDP, as regression from causal relations with economic indicators;

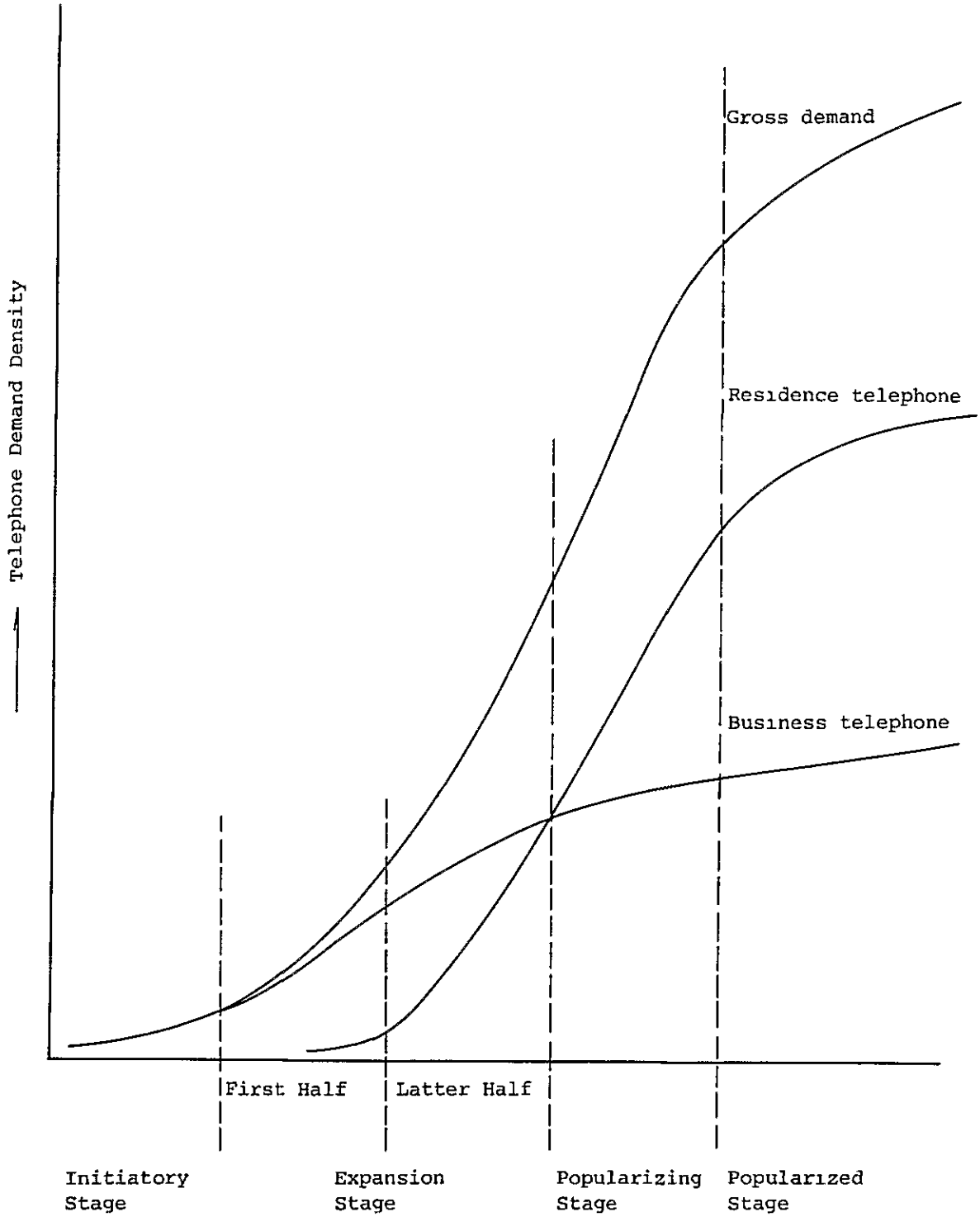


Figure 3-1 Telephone Development Stages

3) Elastic regression from G-P ratio.

In the case of Sri Lanka, judging from the past records, the optimum method of demand forecast is to do the same from the correlation between GDP and telephone density, the method commonly used by other countries under the same conditions as Sri Lanka.

3-2-2 Model Formula for Macroscopic Demand Forecast

Shown below is the formula to determine the relationship between GDP per capita (in U.S. dollars) and main telephone density per 100 inhabitants. This formula is obtained by the method of least squares, based on the referential data in many other countries. (Refer to Table 3-2.)

$Y = 0.00034 \cdot X^{1.26}$ ..... Correlation Factor: 0.92

where

Y : Main telephone density per 100 inhabitants

X : GDP per capita (in U.S. dollars)

References:

1) World Development Report, 1980 (published by the World Bank)

2) The World's Telephones, 1980 (published by AT&T)

The correlation formula introduced above, based on the values concerned in 67 countries as of 1979, presents the favorable correlation as seen in Figure 3-2 and is considered to be appropriate for use as demand forecast model. Therefore, on the assumption that the demand figure (number of working subscriber lines plus waiting subscribers) per 100 inhabitants in Sri Lanka as of 1982

is 0.61, the formula is modified as required. The modified formula to be used as demand forecast model in the Project turns out to be

$$Y = 0.00058.X^{1.26}$$

Where

Y : Demand per 100 inhabitants
(number of working subscriber plus waiting subscribers)

X : GDP per capita (in U.S. dollars)

(Refer to Table 3-6 and Figure 3-3.)

3-3 Estimation of GDP

Telecommunications services network constitutes an important economic infrastructure of a country. Hence, it should be well balanced with the degree of national development. Such being the case, the attempt is made, this time, to estimate the possible development extent of telecommunications services from their correlation with economic indicators.

To attain this purpose, an estimate as to the future size of national economy is necessary. When the government announcement is available concerning the development outlook of national economy, the estimate should of course be based on such government announcement. This time, the estimation of GDP is carried out as under. This, however, is completely from the viewpoint of telecommunications network planning, so that, in the event a long term economic plan is announced by the government, the telecommunications network planning should preferably be reviewed and revised on the basis of the government announcement.

For the estimation of GDP in Sri Lanka, this time, data from "World Development Report, 1981" by the World Bank and "Central Bank of Ceylon Annual Reports, 1979-1981" are used.

Table 3-2 (1/3) GDP and Telephone Density (1979) in 67 Countries

Country	GDP (US$)/Capita	Main Tele. Density /100 persons
Canada	9,578	40.0
Dominican Republic	987	1.8
Jamaica	1,086	2.7
United States	10,510	41.2
Algeria	1,638	1.4
Ethiopia	114	0.2
Ghana	899	0.3
Ivory Coast	1,113	0.4
Kenya	345	0.5
Liberia	522	0.4
Malawi	210	0.2
Mozambique	231	2.5
South Africa	1,857	5.7
Sudan	427	0.2
Togo	417	0.2
Tunisia	979	1.6
Uganda	657	0.2
Zambia	579	0.5
Zimbabwe (Rhodesia)	513	1.2
Austria	9,119	26.5
Belgium	11,318	23.5
Denmark	12,986	42.5
Finland	8,627	31.8
France	10,699	25.9
Germany, Fed. Rep. of	12,483	31.3
Greece	3,588	22.7
Ireland	4,488	13.7
Italy	5,697	21.3
Netherlands	10,647	33.7
Norway	13,163	24.7

Table 3-2 (2/3) GDP and Telephone Density (1979) in 67 Countries

Country	GDP (US$)/Capita	Main Tele. Density /100 persons
Portugal	1,894	9.5
Spain	4,886	16.8
Sweden	12,228	52.2
Switzerland	14,617	43.6
United Kingdom	7,184	31.7
Yugoslavia	2,783	6.1
Argentina	3,484	7.2
Brazil	1,755	3.4
Chile	1,919	3.1
Colombia	967	4.7
Costa Rica	1,814	5.7
Ecuador	1,174	2.7
Guatemala	1,013	1.6
Haiti	241	0.4
Honduras	528	1.0
Mexico	1,852	3.3
Nicaragua	600	1.5
Panama	1,539	6.7
Peru	864	0.6
Venezuela	3,377	5.0
Australia	8,938	33.4
Indonesia, Rep. of	344	0.2
New Zealand	5,725	35.0
Papua New Guinea	707	0.7
Philippines	629	0.7
Singapore	3,754	18.8
Thailand	607	0.7
Hong Kong	3,478	23.4
Japan	8,419	34.4
Korea, Rep. of	1,605	6.3

Table 3-2 (3/3) GDP and Telephone Density (1979) in 67 Countries

Country	GDP (US$)/Capita	Main Tele. Density /100 persons
India	170	0.3
Israel	4,026	19.8
Kuwait	1,792	10.5
Pakistan	225	0.3
Saudi Arabia	8,612	3.3
Sri Lanka	218	0.4
Turkey	1,277	2.5

Source: World Development Report, 1980 (The World Bank)
The World's Telephones, 1980 (AT & T)

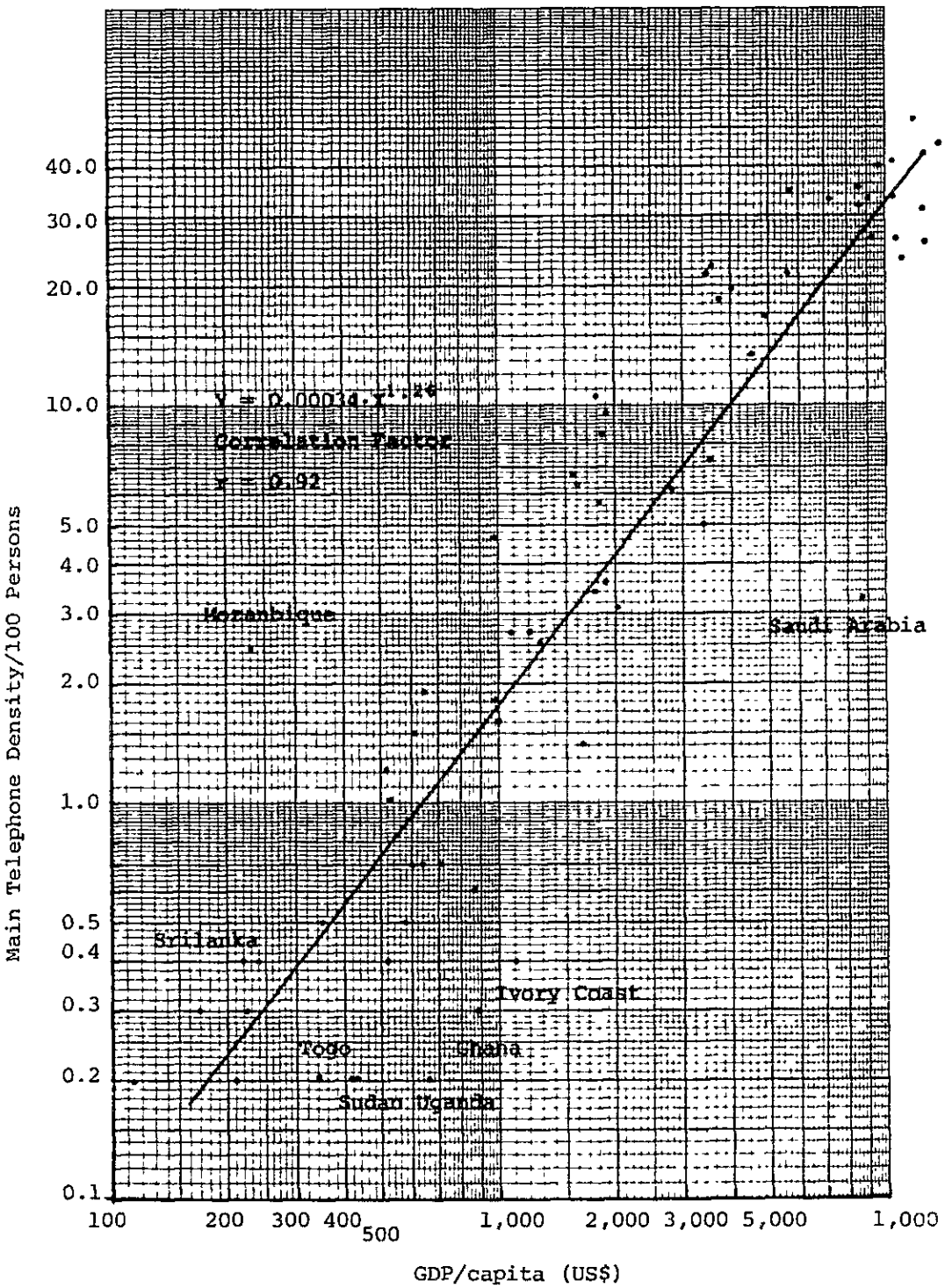


Figure 3-2 GDP and Main Telephone Density (1979) in 67 Countries

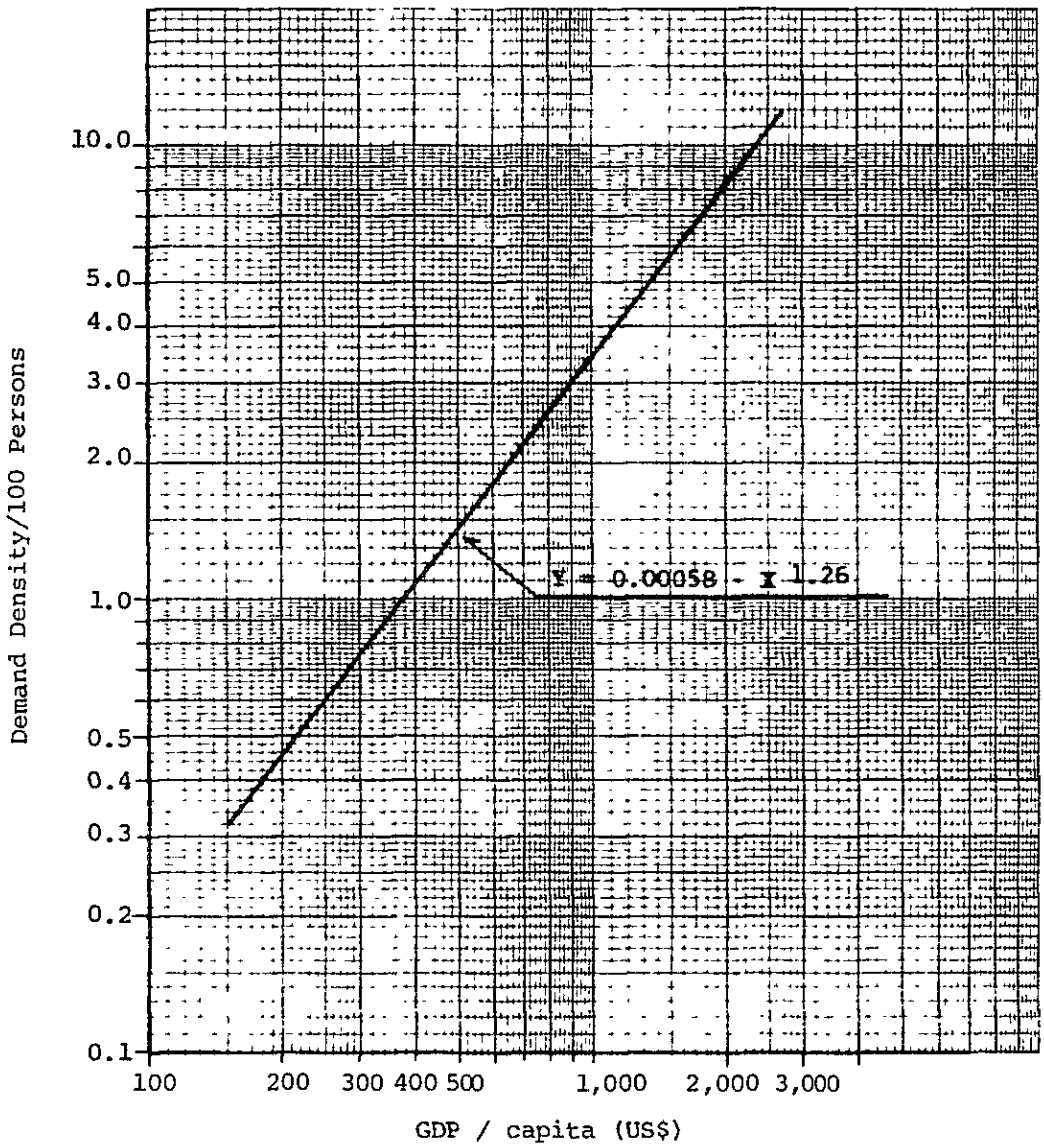


Figure 3-3 Revised Formula for Sri Lanka

According to those data, the average annual growth rate of GDP in the past nine years (1970-1979) is 3.8%. For the past five years (1977-1981), each average annual growth rate as compared with the year before is 4.2% for 1977, 8.2% for 1978, 6.3% for 1979, 6.2% for 1980 and 5.5% for 1981. From these figures, the assumption is made that the average annual growth rate is in the range of 4-8%. GDP growth estimates at 4%, 5%, 6%, 7% and 8% are given in Table 3-3 and Figure 3-4. Since the average annual growth rate in the past five years exceeds 6%, the estimate growth rate to be used in the demand forecast is set at 7%.

3-4 Population Forecast

The total population of Sri Lanka is forecasted as in Table 3-5. This population forecast is made, using the logistic curve based on the population in the past 11 years (1971-1981). (Refer to Table 3-4.)

The logistic curve:

$$y = \frac{K}{1 + m.e^{-at}}$$

where

K : $30,000 \times 10^3$

a : 0.0315

m : 1.4262

t : 1 as of 1971

Reference:

Statistical Pocket Book of the Democratic Socialist Republic of Sri Lanka 1982, published by Department of Census and Statistics, Ministry of Plan Implementation

Table 3-3 Estimated GDP

(x 10^6 US$)

Growth Rate	1979	1987	1992	1997	2002
4 %	3,160	4,330	5,260	6,400	7,790
5 %	3,160	4,670	5,960	7,600	9,700
6 %	3,160	5,040	6,740	9,020	12,070
7 %	3,160	5,430	7,620	10,680	14,980
8 %	3,160	5,850	8,590	12,630	18,550

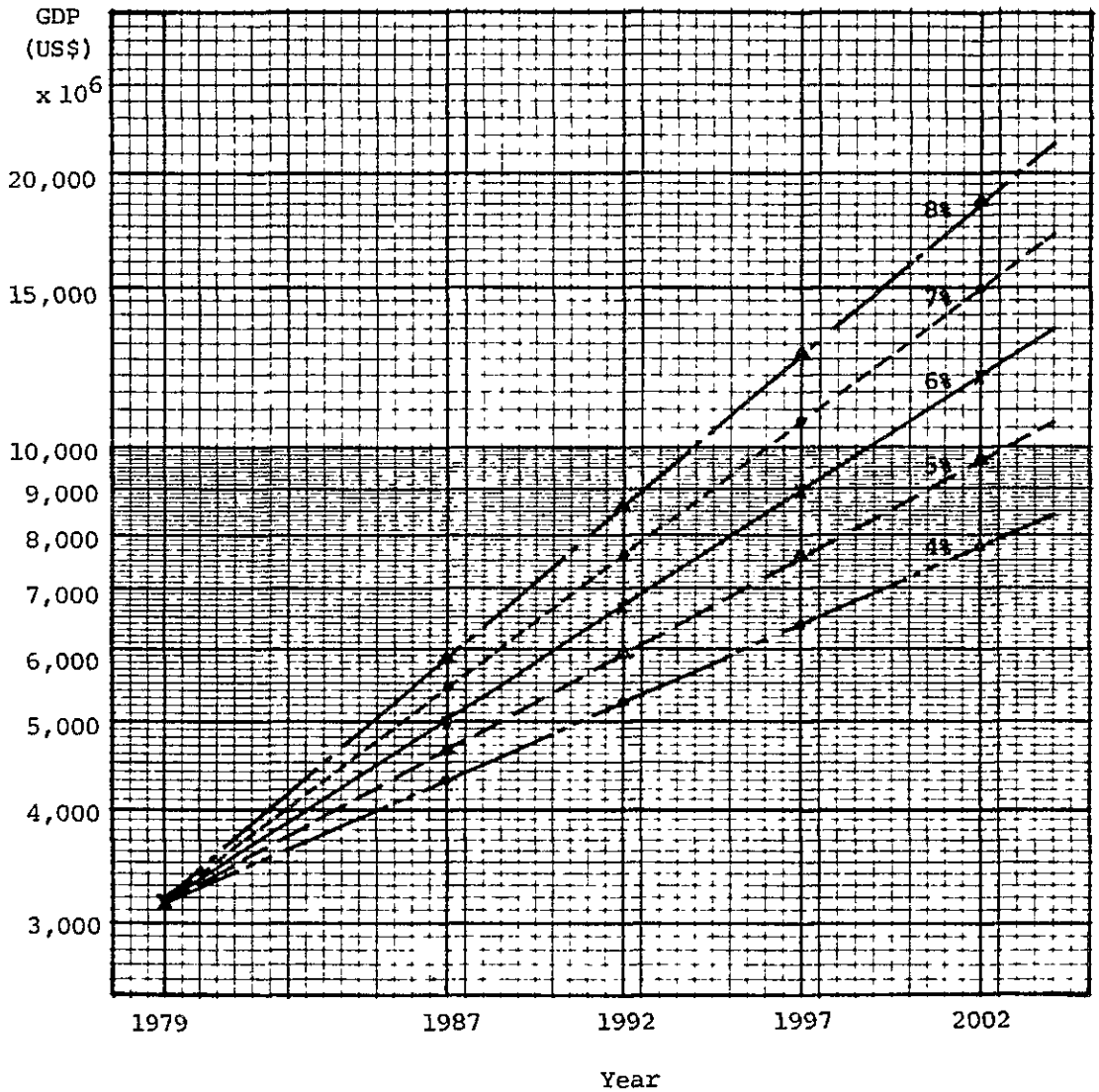


Figure 3-4 Estimated GDP

Table 3-4 Total Population in Sri Lanka

Year	1971	1972	1973	1974
Population (x 10^3)	12,608	12,861	13,091	13,284
Increase Rate (%)	-	2.0	1.8	1.5
Year	1975	1976	1977	1978
Population (x 10^3)	13,496	13,717	13,942	14,190
Increase Rate (%)	1.6	1.6	1.6	1.8
Year	1979	1980	1981	
Population (x 10^3)	14,472	14,738	14,988	
Increase Rate (%)	2.0	1.8	1.7	

Table 3-5 Population Forecast in Sri Lanka

Year	1987	1992	1997	2002
Population (x 10^3)	16,400	17,500	18,600	19,700

Annual Average Increase Rate (%)	1.5	1.3	1.2	1.2	

3-5 Macroscopic Demand Forecast by Years

3-5-1 Nationwide Forecast

The macroscopic demand forecast by years for the whole of Sri Lanka is made, based on GDP per capita and population forecast. The results obtained appear in Table 3-7 and Figure 3-5.

3-5-2 Forecast for Project Area

The demand in Greater Colombo Area, i.e., the area of the Project, occupies approximately 63% of the demand in the whole of Sri Lanka. (Refer to Table 3-8.)

The spread of telephones stage for the whole of Sri Lanka is considered to be the early part of the latter half of the expansion stage as seen in Figure 3-5. Hence the assumption that up to the year 2002 the demand ratio in the Greater Colombo Area will continue to be 63% against the demand in the whole of Sri Lanka, as at present. The demand forecast thus made for the Greater Colombo Area appears in Figure 3-9. After the year 2002, with the expansion of the sphere of economic activities, the demand in rural areas is considered to increase at a higher rate than in the Greater Colombo Area.

The exchange by exchange demand forecast in the Greater Colombo Area is made, based on data collected in the field survey and in consideration of the expansion possibilities of the sphere of economic activities, as well as the development potential of each exchange area. The results obtained appear in Table 3-10, Table 3-11, Figure 3-6 and Figure 3-7.

Meanwhile, the demand allocation to the seven exchanges whose subscriber line networks are to be improved and expanded by the current project and to Kollupitiya Exchange is based on the results of microscopic demand forecast.

In the exchange by exchange demand forecast above, the undermentioned three factors are taken into consideration:

1) Demand ratio (number of working subscribers plus waiting subscribers) as of 1982.

2) Number of households ratio (based on Census of Population and Housing, Sri Lanka - 1981).

3) Area ratio (with effective area measured on the map).

For the foregoing three factors, the load rates are determined as under and distributed to the exchanges concerned.

	1987	1992	1997	2002
Demand ratio	85	80	70	60
Number of Households ratio	10	10	20	25
Area ratio	5	10	10	15

Furthermore, each distributed load rate is minutely adjusted in consideration of political and economic development possibilities of each exchange area.

As the result, the demand ratio between eight exchanges in the urban district of Colombo and 16 others is known as under:

Table 3-6 Total Demand in Sri Lanka

Year	1971	1972	1973	1974	1975	1976
Total Demand	(0.44) 56,078	(0.43) 55,878	(0.42) 55,130	(0.42) 55,979	(0.43) 57,936	(0.46) 62,475
Working Lines	(0.30) 37,746	(0.30) 38,533	(0.30) 39,604	(0.31) 41,537	(0.32) 43,033	(0.32) 44,425
Waiting Lines	18,332	17,345	15,526	14,442	14,903	18,050
Year	1977	1978	1979	1980	1981	1982
Total Demand	(0.48) 66,652	(0.51) 71,870	(0.53) 76,860	(0.53) 77,340	(0.60) 89,796	(0.61) 94,132
Working Lines	(0.33) 45,322	(0.35) 49,414	(0.37) 53,600	(0.42) 61,194	(0.43) 63,878	(0.43) 65,905
Waiting Lines	21,330	22,456	23,260	16,146	25,918	28,227

( ): Density per 100 Persons

Table 3-7 Macroscopic Demand Forecast in Sri Lanka

Year	1987	1992	1997	2002	Remarks
Population (x 10^3)	16,400	17,500	18,600	19,700	
GDP (x 10^6US$)	5,430	7,620	10,680	14,980	Grouth Rate 7%
GDP/Capita (US$)	330	440	580	760	
Demand Density /100 Persons	0.86	1.25	1.76	2.47	
Demand in Sri Lanka	141,000	219,000	327,300	486,600	
Annual Demand Increase Rate (%)	8.4	9.2	8.4	8.3	

Table 3-8 Distribution Ratio to Greater Colombo Area

Year	1978	1979	1980	1981	1982
Total Telephone in Sri Lanka	49,414	53,600	61,194	63,878	65,905
Total Telephone in Greater Colombo	31,025	34,753	37,990	40,038	41,157
Ratio (%)	62.8	64.8	62.1	62.7	62.4

Table 3-9 Macroscopic Demand Forecast in Greater Colombo Area

Year	1987	1992	1997	2002
Total Demand in Sri Lanka	141,000	219,000	327,300	486,600
Total Demand in Greater Colombo	88,800	138,000	206,200	306,500
Annual Demand Increase Rate (%)	8.8	9.2	8.4	8.3

Table 3-10 Number of Demand, Household and Area

No.	Exchange Name	Demand (Working+Waiting)		Household		Service Area	
		Number	Ratio	Number	Ratio	Hectore	Ratio
1	Colombo Central	16,387	28.18			1,156	1.6
2	Kollupitiya	1,950	3.35	112,649	32.41		
3	Mattakkuliya	865	1.49			357	0.5
4	Maradana	8,769	15.08			1,049	1.4
5	Havelock Town	9.235	15.88			784	1.1
6	Nugegoda	3,639	6.26	8,304	2.39	1,778	2.4
7	Mt. Lavinia	6,986	12.01	33,536	9.65	3,123	4.2
8	Boralesgamuwa						
	Sub Total	47,831	82.25	154,489	44.45	8,247	11.2
9	Wattala	764	1.31	8,827	2.54	2,900	3.9
10	Regama	165	0.28	4,283	1.23	2,800	3.8
11	Ja-Ela	569	0.98	14,545	4.18	10,500	14.1
12	Kelaniya	1,146	1.97	16,212	4.66	3,500	4.7
13	Kadawata	391	0.67	20,952	6.03	4,800	6.5
14	Biyagama			6,048	1.74		
	Malwana	142	0.24	12,097	3.48	7,000	9.4
15	Wellampitiya	442	0.76	7,913	2.28	800	1.1
16	Angoda	227	0.39	13,563	3.90	1,200	1.6
17	Kaduwela	134	0.23	6,731	1.94	3,000	4.0
18	Kotte	3,038	5.23	30,403	8.74	3,000	4.0
19	Hokandara	96	0.17	6,706	1.93	3,000	4.0
20	Maharagama	1,048	1.80	9,612	2.77	4,300	5.8
21	Homagama	266	0.46	4,990	1.44	6,600	8.9
22	Padukka	68	0.12	2,885	0.83	7,700	10.4
23	Moratuwa	1,590	2.73	26,079	7.50	1,700	2.3
24	Piliyandala	237	0.41	1,252	0.36	3,200	4.3
	Sub Total	10,323	17.75	193,098	55.55	66,000	88.8
	Total	58,154	100 (%)	347,587	100 (%)	74,247	100 (%)

Table 3-11 Macroscopic Demand in Exchange Area

No.	Exchange Name	Working Line in 1982 (A)	Waiting Sub's+(A) in 1982	Macroscopic Demand			
				1987	1992	1997	2002
1	Colombo Central	13,077	16,387	23,380	36,050	49,810	68,700
2	Kollupitiya	1,500	1,950	3,250	4,130	5,950	7,350
3	Mattakkuliya	625	865	2,200	3,990	6,700	9,120
4	Maradana	6,548	8,769	10,660	14,400	20,610	28,910
5	Havelock Town	7,810	9,235	11,380	15,640	22,370	31,580
6	Nugegoda	1,896	3,639	5,410	8,450	12,620	15,310
7	Mt. Lavinia	4,486	6,986	8,700	13,760	18,680	26,210
8	Boralesgamuwa			930	1,200	1,550	2,040
	Sub Total	35,942	47,831	65,910	97,620	138,290	189,220
9	Wattala	434	764	1,810	3,060	4,900	8,290
10	Ragama	90	165	530	1,060	1,820	3,440
11	Ja-Ela	369	569	1,500	3,100	5,220	9,790
12	Kelaniya	632	1,146	2,320	3,840	6,300	10,190
13	Kadawata	92	391	1,200	2,230	4,320	8,000
14	Biyagama	-					
	Malwana	62	142	950	2,060	4,000	7,890
15	Wellampitiya	182	442	1,250	2,350	4,110	7,330
16	Angoda	89	227	870	1,510	3,170	5,700
17	Kaduwela	44	134	500	1,030	1,880	3,640
18	Kotte	1,820	3,038	4,420	6,700	10,520	15,860
19	Hokandara	47	96	430	920	1,730	3,310
20	Maharagama	304	1,048	2,060	3,510	5,450	8,970
21	Homagama	92	266	790	1,770	2,820	5,520
22	Padukka	38	68	410	1,040	1,680	3,500
23	Moratuwa	790	1,590	3,320	5,080	8,340	12,790
24	Piliyandala	130	237	530	1,120	1,650	3,060
	Sub Total	5,215	10,323	22,890	40,380	67,910	117,280
	Total	41,157	58,154	88,800	138,000	206,200	306,500

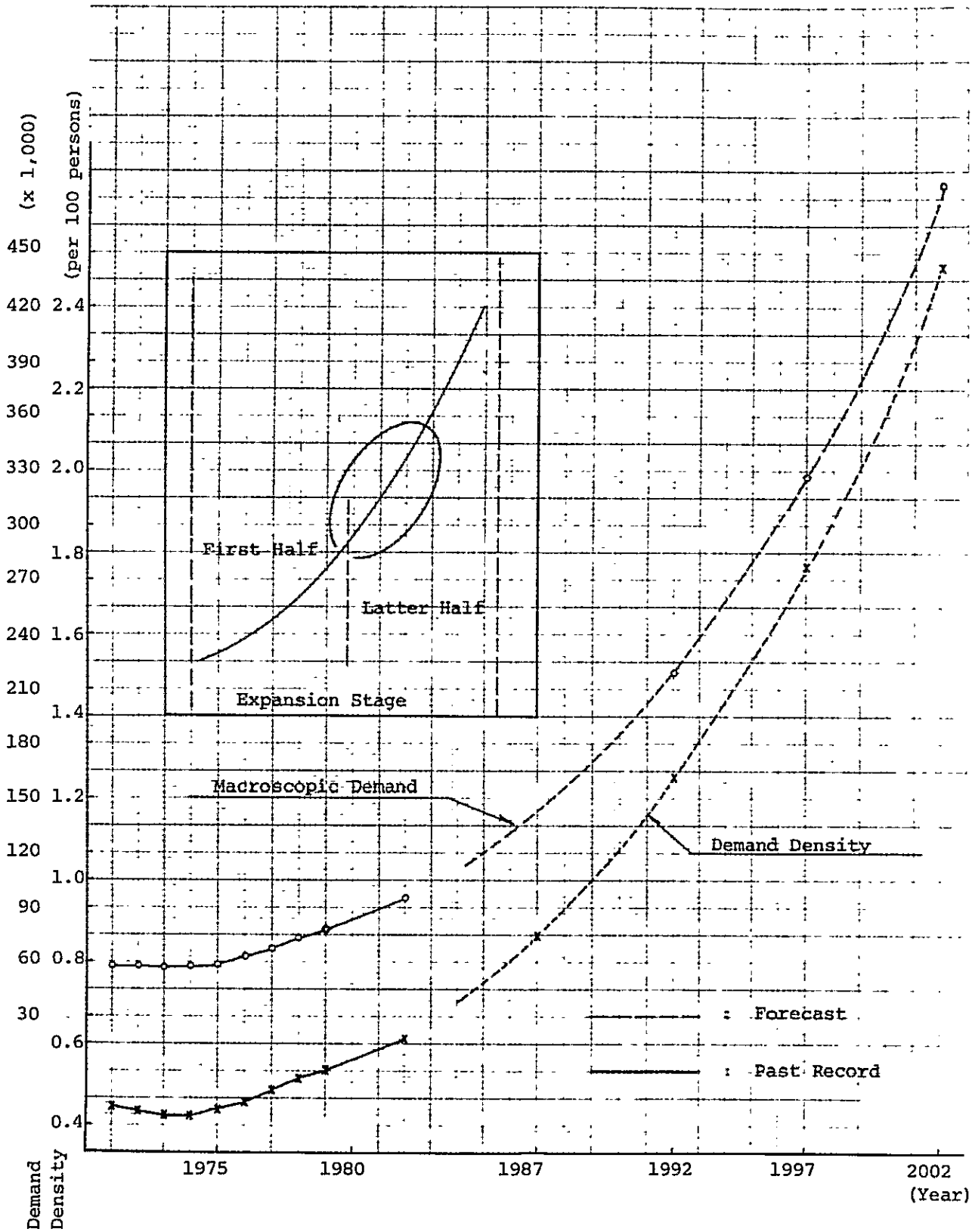


Figure 3-5 Macroscopic Demand and Demand Density in Sri Lanka

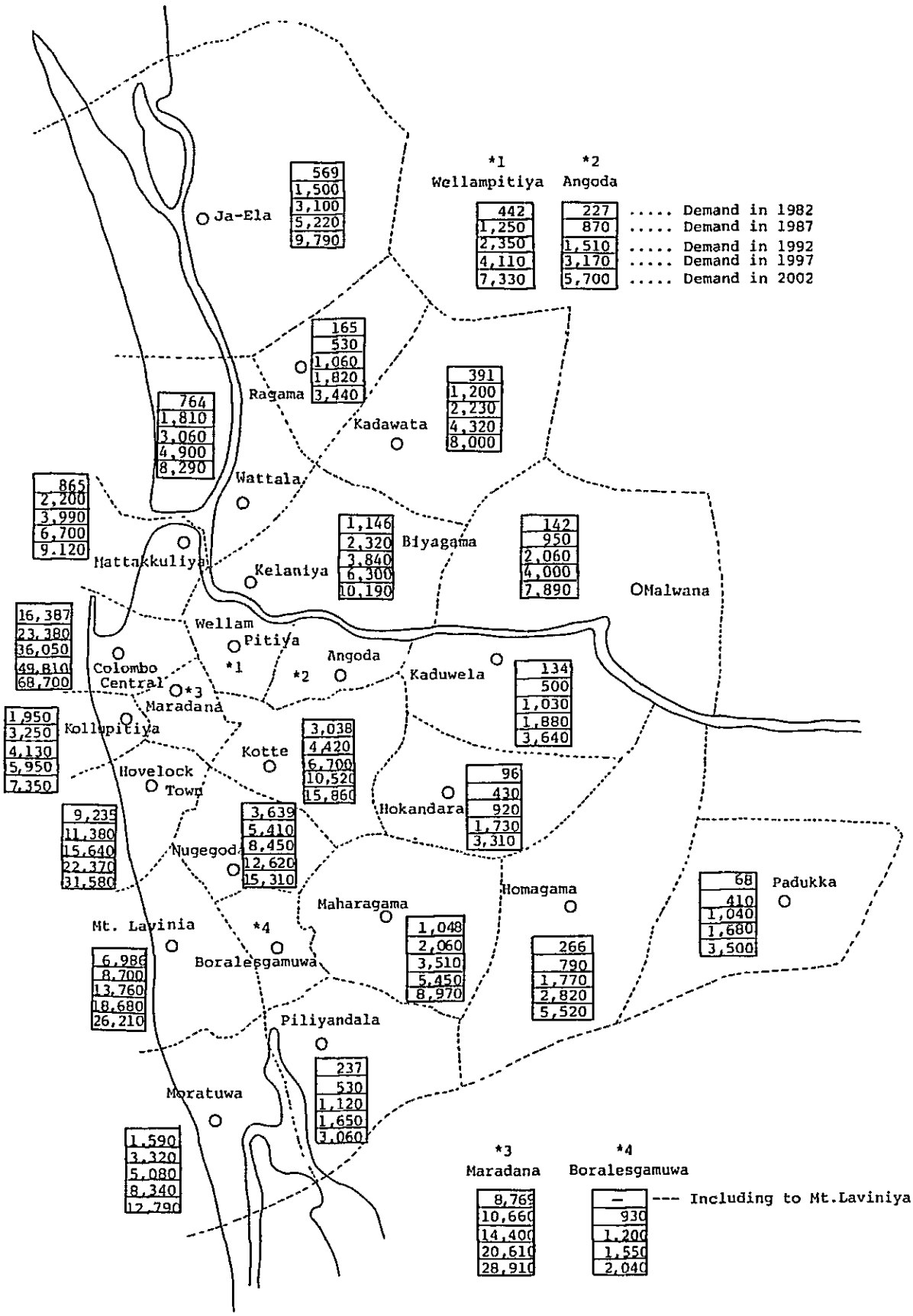


Figure 3-6 Demand Distribution Map

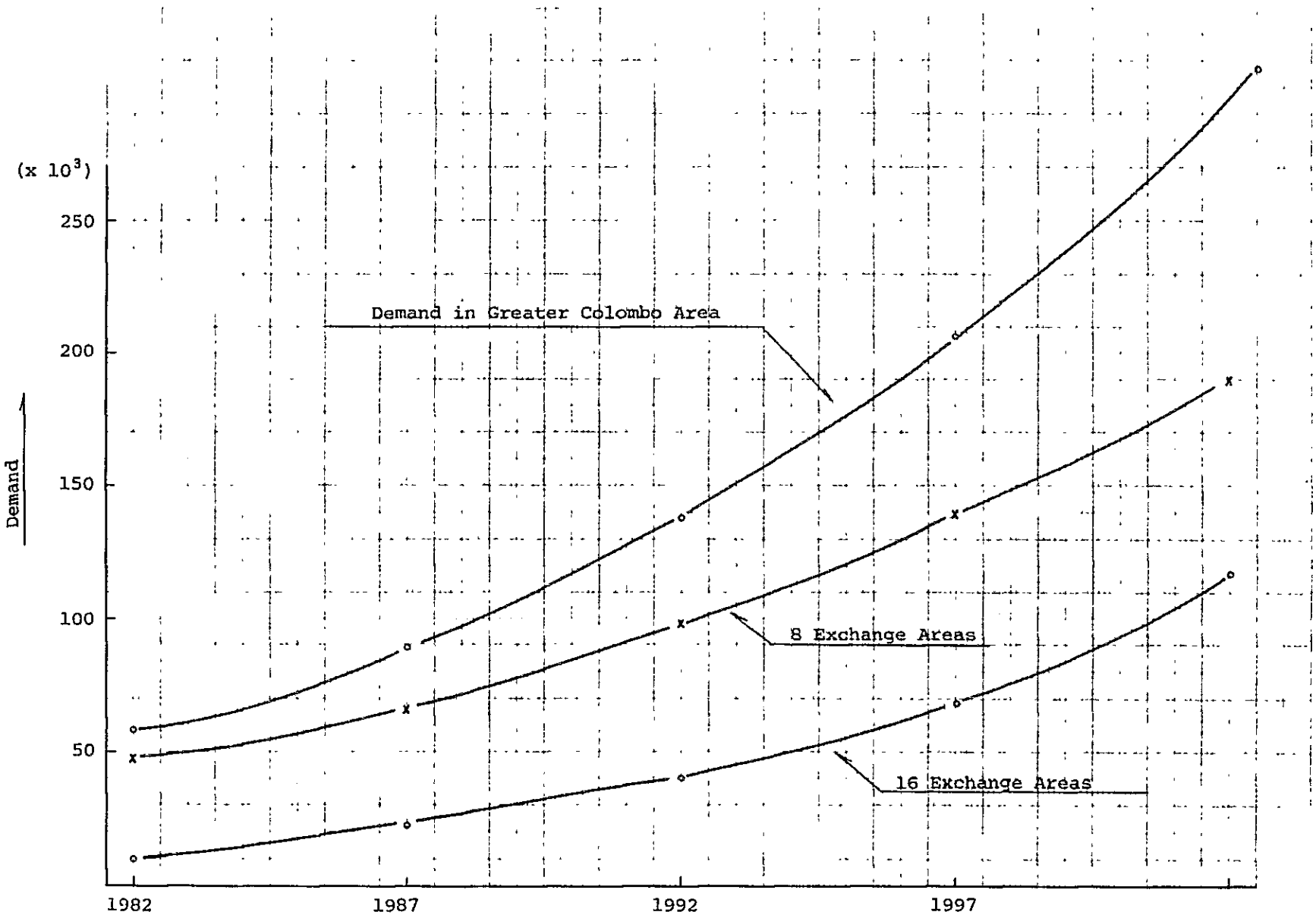


Figure 3-7 Demand Trend Curve in Greater Colombo Area

	1987	1992	1997	2002
8 exchanges	74.94	71.42	67.65	62.24
16 exchanges	25.06	28.58	32.35	37.76

Note: The eight exchanges are;
1) Colombo Central, 2) Mattakkuriya,
3) Havelock Town, 4) Maradana, 5) Nugegoda,
6) Mt. Lavinia, 7) Boralesgamuwa 8) Kollupitiya

3-5-3 Features of Each Area

Locational features of 16 exchange areas in the Greater Colombo Area, other than eight exchange areas in the urban district of Colombo, are as under:

(1) North of Kelani River

1) This area contains the undermentioned six exchanges:

Ja-ela	Ragama	Wattala
Kelaniya	Kadawata	Malwana

2) In this area is included Negambo and vicinity where Katunayaka International Airport is located. This area is under the control of the Greater Colombo Economic Commission (GCEC). Development plans of many kinds, including the industrial zone development, are being carried out.

3) Wattala Exchange, Ragama Exchange and Ja-ela Exchange are located along Negambo Road. The exchange areas consist of commercial area near the railway station, middle grade residential area and nearby farming area.

Wattala Exchange area holds high residence density and is spotted with factories. Ragama Exchange area comprises a large expanse of farmlands.

Ja-ela Exchange area is an area where the brisk atmosphere prevails. This area embraces the light industry factory group in the northeast sector and high grade residence group in the western sector. Farmlands are also well maintained.

In the demand growth, Ja-ela Exchange by far tops the other two. Wattala Exchange can also expect a steady demand growth. At Ragama Exchange, the demand growth tempo will be relatively slow.

4) Kelaniya Exchange and Kadawala Exchange are increasing their importance as they are located along Kandy Road that leads to Kandy, the city of historical significance.

In the Kelaniya Exchange area exists Raja Maha Vihara, the time-honored Buddhist cathedral. This neighborhood is surrounded with the quiet atmosphere. A large number of middle grade residences lie. The small sized, modern business office congregation is being formed along Kandy Road.

Peliyagoda area is an important area of contact with Colombo, the capital city. In this area, the Peliyagoda Integrated Urban Development Project, mainly aimed at the development of warehousing and light industries, is being carried out. This development area strides over Wattala Exchange and Kelaniya Exchange areas so that the exchange area modification will become necessary in due course.

Sapugaskanda area in the east borders on Kadawata Exchange and Malwana Exchange areas, and in this area the heavy industrial zone development centering upon the oil refinery construction is being planned.

Kadawata Exchange and Malwana Exchange areas consist of farmlands all around except for a small group of merchant houses and middle grade residences near the bus terminal. Other facilities in this area are cottage industry type brick factories only, and not large in number.

The growth of demand at the three exchanges mentioned above is expected to gather momendum in accordance with the progress of the development project.

(2) East of Colombo City

The undermentioned five exchange areas located east of Colombo City belong to the New Capital Project Area. For this area, development plans of many kinds are now being prepared.

Wellampitiya, Angada, Kotte,

Hokandara, Maharagama

1) In Wellampitiya Exchange area, middle grade residences are built at nearly equal density for the whole area. Large scale facilities are Kelanitisa Thermal Power Station in the northwest and Kollonnawa Oil Installation in the southwest.

   Angoda Exchange area also is teemed with middle grade residences. In view of the good hill land environment, this area provides ideal locations for such public facilities as Mental Hospital and Infectious Diseases Hospital.

   In the aforementioned development project, the area between Low Level Road and Kelani River and eastern Angoda area are specified as light industrial and mixed zone.

   The demand growth at these two exchanges - Wellampitiya and Angoda - will be mostly for residence telephones in the immediate future. And the steady demand growth can be expected.

2) Kotte Exchange area is to form the center of the projected New Capital, Highway network and National Assembly Hall construction has already been completed. Now the peripheral area improvement is being carried out. The construction of Sri Jayewardenepura General Hospital (in-patient capacity: 100 beds), donated by the Government of Japan, is also making steady headway.

A broad demand growth is expected to follow the development project progress.

Hokandara Exchange area is presently the farming area. The demand growth will be slow and mild.

East of the motorway to be constructed as part of the aforementioned development project is scheduled to be light industrial and mixed zone. An appreciable demand growth will ensue.

3) Maharagama Exchange area contains brisk commercial quarters near the main railway station. The surroundings are composed of a mixture of middle grade residential area and farming area. The demand growth potential is large.

According to the development project previously mentioned, light industrial and mixed zone is to be realized south of Avissawalla Road.

(3) Other Exchange Areas

1) Kaduwela Exchange area consists of the farming area for the most part. Only in commercial quarters near the bus terminal, the atmosphere is brisk. The demand growth will be slow and mild.

2) Homagama Exchange area is featured with the Army garrison and a handful of lumber mills. The remaining sector is the farming area. The demand growth will be slow and mild.