Qatar Public Telecommunications Services in the past and Present, and future forecast supporting national background Study Report (2)

by Mr. Takuyasu FUJIKURA

April 1979

Japan Internatinal Cooperation Agency

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Contents

1. Introduction

The study report (1) sent to the Ministry of Communications and Transportations in February of the last year (1978) delt with various problems mainly pertaining to the factfinding and feasibility studies mentioned in the following.

Those are the present traffic condition and its problems, progress of past system expansion and its problems, present communication network condition and future network configuration desirable from the viewpoint of traffic, national telephone demand forecast, present charging system, present status of national number and zone system and its problems, broad perspective of introduction of electronic switching systems, traffic exchange among national network zones, trunk demand forecast, etc.

The study report (1) contained a theme derived and developed from the original, limited theme of the study of present traffic condition and examination of interface with a newly introduced electronic switching system, i.e. a theme pertaining to the proposition and analysis of the above problems which must be seized and solved before the analysis of the original theme. Accordingly, the study report (1) was produced under the severe condition of completing the study during the short stay in Qatar.

Though the above study report mainly delt with the telephone network, it won a high praise from the Ministry of Communications and Transportations as a document discussing the electric communications in general and suggesting a definite idea of future system development (until 2000). As for the interface, definite analysis must be performed in the process of settling the electronic switching system implementation plan, after it is decided to introduce the system, as mentioned in the previous report.

Recently, more than one year after the submission of the study report (1) at the request of the Government, we have a chance to make ammendment and more progressive study which improves document to sketch the communication network centering around the capital city, which is based on a time division electronic switching system and a PCM transmission network, to serve for the present nation-building project and so on. Therefore, this, the study report (2) was made up.

Since this report has been made on a short-term schedule uncomparable to

the previous report, it requires analysis of a lot of fundamental problems prior to the settlement of definite implementation plan (general plan included), as mentioned at the end of this report.

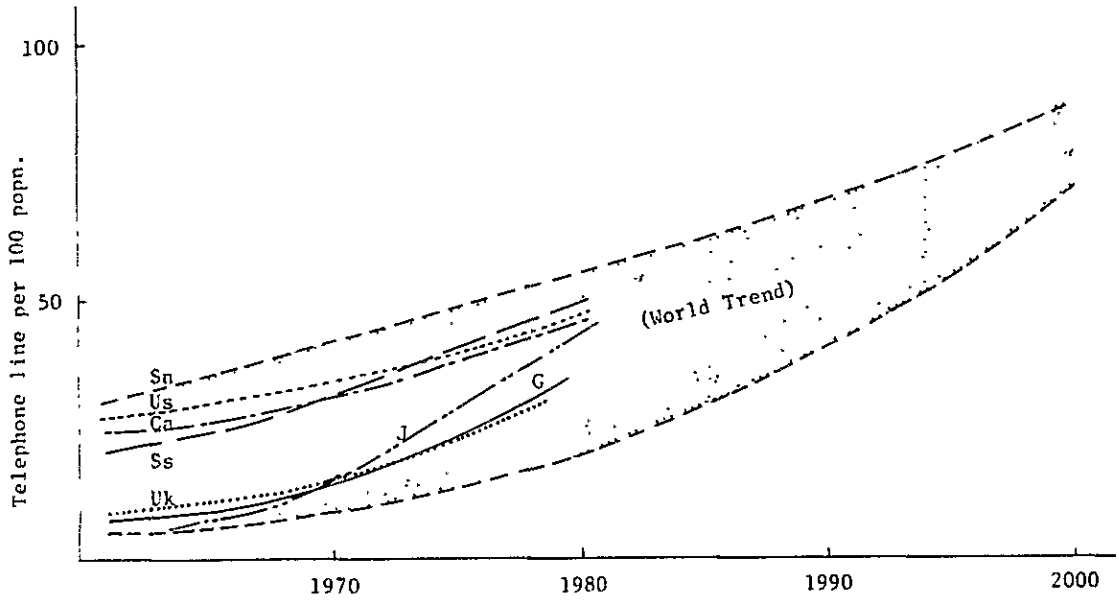
2. Telephone density forecast

(1) International trend

Before the facility investment to the electric communications system, it is needed to forecast the number of main telephone sets (telephone sets directly connected to the switching system in the telephone office via lines) per 100 population.

Figure 1 shows the past telephone density and future trend of Sweden, USA, Canada, Switzerland, Japan, Great Britain, West Germany and France among the foreign countries, as referable as forward indexes.

Fig. 1 World Subscriber Telephone line increase trend up to the year 2000



As Fig. 1 shows, the maximum number of main telephone sets per 100 population as of 1960 is 28.9 (Sweden), while the minimum number is 5. Nevertheless, the numbers range between 15 and 35 as of 1970. The maximum number will exceed 50 in 1980s. It is easily expected that the telephone density in some countries will become as high as to exceed 80 in 2000s, if the present pace of increase is kept as it is.

(2) Telephone density in Qatar

The following three cases are assumable to forecast the telephone density in Qatar in relation to the foreign countries, especially the countries

having high telephone density.

Case 1 : The present condition is maintained irrespective of the international trend. In the process of nation building, requests for the implementation of residence telephones and business telephones are rejected to the utmost, since they involve unprobable factors. Instead, pay-station type public telephones are implemented to answer such requests.

Case 2 : The telephone density is gradually increased through the comparison of national industrial and economical donditions with those of the foreign countries having high telephone density, so that it will approach the average telephone density of these countries by 2000.

Case 3 : The telephone density is deliberately and gradually approached to the forecasted telephone density of typical countries in 2000.

The telephone density levels reached in the above cases are represented by levels P_0, P_1 and P_2 respectively.

3. Population forecast

To the gulf countries, intellectual and physical workers of various classes flock from everywhere all over the world including the Middle East. The percentage of floating population consisting of these people to the total population of these countries cannot be ignored. On the recognition of this fact, it is extremely difficult to numerically forecast the population in the future.

However, the problem of forecasting the population as having unprobable factors cannot be left intouched in settling a variety of long-term, fundamental national projects. The study of the above problem naturally makes us face the fundamental theme of what is the optimum configuration of population matrix as involving multi-dimensional factors.

This theme is of great importance for the settlement of electric communication system plan. Among the various factors composing the matrix, the population of each educational class and religional customs require detail, systematic analysis, since they will make direct and indirect influences to such a macroscopic matter as how to manage the project, as well as to such microscopic matters as system functions and working system pertaining to the maintenance and operation, and the training system.

This report was revised from the previous report according to the extremely valuable comments directly given by the Director of Telecommunications of the Ministry of Communications and Transportations and based on the prospect that the population in 2000 will not be very optimistic nor pessimistic, in other words, the national population plan will be steadily set forward under extremely sound, careful consideration and control. The social movement in these one or two years was also taken as a dynamic factor.

This report adopts the same scheme as employed in the previous study report (1), namely, the scheme to forecast the telephone density by connecting individual conditions of each area to the development factors which can be thought at present.

Table 1 and Fig. 2 show the population forecast until 2000 (revised). Besides the forecasted value shown in the previous study report (1) (Pattern A), Fig. 2 shows the revised Q.N.T.S. value (Pattern C) sent from the Ministry of communications and Transportations on the date of September 1, 1978, and the

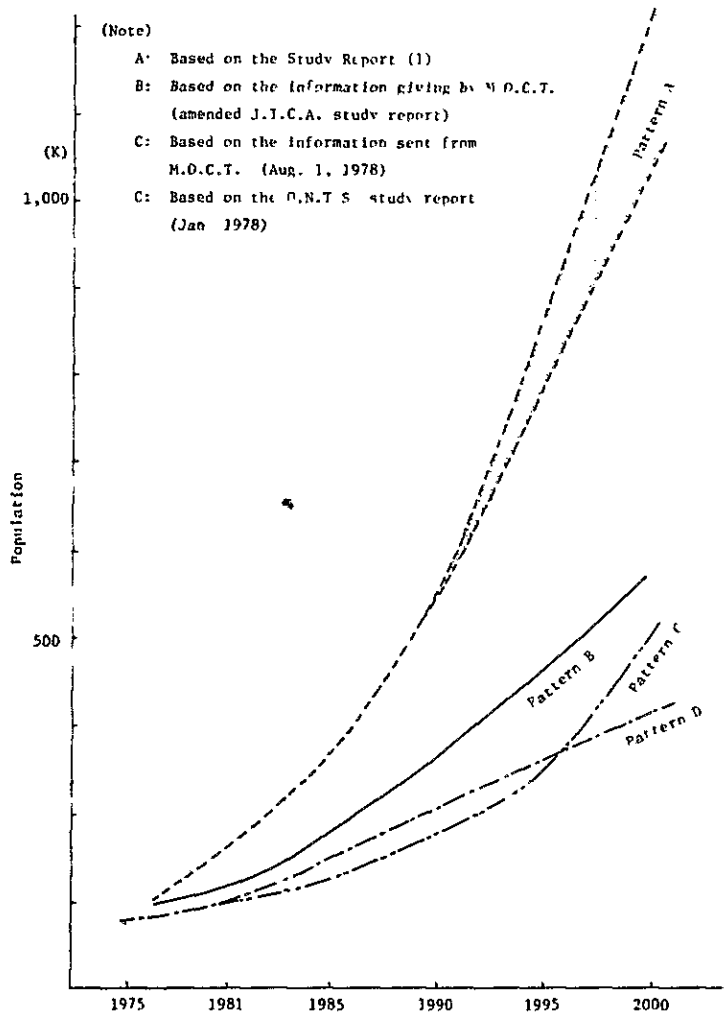
second-revised Q.N.T.S. value (Pattern D) sent in January 1979, for the sake of reference.

Table 1. Population Trend Estimated

Item	1977	1981	1985	1990	1995	2000
Population	196,000	224,000	283,000	357,000	455,000	565,000

In the subsequent sections, the forecasted population of each year is expressed to the smallest significant figure (tens position of integer). This is caused by the calculation method of forecasting the population in each area and accumulating it to the others. This calculation method is indispensable for the definite settlement of zone system plan, telephone site setting plan, switching terminal implementation plan, etc. on an area bases, which is described in the subsequent sections.

Fig. 2 Population Trend Estimated



4. Subscriber's line demand forecast

The problems of what size to determine the service area of each telephone office and where to set the site of upper class office in the network hierarchy have close relation to various factors, such as the number of subscribers' lines, number of trunk lines, number of distributing frames (MDFs and TDFs) and congestion, traffic overflow, numbering plan, charging and billing process network and various technical interfaces. Accordingly, it is desirable to take these factors into consideration in the process of subscriber's line demand forecast.

The question of assigning the service area of telephone office and setting the site of upper class office in the network hierarchy, in other words, the question of zone setting, was discussed in the previous study report (1); however, the contents were revised by reference to the map of the whole of Qatar newly made by the government and receiving in great deal the opinions of Qatari staffs in the ministry as based on the perception of inhabitants. Zone block Nos. are newly entered into the figure illustrating the subscriber's line demand forecast per zone block, whose correspondence to the numbering plan will be described later in this report. For the fundamental thought of the correspondence of zone blocks to the numbering plan, refer to the Annex.

Tables 2.1 through 2.3 show the subscriber's line demand forecast subtotals per zone block and per site of upper class office in the network hierarchy, pertaining to each telephone density level defined previously.

In the level P_0, the national average of the number of main telephone sets per 100 population all is 20 in 1981, 25 in 1990 and a little over 27 in 2000. If these values are compared with those of the typical countries, it is proved that the value in 2000 equals to the value of USA in 1962, and to the values of Canada and Switzerland in about 1967.

In the level P_1, the national average of the number of main telephone sets per 100 population is 20 in 1981 and 30 in about 1990 when the effect of steelmaking, aluminium and other industries on various fields will be revealed at a relatively high degree. Subsequently, the industrial effect will bring forth the consuming effect, needs for various kinds of new telephone services, and so on; therefore, the number of main telephone sets per 100 population will reach 50 in 2000, which is close to the average telephone density level of typical countries.

In the level P_2, the country itself or the friendly relationship between this and related countries has an impact on various industrial fields so that they will bring forth a relatively high degree of effect in 1980. On this occasion, the telephone demand will make a sudden rise, and the number of telephone sets per 100 population will exceed 50 in 1990.

Table 2.1 Forecast of Future Telephone Line (Po Level)

Area	Center	1977	1981	1985	1990	1995	2000
8[1*]	Al Shamal	810	1,150	2,200	3,000	4,050	6,100
2	Al Khor	1,150	1,420	2,050	3,150	4,900	7,750
3	Al Doha	21,000	28,500	38,500	52,000	66,500	83,000
4	Al Rayyan	6,500	11,000	17,000	24,000	34,000	46,000
5	Umm Said	2,100	3,600	5,150	7,200	9,250	11,800
6	Al Kharrarah	50	60	90	130	190	250
7	Dukhan	180	250	320	450	570	700
8[2*]	Al Ghuwairiyah	220	310	390	470	600	720
Telephone Line		32,010	46,290	65,700	90,400	120,060	156,320
Population		196,360	223,980	283,130	357,080	454,830	565,230
Per 100 Popn.		16.3	20.7	23.2	25.3	26.4	27.7

(Note) See Annex

Table 2.2 Forecast of Future Telephone Line (P1 Level)

Area	Center	1977	1981	1985	1990	1995	2000
8[1*]	Al Shamal	810	1,150	2,200	3,000	4,050	6,100
2	Al Khor	1,150	1,420	2,050	3,150	4,900	7,750
3	Al Doha	21,000	28,500	38,500	68,800	127,000	206,600
4	Al Rayyan	6,500	11,000	17,000	24,000	34,000	46,000
5	Umm Said	2,100	3,600	5,150	9,000	11,500	13,500
6	Al Kharrarah	50	60	90	130	190	250
7	Dukhan	180	250	320	450	570	700
8[2*]	Al Ghuwairiyah	220	310	390	470	600	720
Telephone Line		32,010	46,290	65,700	109,000	182,810	281,620
Population		196,360	223,980	283,130	357,080	454,830	565,230
Per 100 Popn.		16.3	20.7	23.2	30.5	40.2	49.8

(Note) See Annex

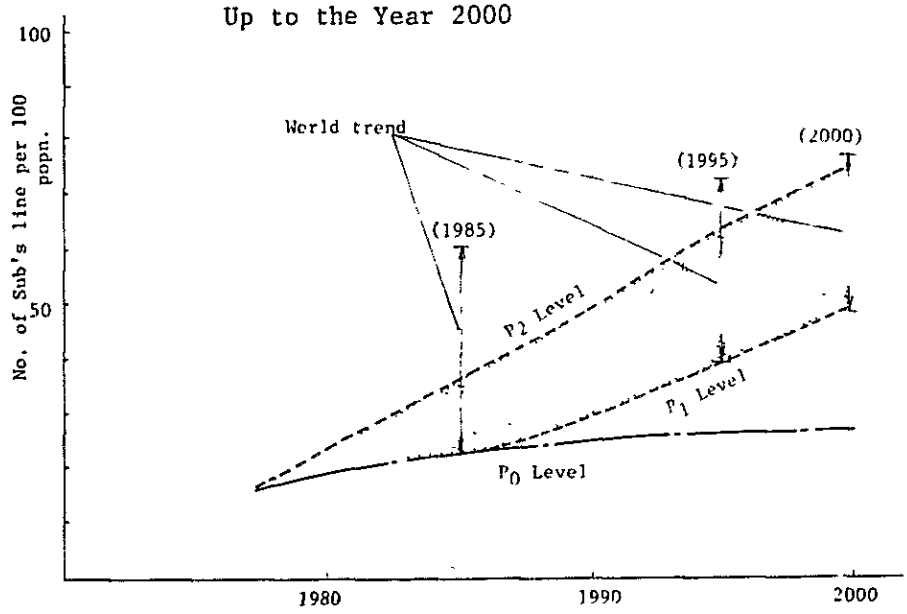
Table 2.3 Forecast of Future Telephone Line (P2 Level)

Area	Center	1977	1981	1985	1990	1995	2000
8[1*]	Al Shamal	810	1,150	2,200	3,000	4,050	6,100
2	Al Khor	1,150	1,420	2,050	3,150	4,900	7,750
3	Al Doha	21,000	40,600	79,500	140,000	234,500	337,000
4	Al Reyyan	6,500	11,000	17,000	24,000	34,000	46,000
5	Umm Said	2,100	3,600	5,500	9,200	14,500	20,500
6	Al Kharrarah	50	60	90	130	190	250
7	Dukhan	180	250	320	450	570	700
8[2*]	Al Ghnwairiyah	220	310	390	470	600	720
Telephone Line		32,010	58,380	107,050	180,400	293,310	419,020
Population		196,360	223,980	283,130	357,080	454,830	565,230
Per 100 Popn.		16.3	26.1	37.8	50.5	64.5	74.1

(Note) See Annex

Figure 3 compares the telephone demand in Qatar with those of typical foreign countries. Various projects settled for the advancement of agriculture, fisheries, chemical and metal-working industries and education, which are now steadily put into practice, will make a good effect on the increase of subscriber's line demand. This assumption easily leads to the forecast that the substantial telephone density in the future will take a value within the range between the levels P_2 and P_1.

Fig. 3 Qatar Subscriber Telephone Line Increase Trend Up to the Year 2000



Figures 4.1 through 4.3 show maps in which are entered the telephone density values in 1981, 1990 and 2000 in the respective levels of P_0, P_1 and P_2 previously defined. These maps are supplied as a preparation for the map analysis of the development plan of each area, implementation schedule, outgoing and incoming telephone call traffic density per subscriber's line, etc. to be executed in the near future, to determine the desirable configuration of national communication network. Each point in the figures represents a switching point or a subscriber's line concentrating point implemented in a distant site. (For the name of each site, refer to the Annex.)

Fig. 4.1 Forecast of Future Telephone Line (P_0 Level)

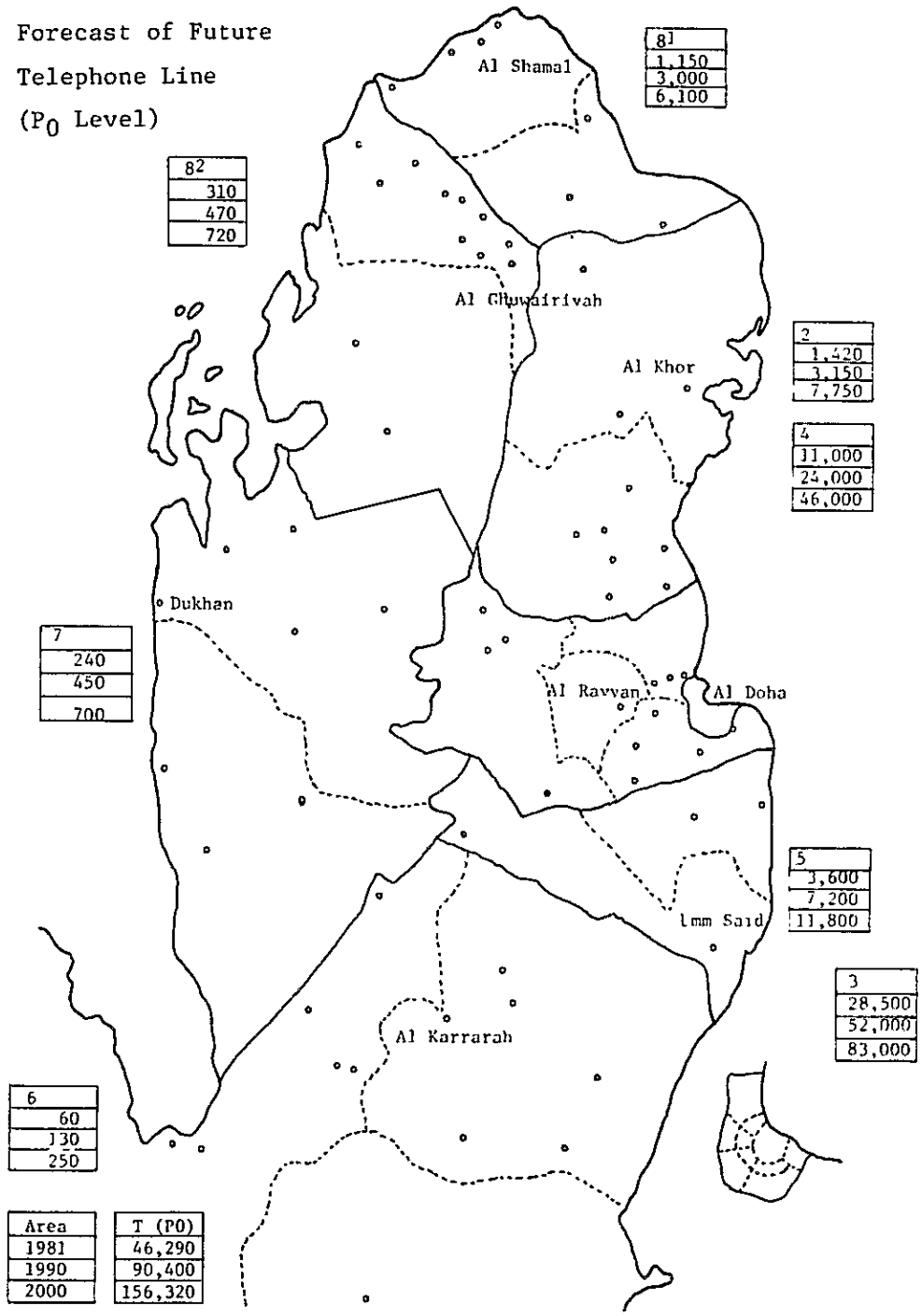


Fig. 4.2 Forecast of Future Telephone Line (P_1 Level)

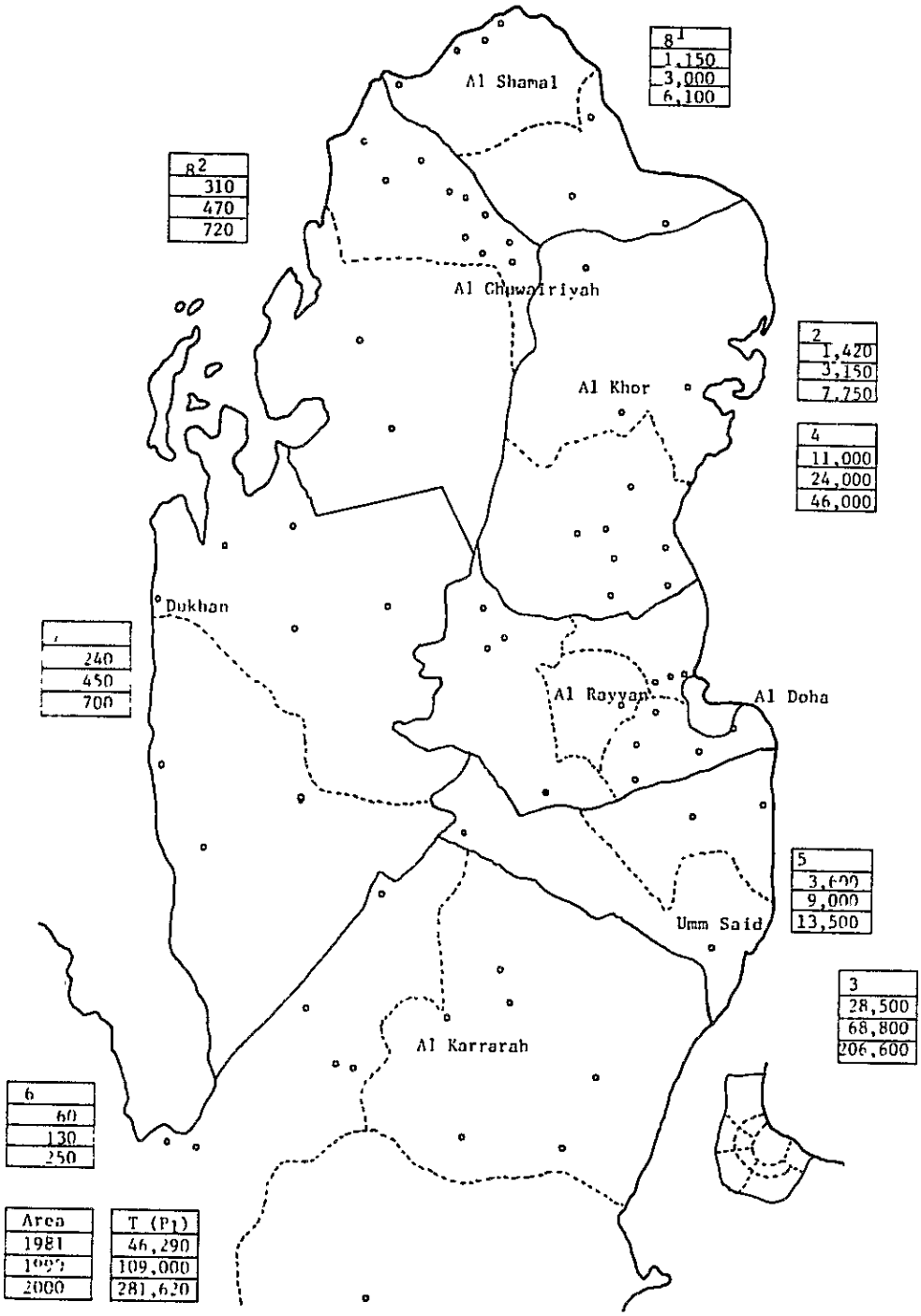
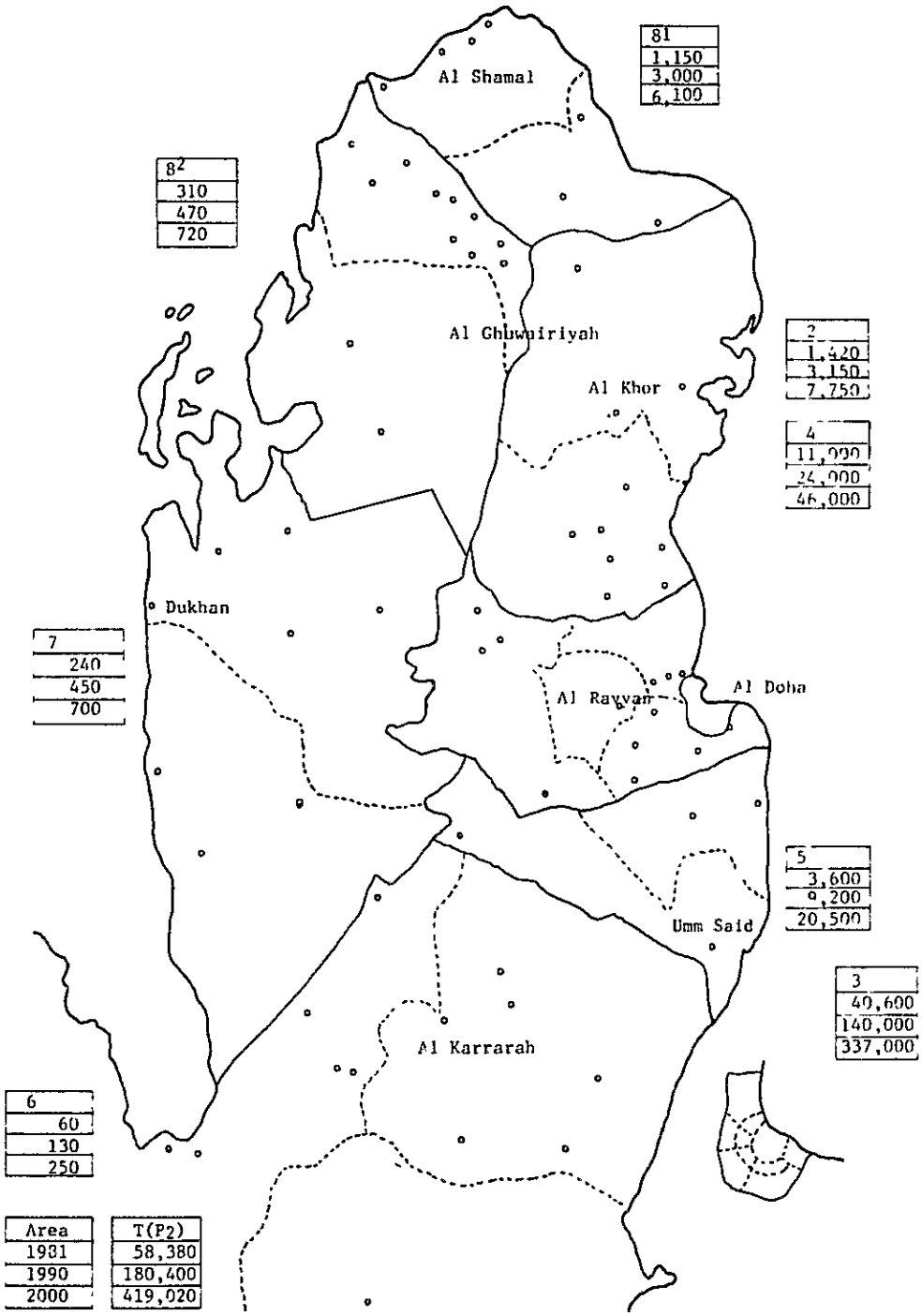


Fig. 4.3 Forecast of Future Telephone Line (P_2 Level)



Tables 3.1 through 3.8 list the sub-totals of the number of subscribers' lines per switching point provided in each zone block.

Table 3.1 Forecast of Future Telephone Line (Area)

Area	Sub Area	1977	1981	1985	1990	1995	2000
8[1*]	Al Shamal	400	550	1,200	1,500	2,000	3,000
	Al Ruwais	200	250	400	750	1,000	1,500
	Abu Dluf	170	300	500	600	800	1,200
	Al Arish	20	30	60	90	150	240
	Fuwairet	10	10	20	30	50	80
	Al Khisa	10	10	20	30	50	80
	Total	810	1,150	2,200	3,000	4,050	6,100

Table 3.2 Ditto

Area	Sub Area	1977	1981	1985	1990	1995	2000
2	Al Khor	650	800	1,000	1,500	2,500	4,000
	P. Post	40	60	80	170	260	450
	U. Swaijah	10	10	20	30	40	50
	U. Jarn	80	100	200	300	500	1,000
	U. Ali. Mohd.	370	450	750	1,150	1,600	2,250
	Total	1,150	1,420	2,050	3,150	4,900	7,750

Table 3.3 Ditto

Area	Sub Area	1977	1981	1985	1990	1995	2000
3	Doha Block "A"	10,500	13,000	16,000	17,000	19,000	23,000
	Block "B"	4,200	5,000	6,000	7,000	8,000	9,000
	Block "C"	2,500	3,000	3,500	4,000	4,500	5,000
	Block "D"	3,800	4,500	5,000	6,000	7,000	8,000
	Total	21,000	25,500	30,500	34,000	38,500	45,000
	New Doha Block "A"		3,000	6,000	11,000	16,000	20,000
	Block "B"			2,000	7,000	12,000	18,000
	Total		3,000	8,000	18,000	28,000	38,000
	Total	21,000	28,500	38,500	52,000	66,500	83,000

Table 3.4 Ditto

Area	Sub Area	1977	1981	1985	1990	1995	2000
4	Al Rayyan	2,300	3,700	6,000	8,500	11,900	17,300
	M. Khalifa	3,000	5,700	7,000	10,000	15,000	20,000
	El Jadid	1,000	2,000	3,500	5,000	6,500	8,000
	Shahaniyah	200	300	400	500	600	700
	Total	6,500	11,000	17,000	24,000	34,000	46,000

Table 3.5 Ditto

Area	Sub Area	1977	1981	1985	1990	1995	2000
5	Wukair Wakra	1,500	2,000	2,500	3,000	4,000	5,000
	U. Said	600	1,600	2,650	4,200	5,250	6,800
	Total	2,100	3,600	5,150	7,200	9,250	11,800

Table 3.6 Ditto

Area	Sub Area	1977	1981	1985	1990	1995	2000
6	Al Kharrarah	20	25	30	45	70	100
	Karanah	25	30	50	70	100	120
	S. Nathil	5	5	10	15	20	30
	Total	50	60	90	130	190	250

Table 3.7 Ditto

Area	Sub Area	1977	1981	1985	1990	1995	2000
7	Dukhan	100	150	170	250	320	400
	U. Bab	80	100	150	200	250	300
	Total	180	250	320	450	570	700

Table 3.8 Ditto

Area	Sub area	1977	1981	1985	1990	1995	2000
82*	Al Ghuwairiyah	140	190	240	290	390	470
	Al Jumairiyah	80	120	150	180	210	250
	Total	220	310	390	470	600	720

(Note) See Numbering Plan Tables

Figures 5.1 through 5.8 are graphic representations of the above tables. Figure 5.3 is provided for the perceptive understanding of the three telephone density levels as applied to the capital city (area 3).

Fig. 5.1 Forecast of Future Telephone Line

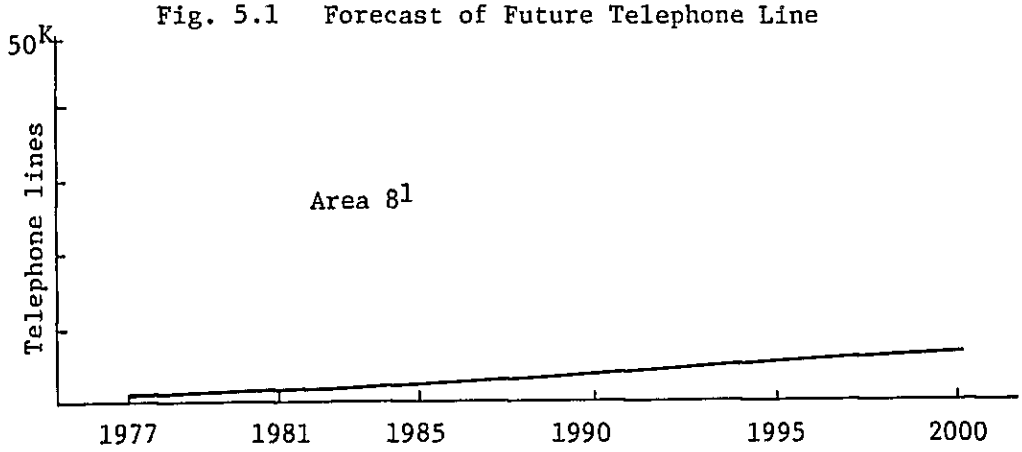


Fig. 5.2 Ditto

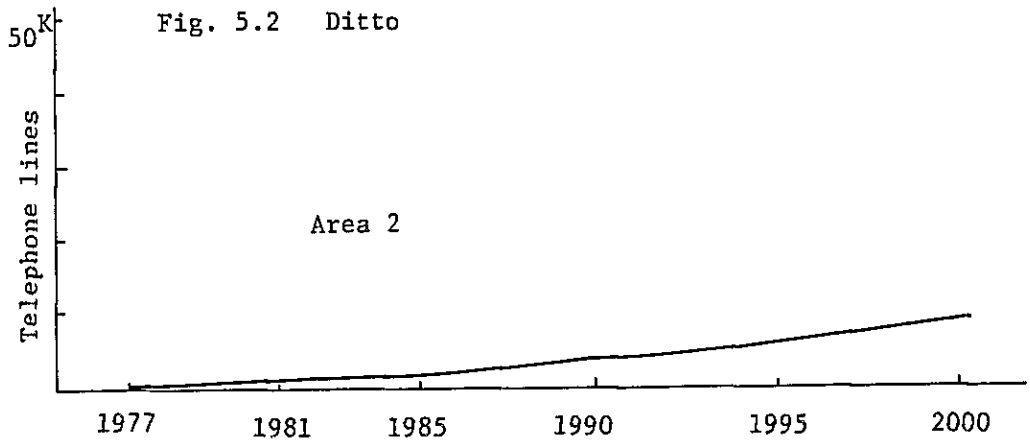


Fig. 5.4 Ditto

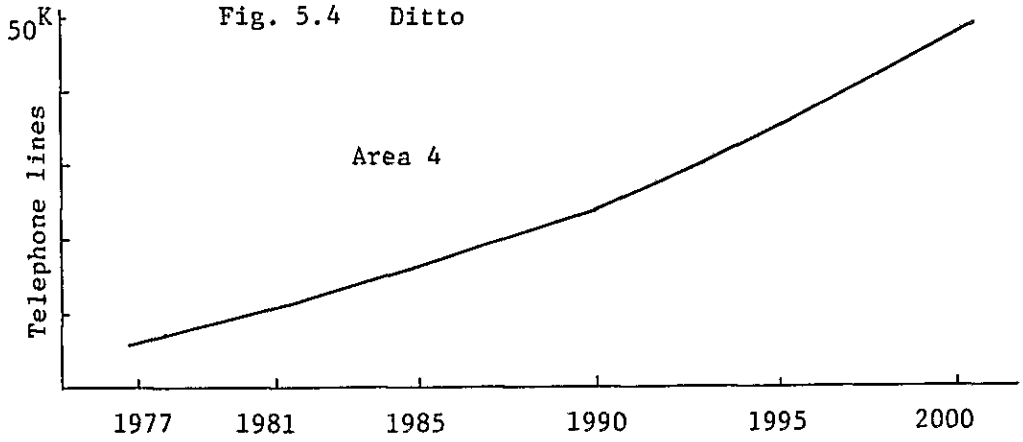
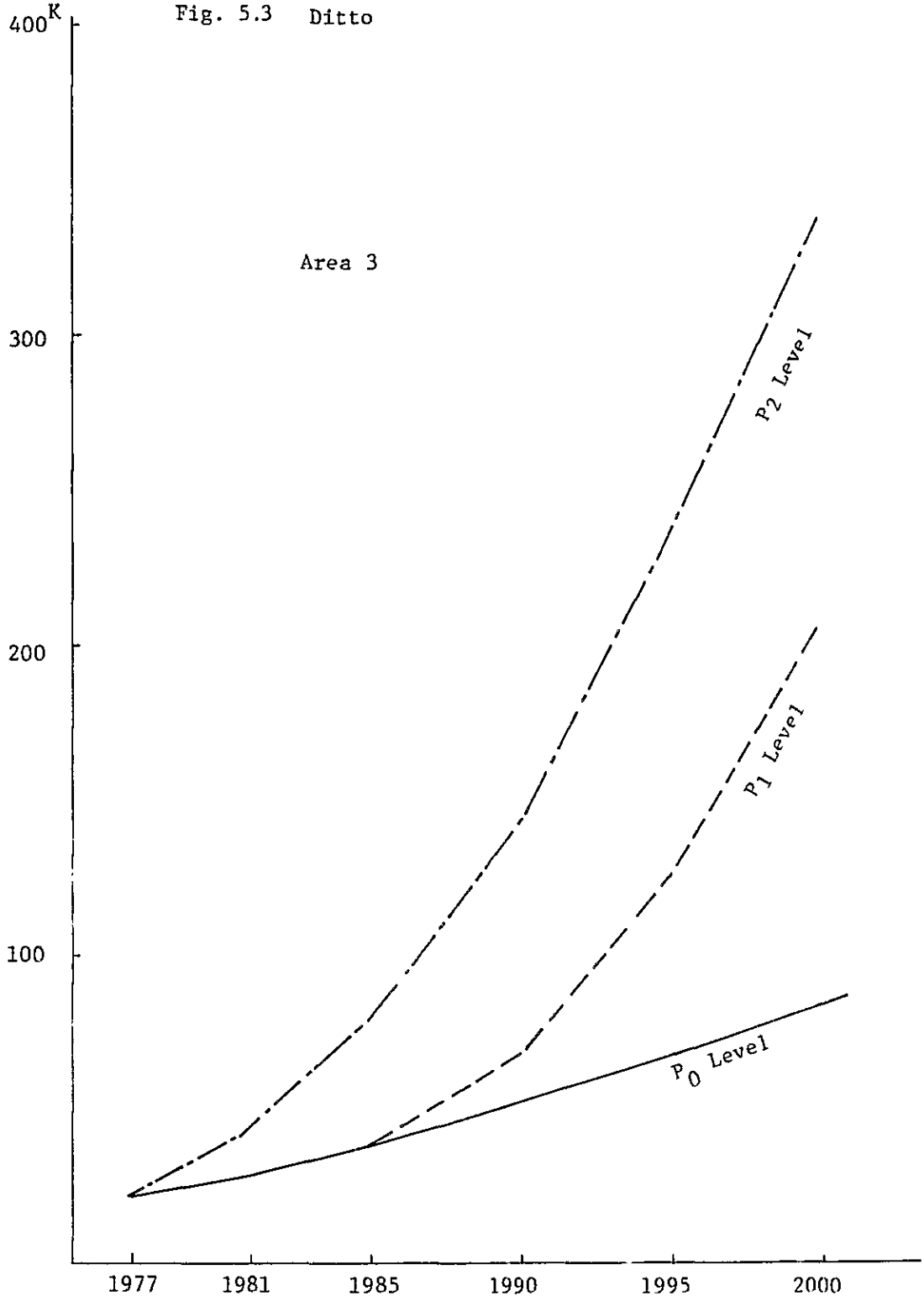


Fig. 5.3 Ditto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300
200
100
Area 3
P2 Level
P1 Level
P0 Level
1977
1981
1985
1990
1995
2000

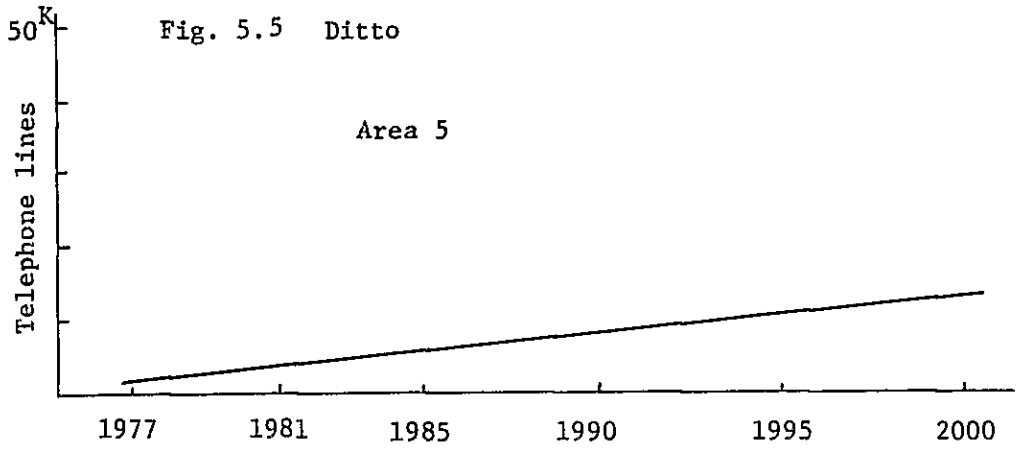


Fig. 5.5 Ditto

Area 5

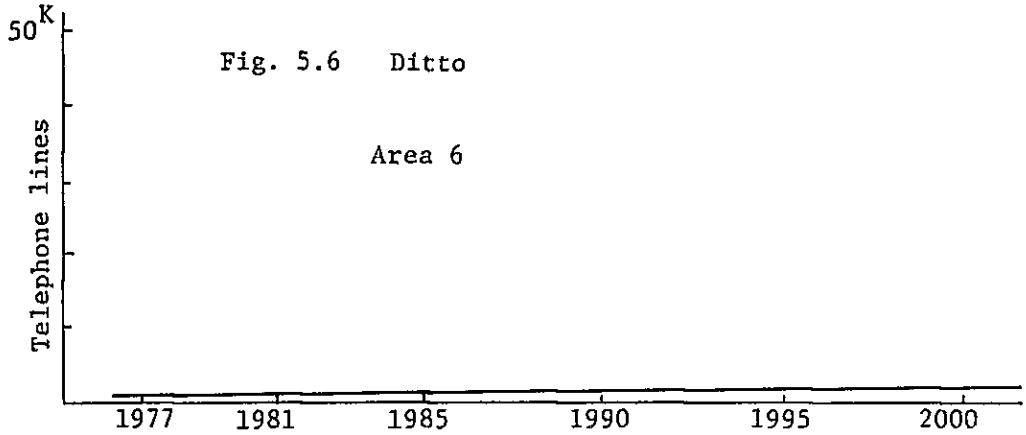


Fig. 5.6 Ditto

Area 6

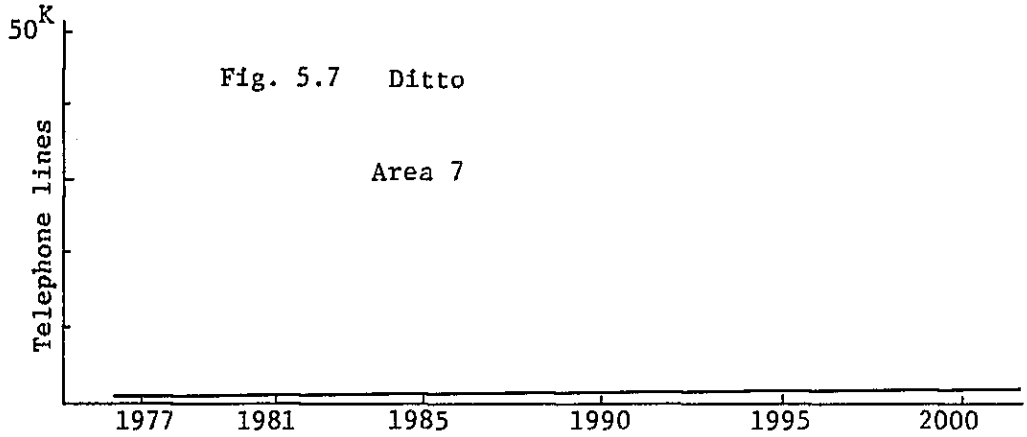


Fig. 5.7 Ditto

Area 7

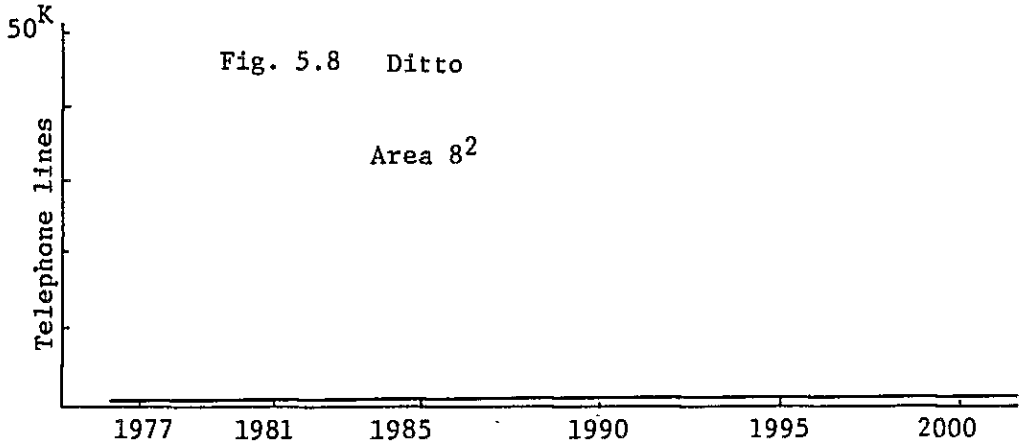


Fig. 5.8 Ditto

Area 8^2

5. Switching terminals as implementation plan

What to settle the switching terminal implementation plan for the satisfaction of subscriber's line demand per area described in the previous section is regarded as one of the most important subjects to be examined, since it will make direct and indirect influences on the investment amount, traffic overflow level and other factors.

As described in the study report (1), the investigation in October 1977 proved the occurrence of such an event as that the difference between the line accommodating capacity of switching system and the sum of waiter lines and subscribers' lines swelled to so many as 5,000 lines, and in order not to cause such an event, it is necessary to define the principles of switching terminal implementation plan.

The principles of switching terminal implementation plan described in this section mainly include the following three points.

First, the implementation plan should be settled to fully satisfy the total demand for subscribers' lines.

Second, to avoid such an inefficiency as to implement new switching terminals every year, the period for the practice of switching terminal implementation plan should be divided into two classes: for the offices with relatively low demand per year, 3 years after the start of service, while for the offices with relatively high demand per year, 2 years after the start of service.

Third, the basic plan settled on the above principles should be adjusted by addition or reduction, according to the individuality of each area, industrial development plan, etc. (see Note).

Tables 4.1 through 4.3 and Fig. 6 show the sub-total number of switching terminals per zone block in the implementation plan. The total number of switching terminals all over the country will be 55,000 in 1981. In the level P_1, this number will be increased to 76,000 in 1985, 123,000 in 1990 and 32,000 in 2000.

Table 4.1 Future Switching System Capacity Implemented (P_0 Level)

	Area	Center	1981	1985	1990	1995	2000
P_0	8^1	Al Shamal	1,500	2,300	2,900	4,000	5,600
	2	Al Khor	2,000	2,700	4,000	6,500	9,300
	3	Al Doha	31,700	43,900	57,800	73,100	89,600
	4	Al Rayyan	14,500	19,800	28,100	38,900	50,900
	5	Umm Said	4,300	6,100	8,100	10,300	12,800
	6	Al Karrarah	90	140	170	240	300
	7	Dukhan	350	450	550	700	850
	8^2	Al Ghuwairiyah	350	450	550	700	850
	Total		54,790	75,840	102,170	133,440	170,200

Table 4.2 Ditto (P_1 Level)

	Area	Center	1981	1985	1990	1995	2000
P_1	8^1	Al Shamal	1,500	2,300	2,900	4,000	5,600
	2	Al Khor	2,000	2,700	4,000	6,500	9,300
	3	Al Doha	31,700	43,900	76,500	139,600	238,100
	4	Al Rayyan	14,500	19,800	28,100	38,900	50,900
	5	Umm Said	4,300	6,100	10,200	12,900	14,700
	6	Al Karrarah	90	140	170	240	300
	7	Dukhan	350	450	550	700	850
	8^2	Al Ghuwairiyah	350	450	550	700	850
	Total		54,790	75,840	122,970	203,540	320,000

Table 4.3 Ditto (P_2 Level)

	Area	Center	1981	1985	1990	1995	2000
P_2	8^1	Al Shamal	1,500	2,300	2,900	4,000	5,600
	2	Al Khor	2,000	2,700	4,000	6,500	9,200
	3	Al Doha	58,000	90,800	155,500	257,800	377,400
	4	Al Rayyan	14,500	19,800	28,100	38,900	50,900
	5	Umm Said	4,300	6,500	10,400	16,200	22,300
	6	Al Karrarah	90	140	170	240	300
	7	Dukhan	350	450	550	700	850
	8^2	Al Ghuwairiyah	350	450	550	700	850
	Total		81,090	123,140	199,560	325,040	467,400

Fig. 6 Future Switching System Capacity Implemented

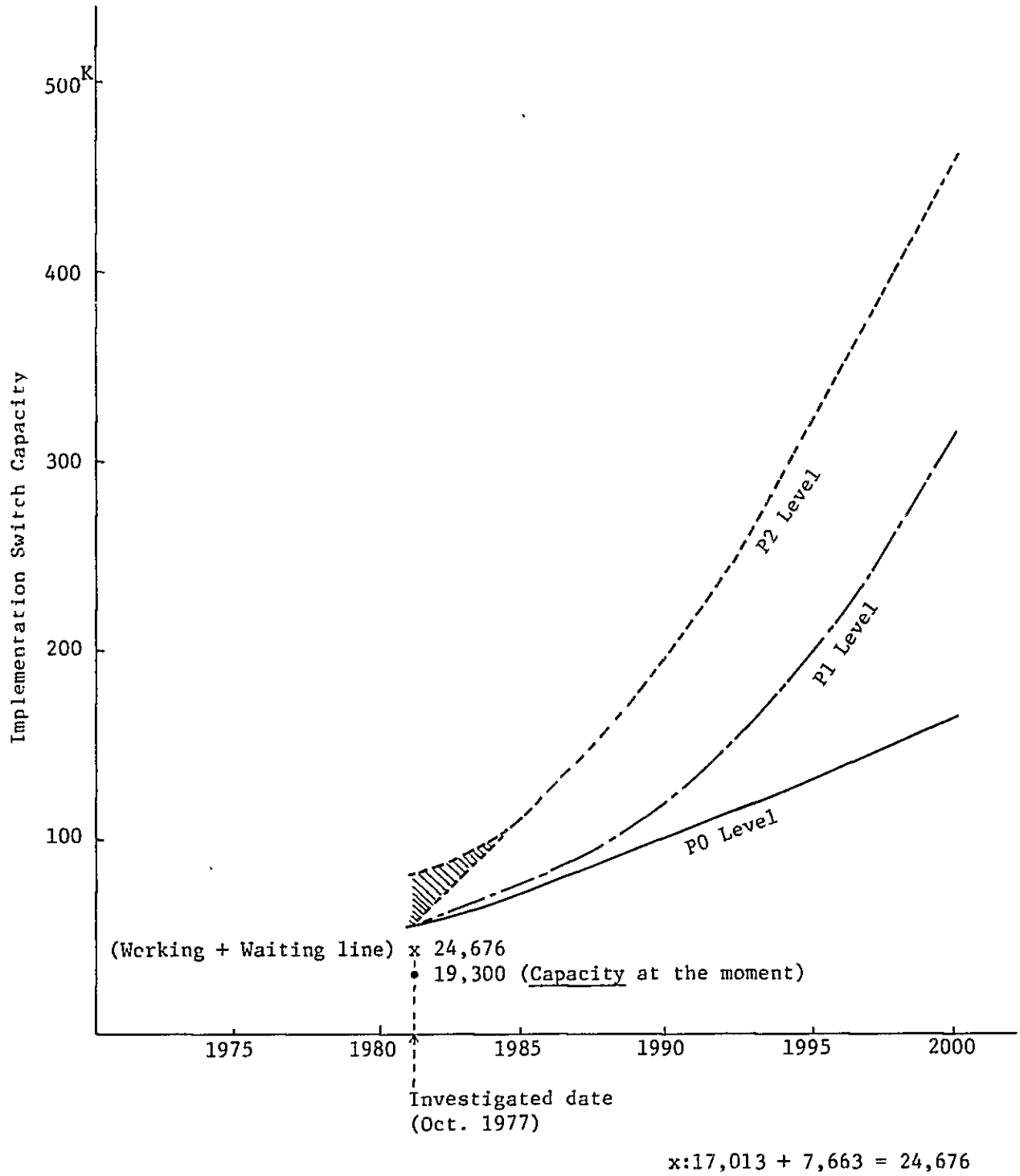
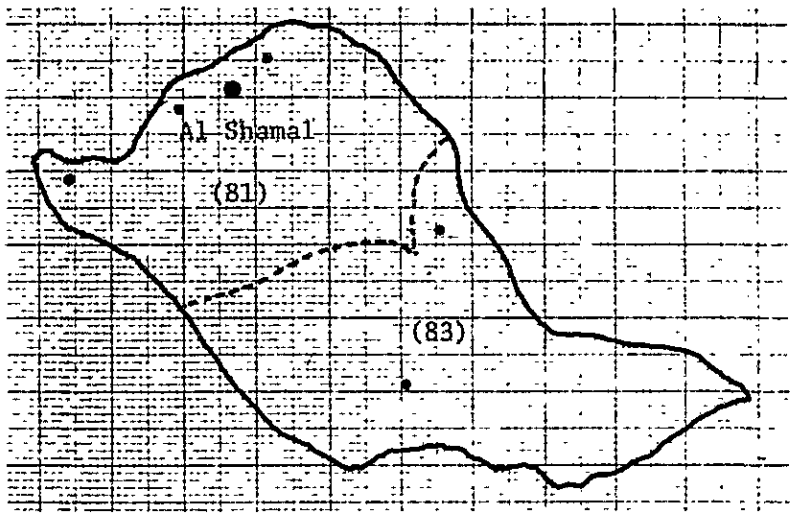


Figure 7 shows the number of switching terminals per area, per switching point and per year, in the implementation plan. Al Shamal office (area codes "81" and "83"), for example, will require 1,500 terminals in 1981 and 5,600 terminals in 2000. Al Rayyan office (area code "41"), on the other hand, will require 4,900 terminals in 1981 and 19,500 terminals in 2000.

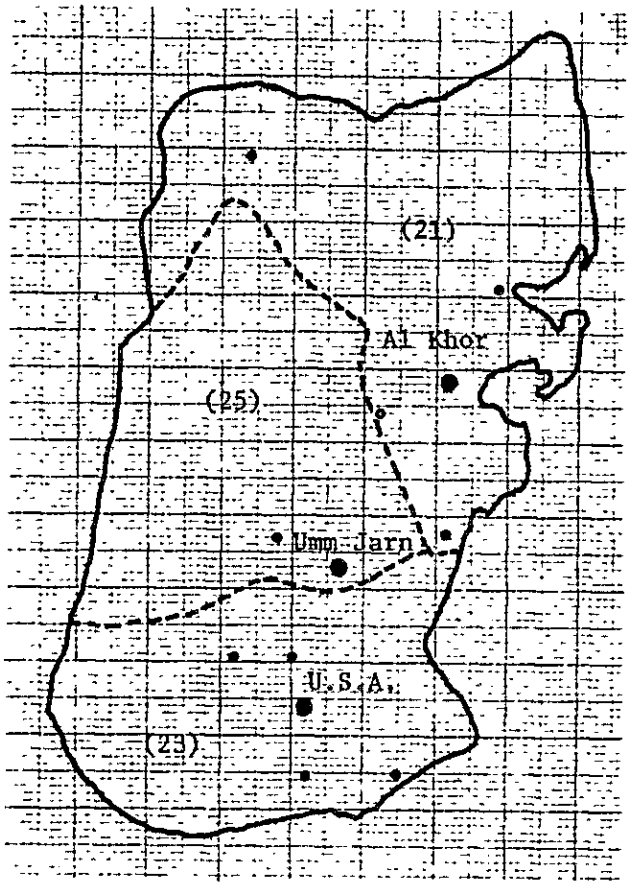
Fig. 7.1 Future Switching System Capacity Implemented at Each Switching point Area 8[1] (Al Shamal zone)



Service Area	1981	1985	1990	1995	2000
Al Shamal	1,500	2,200	2,900	4,000	5,600
Total	1,500	2,200	2,900	4,000	5,600

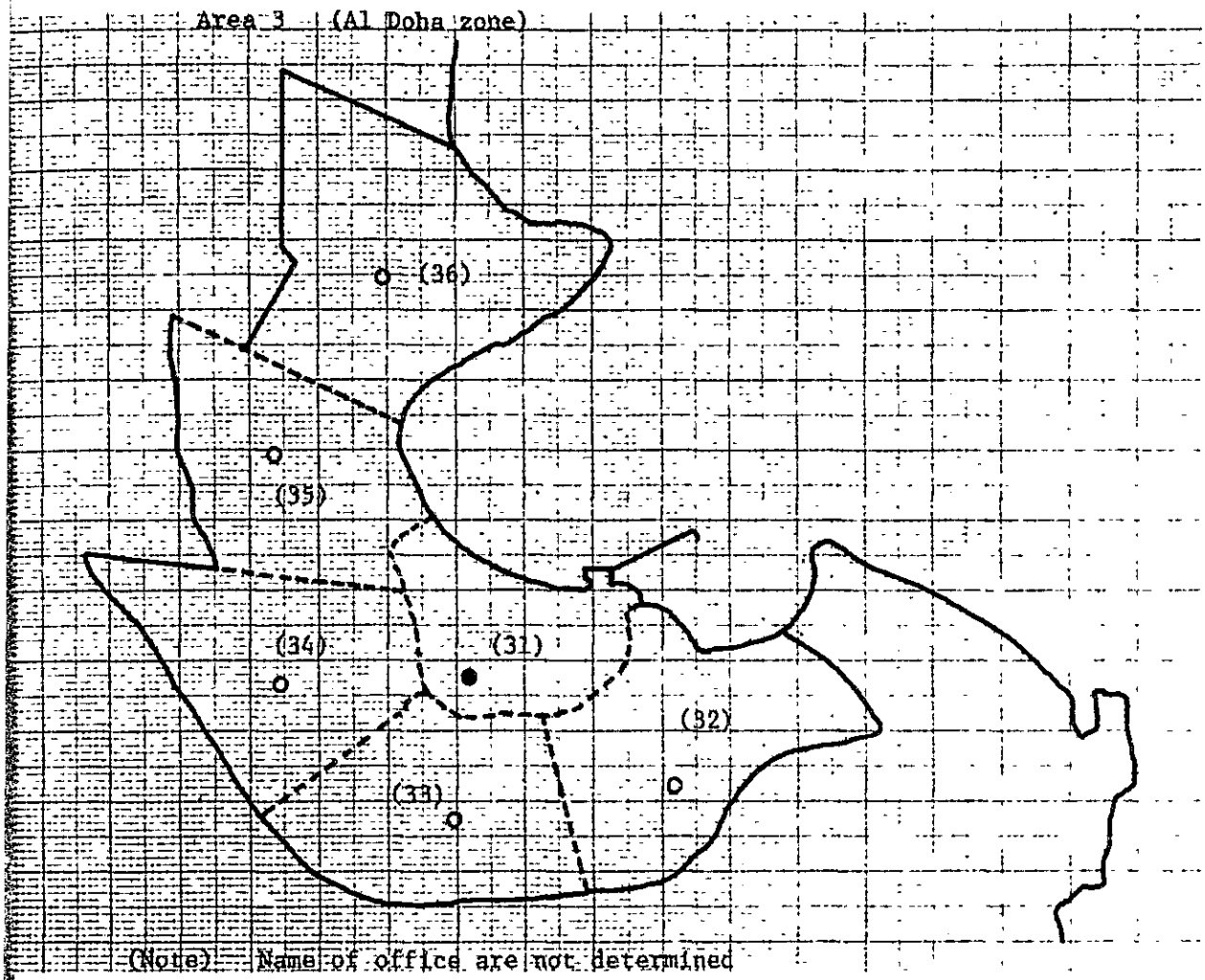
Fig. 7.2

Area 2 (Al Khor zone)



Service Area	1981	1985	1990	1995	2000
Al Khor	1,100	1,400	2,200	3,900	5,600
Umm Jarn	200	300	500	700	1,200
U.S.A. and M	700	1,000	1,300	1,900	2,500
Total	2,000	2,700	4,000	6,500	9,300

Fig. 7.3

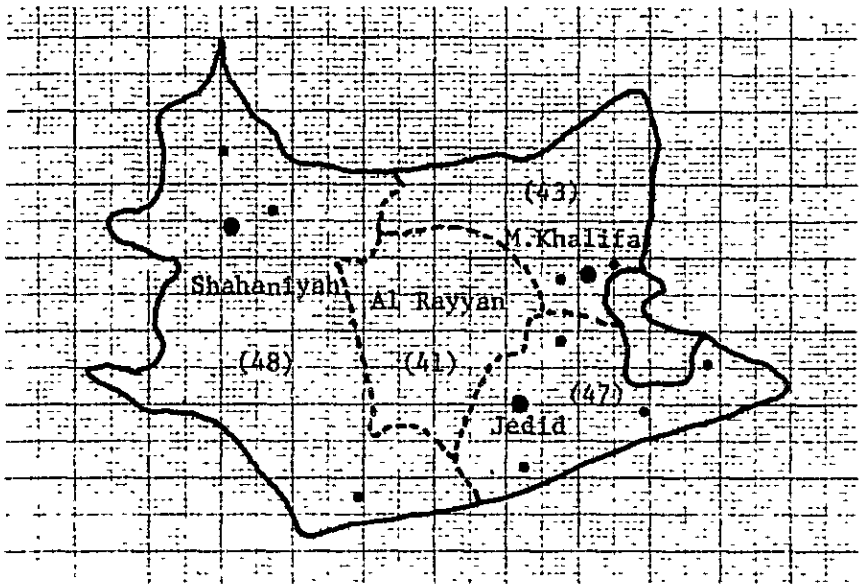


Service Area	1981	1985	1990	1995	2000
Doha Block "A"	14,200	16,400	17,800	24,600	24,600
Block "B"	5,400	6,400	7,400	8,400	9,400
Block "C"	3,200	3,700	4,200	4,700	5,200
Block "D"	4,700	5,400	6,400	7,400	8,400
Total	27,500	31,900	35,800	41,100	47,600
New Doha Block "A"	4,200	8,000	13,000	17,600	21,600
Block "B"		4,000	9,000	14,400	20,400
Total	4,200	12,000	22,000	32,000	42,000
Total	31,700	43,900	57,800	73,100	89,600

Developt. pattern	1981	1985	1990	1995	2000
P_0	31,700	43,900	57,800	73,100	89,600
P_1	31,700	43,900	76,500	139,600	238,100
P_2	58,000	90,800	155,500	257,800	377,400

Fig. 7.4

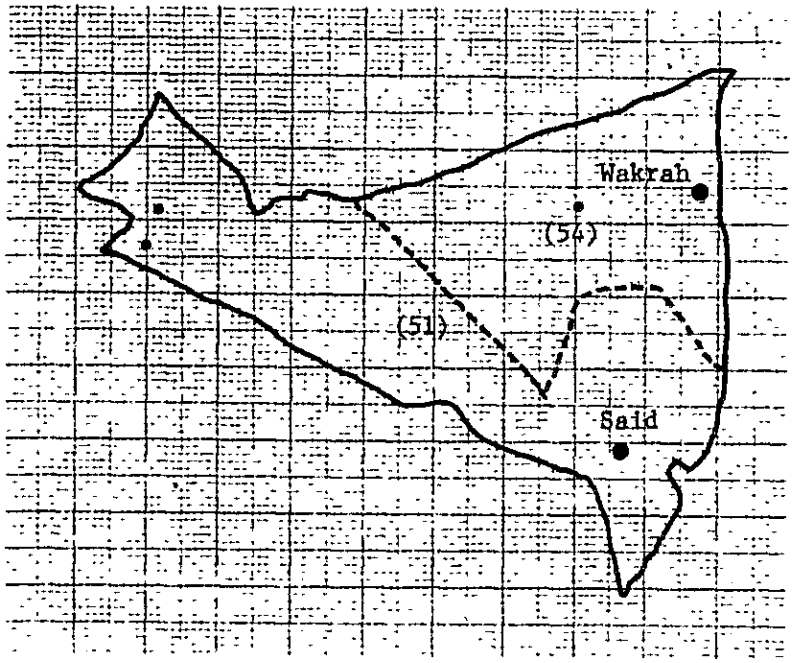
Area 4 (Al Rayyan zone)



Service Area	1981	1985	1990	1995	2000
Al Rayyan	4,900	7,000	9,900	14,100	19,500
M. Khalifa	6,400	8,200	12,000	17,000	22,000
E. Jedid	2,800	4,100	5,600	7,100	8,600
Shahaniyah	400	500	600	700	800
Total	14,500	19,800	28,100	38,900	50,900

Fig. 7.5

Area 5 (Umm Said zone)

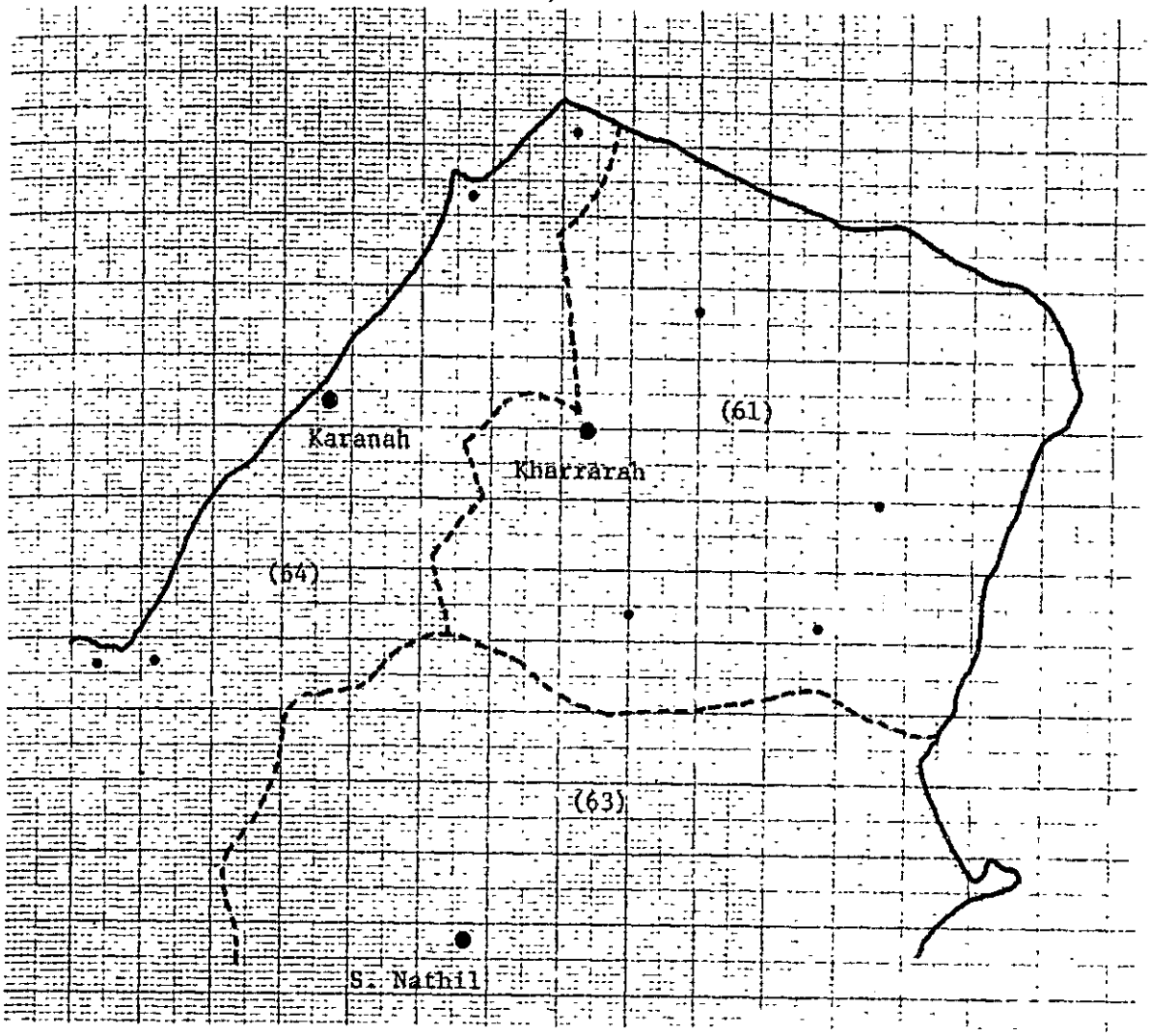


Service Area	1981	1985	1990	1995	2000
W. and Wakrah	2,200	2,700	3,000	4,400	5,400
U. Said	2,100	3,400	4,700	5,900	7,400
Total	4,300	6,100	8,100	10,300	12,800

Devnet pattern	1981	1985	1990	1995	2000
P_0	4,300	6,100	8,100	10,300	12,800
P_1	4,300	6,100	10,200	12,900	14,700
P_2	4,300	6,500	10,400	16,200	22,300

Fig. 7.6

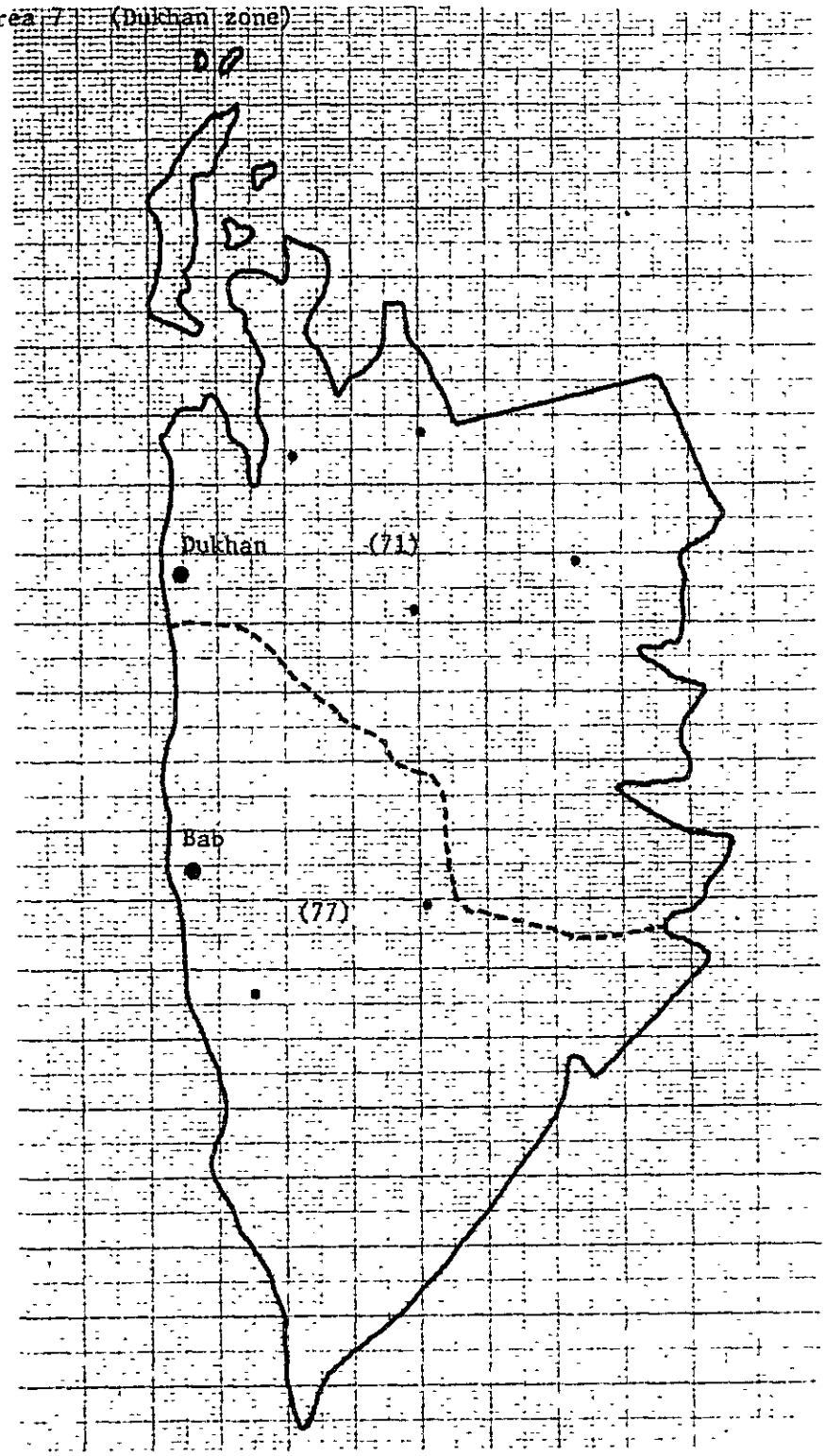
Area 6 (Al Karrarah zone)



Service Area	1981	1985	1990	1995	2000
Al Kharrarah	30	50	60	90	120
Karanah	50	70	90	120	140
S. Nathil	10	20	20	30	40
Total	90	140	170	240	300

Fig. 7.7

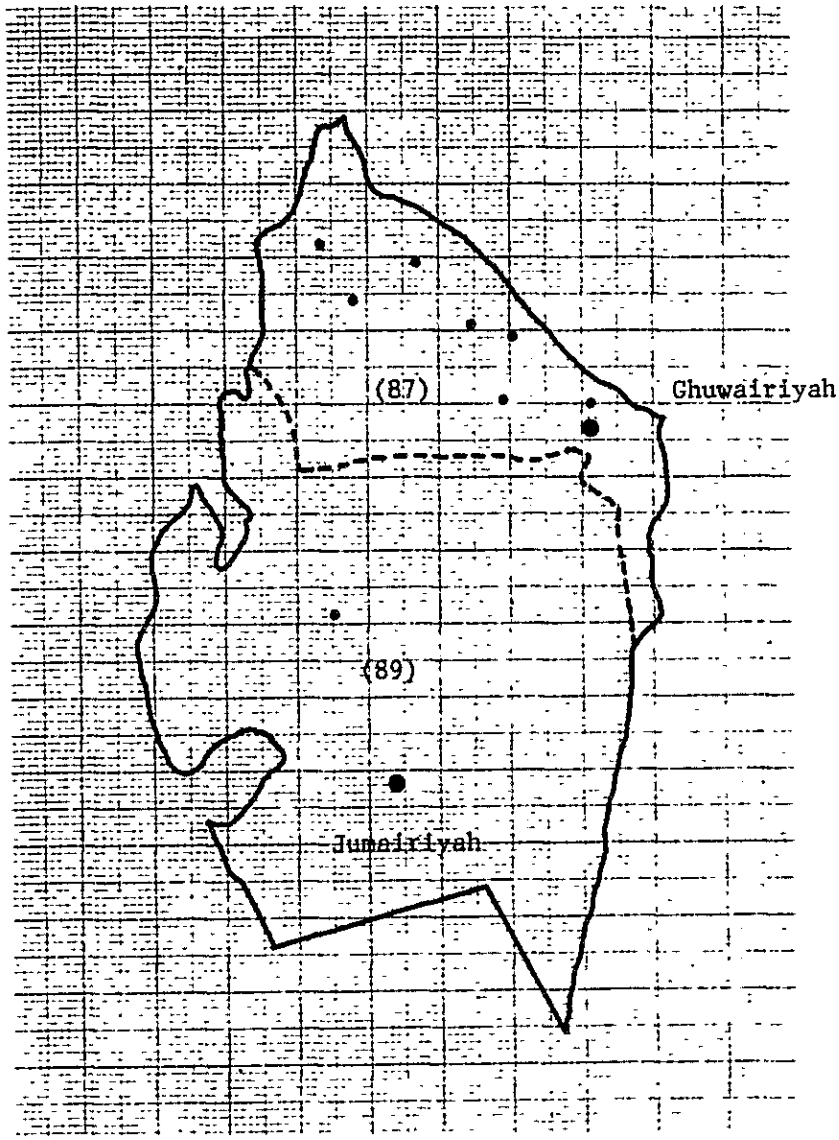
Area 7 (Dukhan zone)



Service Area	1981	1985	1990	1995	2000
Dukhan	200	250	300	400	500
Bob	150	200	250	300	350
Total	350	450	550	700	850

Fig. 7.8

Area 8^2 (Al Ghuwairiyah zone including into Al shamal zone)



Service Area	1981	1985	1990	1995	2000
Al Ghuwairiyah	200	250	350	450	550
Al Jumairiyah	150	200	200	250	300
Total	350	450	550	700	850

(Note) ● :Switching point

( ):Area code

The numbers presented in the figure are significant as the values to satisfy the subscriber's line demand mentioned in section 4, from the macroscopic point of view.

Since we had no enough time for the examination in detail, this report does not take the following factors into consideration: systematic implementation of public telephone boxes or pay station for diversification of risks in satisfying the telephone demand of foreign workers of every class engaged in various kinds of national development projects, new line implementation to avoid traffic overflow of the existing subscribers' lines, line assignment to business and residence telephones, etc. These factors must be defined in the preparatory stage of the definite settlement of the implementation plan.

Note: Implementing new switching terminals every other year according to highly accurate statistical data brings forth the following advantages: the idle period of planning staff can be applied to the self-active study and improvement of the statistical processing scheme, for finding latent demands for new telephone services and analysis study of population matrix configuration, which are followed by the feedback to the implementation planning; the idle period of staff of designing, construction, and maintenance and operation can be applied to the self-active study and improvement of the technical functions of facilities already implemented; as a result, it is possible for the whole staff to self-actively improve their abilities.

6. Switching system and transmission network in the national capital region

If the principles for the establishment of communication network in the capital city and its neighboring districts are summarized, they will become applicable to the establishment of nationwide communication network as a technical and project management standard.

In general, the conditions which must be satisfied for the configuration of a communication network are summarized into the following items:

(1) To secure the traffic ever changing in both quality and quantity, the communication network itself must be effective and sufficiently resistive both economically and functionally, whatever the condition be, normal, abnormal or emergent.

(2) It must be technically possible in the space of office floor to adopt new techniques and functions for cooperation with the existing system, at any time, after due consideration on the effect of equipment investment.

(3) Such works as collection of charging information, service order construction and traffic information processing must not be affected by the number and ability of staff members, but must be carried out relatively easily by means of online processing. It must also be possible to give the management information.

(4) The interface matching of the communication network with various communication systems introduced in the future, e.g. data communication systems, mobile communication systems, video communication systems, etc. must be performed relatively easily.

(5) Sound linkages must be established with the departments for support of system maintenance, such as the communication device manufacturing and assembling department and the parts and electronic device package supply center as well as with the department for support of construction works.

(6) It must be possible to carry out constant investigation, research and development pertaining to the techniques for improving and expanding the communication network, and pertaining to the devices and equipment composing the communication network and the necessary functions of network, independently or organically in cooperation with similar institutions of

the neighboring countries.

Figures 8 through 12 show technical network plans, each satisfying the conditions (1) through (3), which should have precedence in connection to the theme discussed herein. The subsequent explanation of each figure does not refer to the step-up periods in the process of network improvement and functional content needed in each period. The main reason for this omission is as follows:

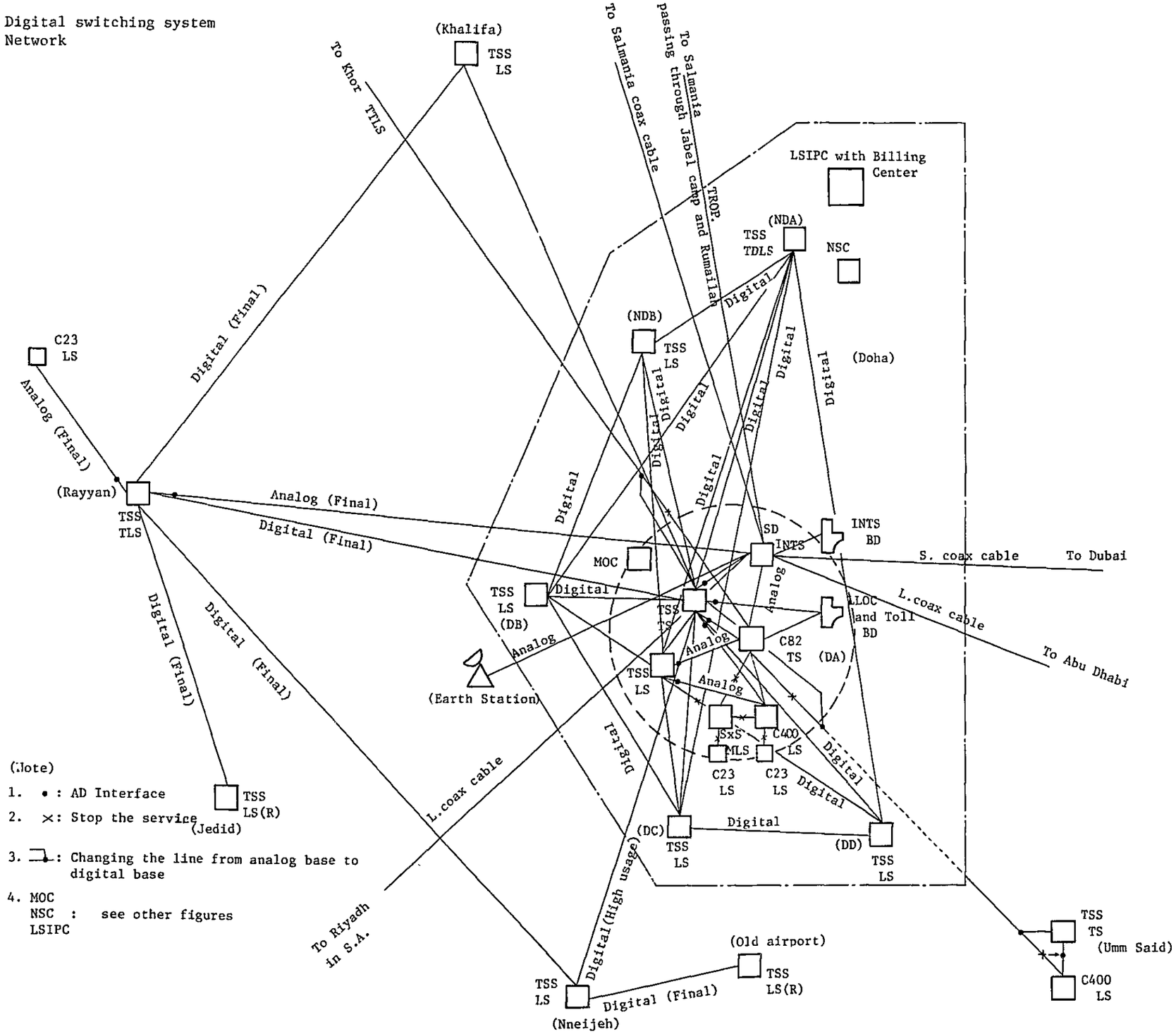
The functional content itself, the functional level in other words, has close relation to what level to set the number and ability of staff members responsible for the operation, investment amount, and the level and range of independent techniques introduced at the start of system. For the employment of staff, for example, there are so many important problems to be analyzed immediately: the educational system of Qatar must be analyzed, yearly change of the number of university graduates, general secondary and industrial secondary school graduates must be analyzed, the employment plan and training plan to match the expansion of communication system project (as well as to satisfy the racial harmony) must be settled, satisfaction of the condition previously mentioned in item (6) must be taken into consideration, and so on. Unless these problems are analyzed, true introduction of techniques cannot be achieved. Part of these problems have been analyzed and part of external conditions have been examined; however, the results of these examinations are omitted from this report as is not the main theme of the report, and further, for sufficient examination, it is indispensable to stay fairly long in Qatar and make a substantial discussion with the staff of each department and collect information.

Figure 8 shows a digital switching system network. This network plan is based on the following principles:

(1) The interface with the existing analog switching system network is provided. (It is inevitable that the interfaces to both the single-controlled and common-controlled switching systems are provided in the transient stage; however, to improve the call fill of digital switching system network, the single-controlled switching system is replaced with a common-controlled system in an early stage, as is low in traffic efficiency and noise characteristic. Note: Employment of removed system is described elsewhere in this report.)

(2) The interface with the analog switching system network is provided to the digital switching system side in principle; however, if this

Fig. 8 Digital switching system Network



(Note)

1. • : AD Interface
2. × : Stop the service
3. : Changing the line from analog base to digital base
4. MOC
   NSC : see other figures
   LSIPC

provision is inconvenient from the viewpoint of network economy or some specialties of the analog switching system of the existing network, a special interface only applicable to this case is provided, which will never affect another switching system introduction.

(3) The trunk class (high usage trunk or final trunk) is defined according to the character of site in which the switching system is implemented.

(4) Connection to the digital switching system network in the capital city is performed via a digital toll switching system, and the addition of analog transmission system via the C82 switching system is avoided to the utmost.

(5) The digital switching system is limited to that having building-block type structure, unless unavoidable (in other words, the blocks can be freely removed or appropriated to some other use in the case of miscalculation of future demand forecast or demand reduction).

(6) A remote control concentrator to satisfy demands of rural area is supplied to an area.

(7) Measures are taken for diversification of risks in the capital city communication network (traffic of telephone system, data communication system and wide area mobile communication system, underground facilities, change of demand and satisfaction level, etc.).

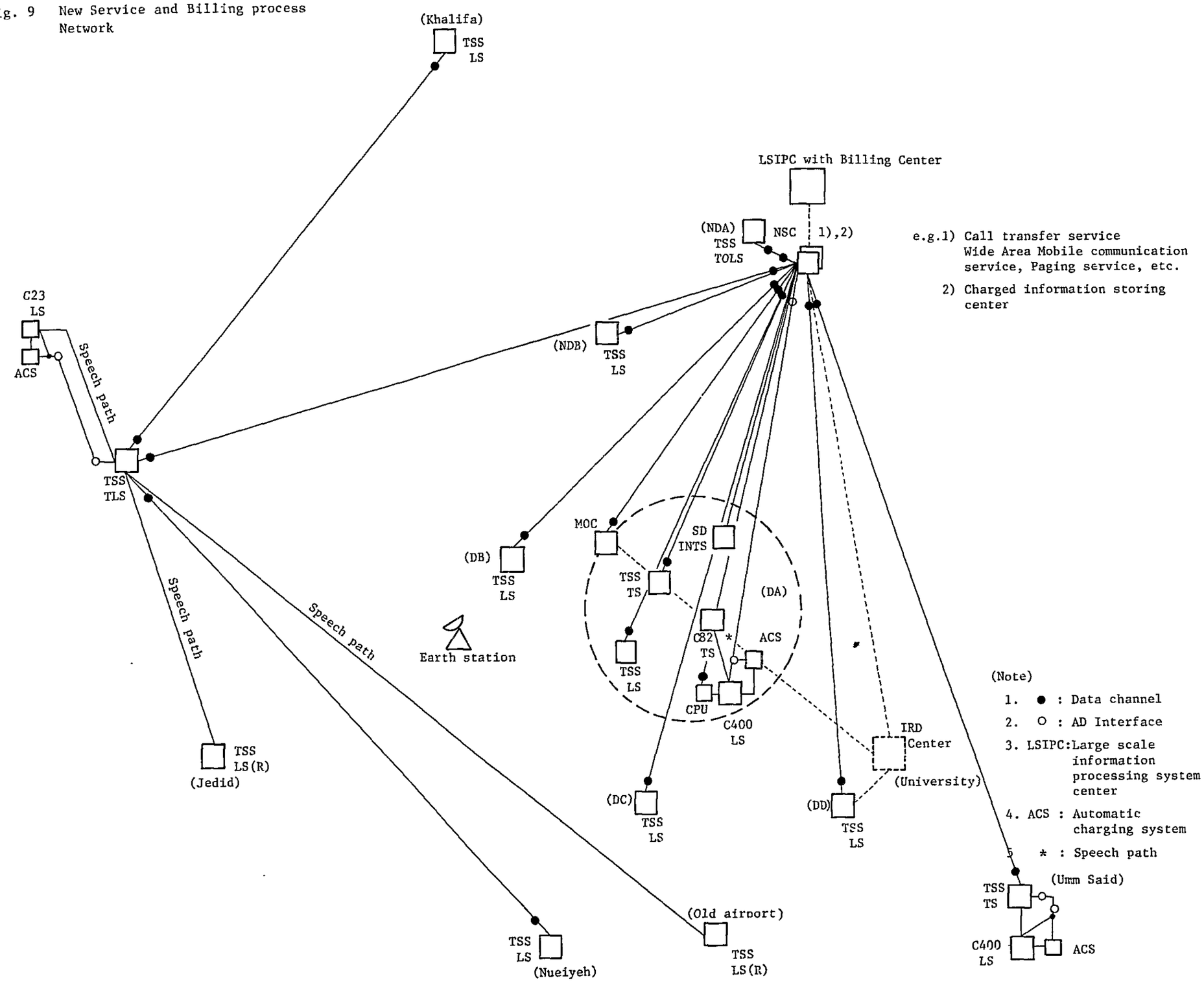
Figure 9 shows a new service and charging system network. The principles of this network plan are as follows:

(1) By the use of the features of the digital switching system, the call meter charging system of the existing analog switching network is functionally expanded, so that detail recording of both local and toll calls is enabled. For this purpose, the automatic charging system (ACS) is attached to the analog switching system.

(2) Irrespective of whether the switching system is based on the digital or analog technique, a channel separate from the speech path is provided to concentrate the information line to the new service center (NSC).

(3) The billing processing information or other information that require processing by a large-scale computer system is sent to the large-scale

Fig. 9 New Service and Billing process Network



information processing center (LSIPC) via NSC, by either online or offline base.

(4) The service of call transfer system, wide area service mobile communication system, and other systems, the up-to-date information of which must be integratedly processed (memorization included) as required by the whole country, are all performed via NSC.

(5) If a university or an investigation research and development center (IRD center) wants to make some actions through the communication network, it does so through the NSC and the maintenance and operation management center (MOC) described in the subsequent paragraph. If necessary, further, it makes the action through the network interface with one of digital switching systems, TSS LS of DD office for instance, which can be used with no troubles concerning the distance and traffic overflow.

Figure 10 shows a maintenance and operation management network. Figure 10 consists of two sheets, one showing the switching system side and the other the transmission system side. In the actual system, however, a great part of operation and maintenance functions pertaining to the switching, transmission, new service and charging networks are connected online to a single maintenance and operation management center (MOC), and in principle, operations are integratedly performed under the management of this center.

For the information transmission technique, the technique of controlling various functions according to this information, and the content of information processed in this system, various levels of technical hierarchy are considered. The levels can be naturally decided by the determination on whether only the communication network should be furnished with high-level functions or the communication network should be furnished with functions commensurate with similar functions of other public networks, and by the determination of what level to set the functions to meet the investment amount.

The principles of this network plan are as follows:

(1) The major maintenance and operation functions pertaining to the capital city digital switching system network are directly integrated to MOC irrespective of whether the system is a local system or toll system.

(2) The functions of analog switching system network are treated as follows:

Fig. 10 Maintenance and operation Management network (1/2)

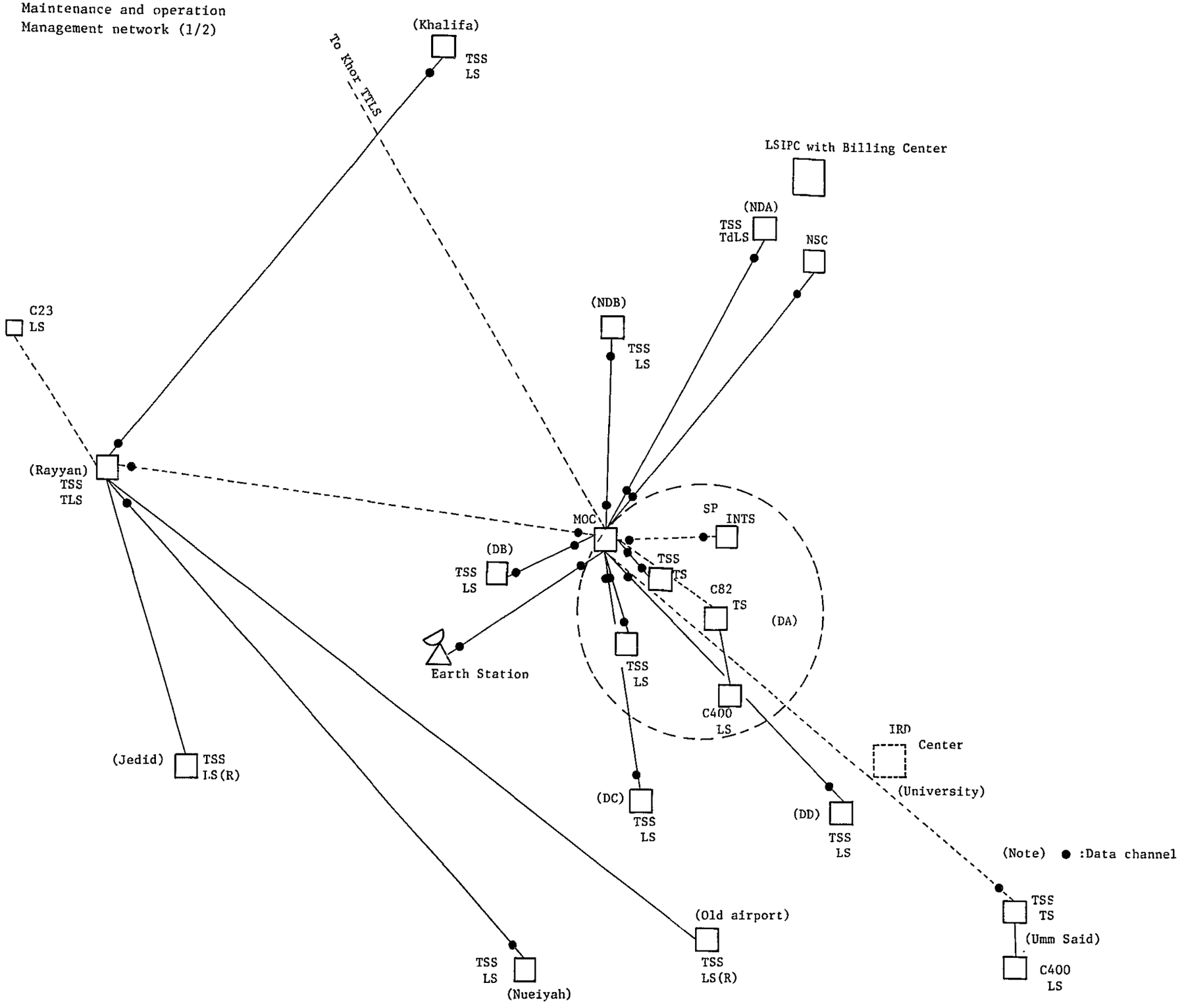
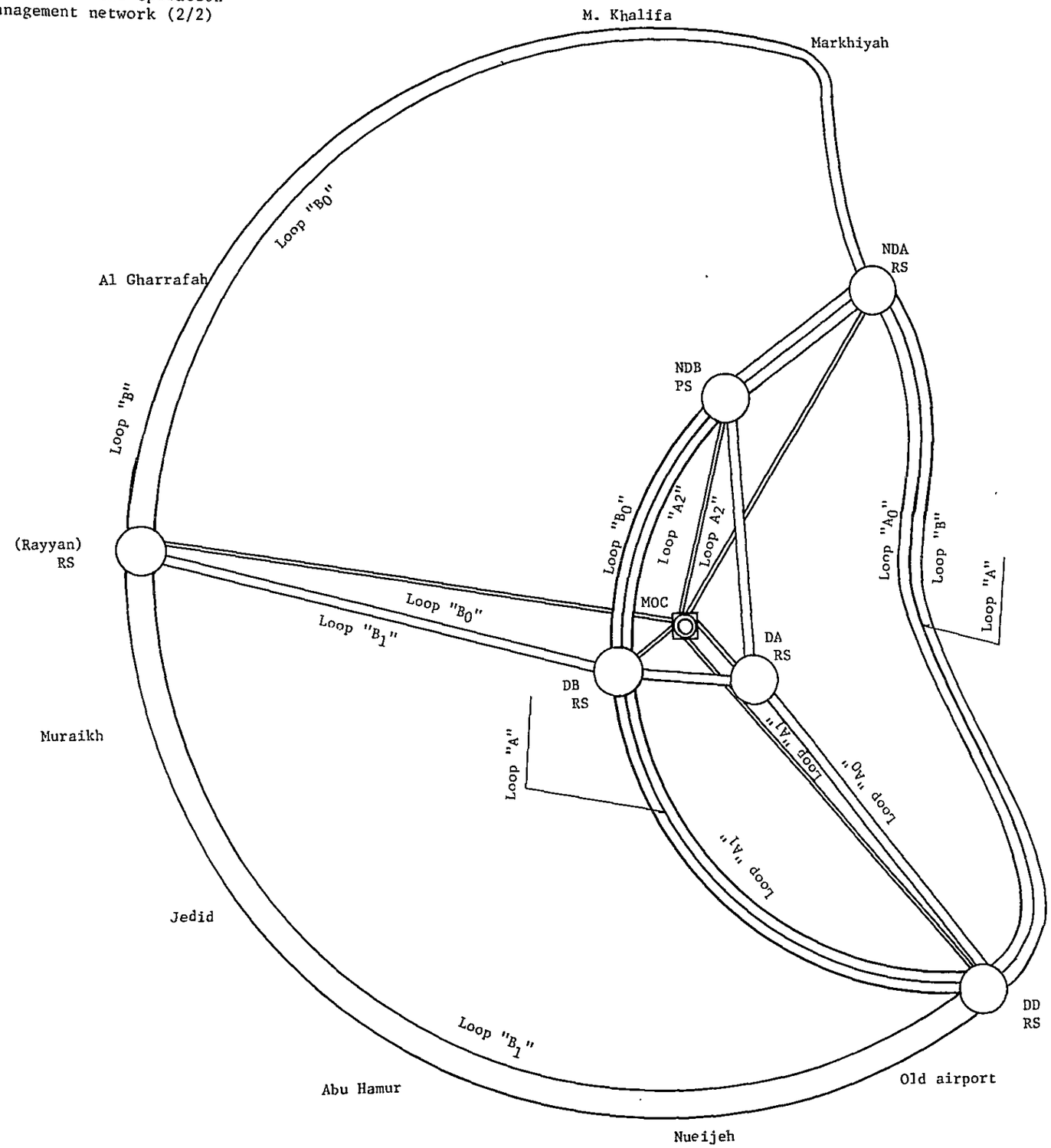


Fig. 10 Maintenance and operation
Management network (2/2)



①. The functions pertaining to the maintenance and operation of network are integrated to MOC via the upper class office in the network hierarchy, which is directly connected to the office.

②. The functions pertaining to subscribers' lines are left for the present in a part of maintenance and operation functions of the corresponding office currently responsible for those lines.

(3) The functions pertaining to the maintenance and operation of other offices than those in the capital city are integrated to the upper class toll offices in the network hierarchy, which are respectively connected to those offices. If required, necessary information is transmitted to MOC via the information line provided separately from the speech path.

(4) The functions for maintenance and operation of international network including satellite earth stations and international switching systems are partially integrated.

(5) The functions for maintenance and operation of NSC are partially integrated.

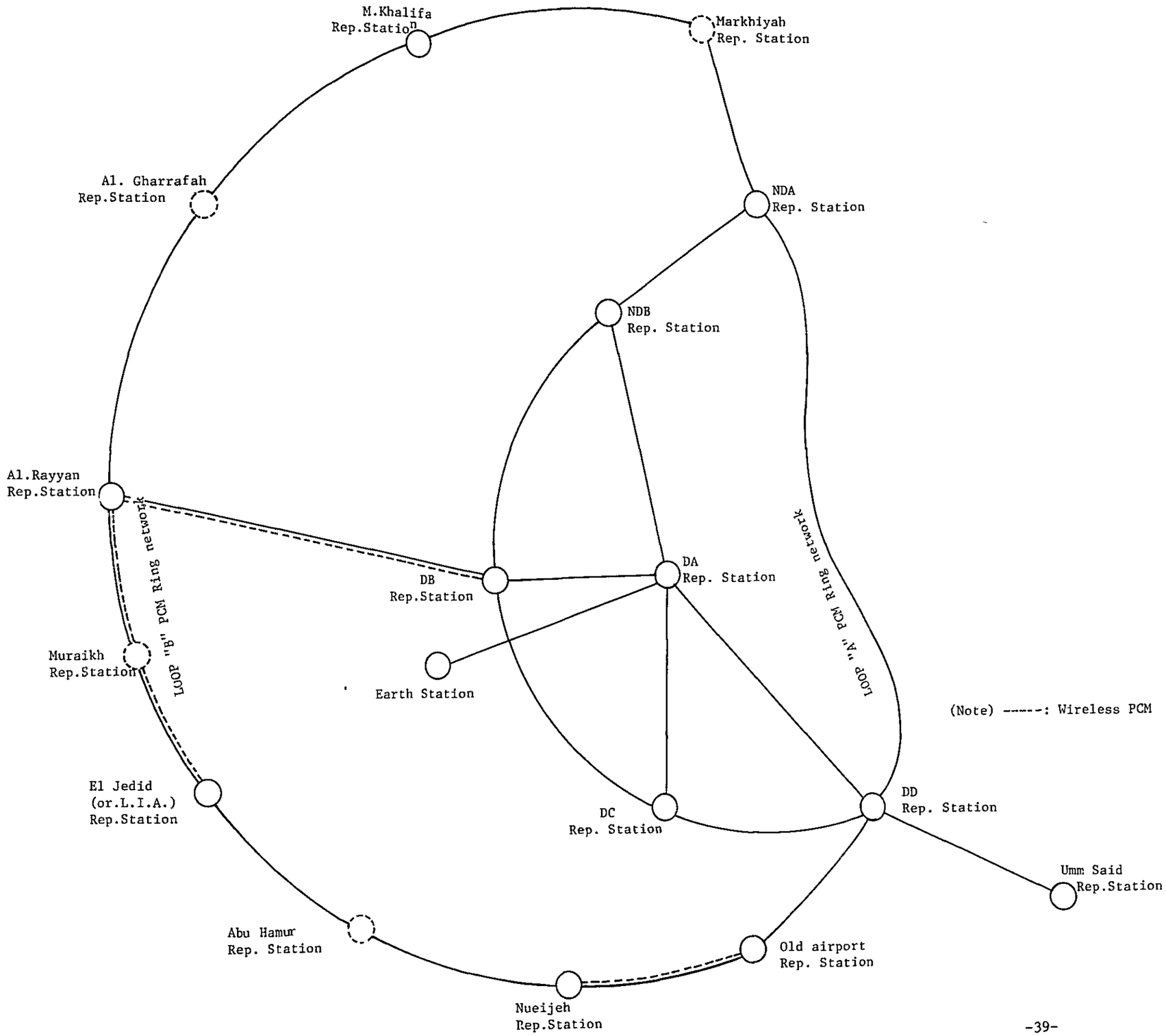
(6) Test devices necessary for installation test are all supplied to MOC.

(7) From the offices sited at the cores and nodal points of the loop type and star type PCM transmission networks (Rayyan, DB, DA, DD, NDB and NDA repeater stations; see Fig. 10), the operation information pertaining to two or more transmission routes is taken out and sent to MOC. MOC, on the other hand, performs network controls on a small loop basis, such as line supervision, fault section finding and route switching on a fault occurrence or test execution, as well as the traffic restriction of telephone offices under its control, job scheduling especially related to the switching system, transmission system and trunk lines among the ordinary works carried out as required, and various data collecting and totalizing processings.

Figure 11 shows the PCM transmission network in the national capital region (refer to Fig. 10 (2/2)). The principles of this network plan are as follows:

(1) Corresponding to the urban planning developed centering around the A, B and C ring road of the capital city, a concentric loop transmission

Fig. 11 Double Loop PCM Transmission Network



network is established, and a star transmission network is established around DA located in the center of the concentric circles.

(2) An outside loop transmission network is established to connect Rayyan to the neighboring districts of the capital city, which are partially developed as commuting towns, and the centers (DA and Rayyan) are connected with each other.

(3) The digital radio tranamission system is introduced to the sections between offices or concentrators of which the traffic and subscriber's line demand are low, or the sections in which the installation of transmission cables is difficult.

The above description is based on the assumption that the PCM technique will be introduced to trunk lines; however, consideration will be made also for the introduction of PCM technique (introduction of loop transmission system included) to the subscribers' lines if necessary, irrespective of whether the switching system is based on the analog technique or digital technique.

7. National communication network development phases (example: zone "8")

The sites of switching offices, subscriber's line demand, and switching terminal implementation plan for each area are described in the previous sections.

It is necessary to have a definite thought of what steps will be or should be taken to develop the communication network centerring around each switching office in each zone or between zones.

Three development phases of zone "8" are shown in Fig. 12, since it is an important point though not included in the range of the present work.

In the first phase, a switching system (a removed portable switching system is appropriated) and a rural communication device are implemented in Al Shamal, and subscribers' lines in the service area are integrated to this office. Further, a small-capacity digital toll switching system is implemented with direct lines provided between Khor switching office and this office and between Doha switching office and this office respectively.

In the second phase, the portable type switching system is modified into a digital switching system for the commensuration with the trend of telephone demand. The period of this phase is decided to meet not only the telephone demand but also the time of introduction of national wide area mobile communication service, etc.

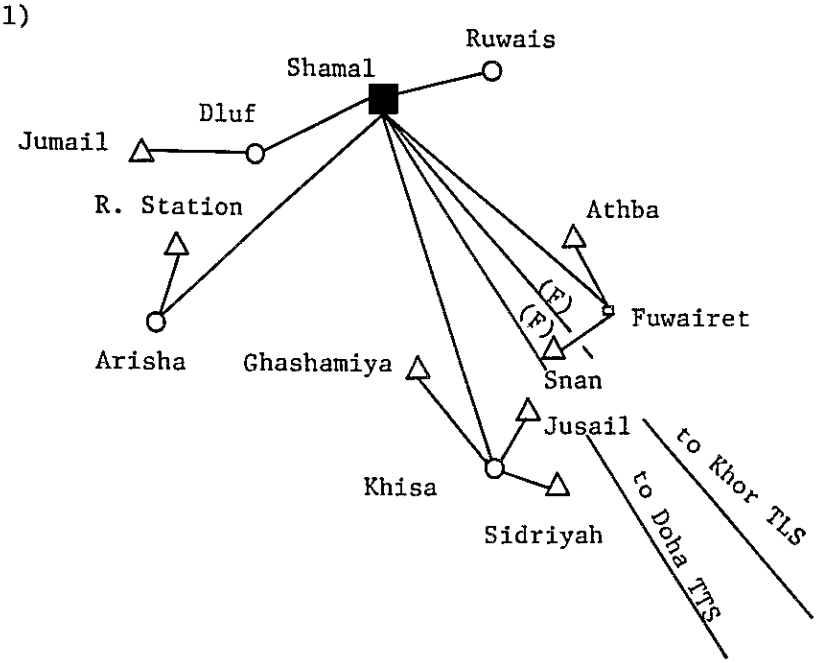
Besides the introduction of PCM transmission system technique to both Al Shamal - Ruwais section and Al Shamal - Abu Dluf section to improve the investment efficiency, single-controlled digital switching systems commensurate with the demand of these two destinations are implemented to the respective offices, or a concentrator is implemented, so that the destinations can be remotely controlled from the parent office (Al Shamal office). Also the trunk class is changed from direct or final trunk to high usage trunk to be commensurate with the traffic density.

With the practice of wide area mobile communication service, a mobile wireless telecommunication station is implemented at each of Khisa (car telecommunication use), Fuwairet and Arish (maritime telecommunication use).

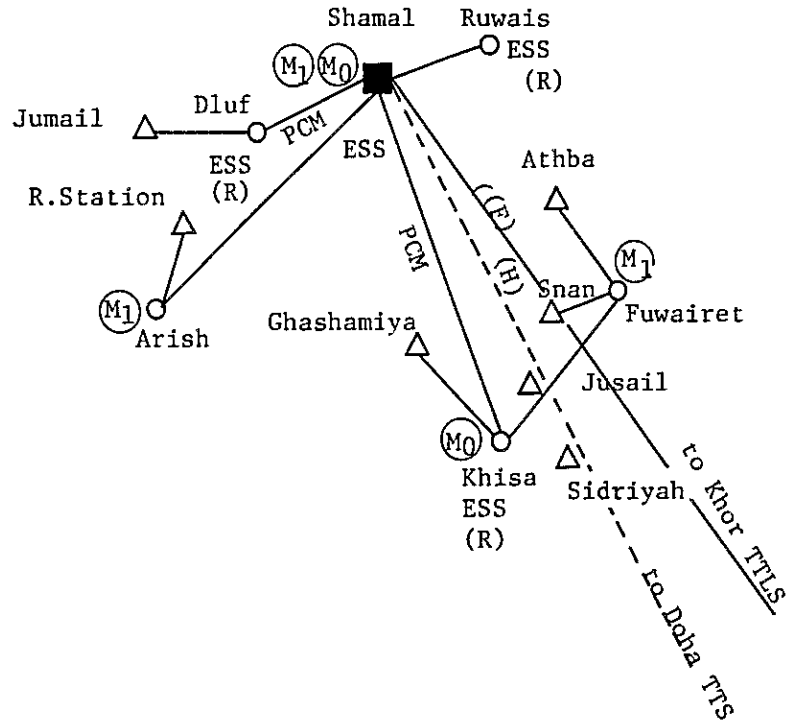
In the third phase, the whole transmission system and switching system are expanded and the digital technology is introduced to part of the system.

Fig. 12 Area 81 Network development phases (Example)

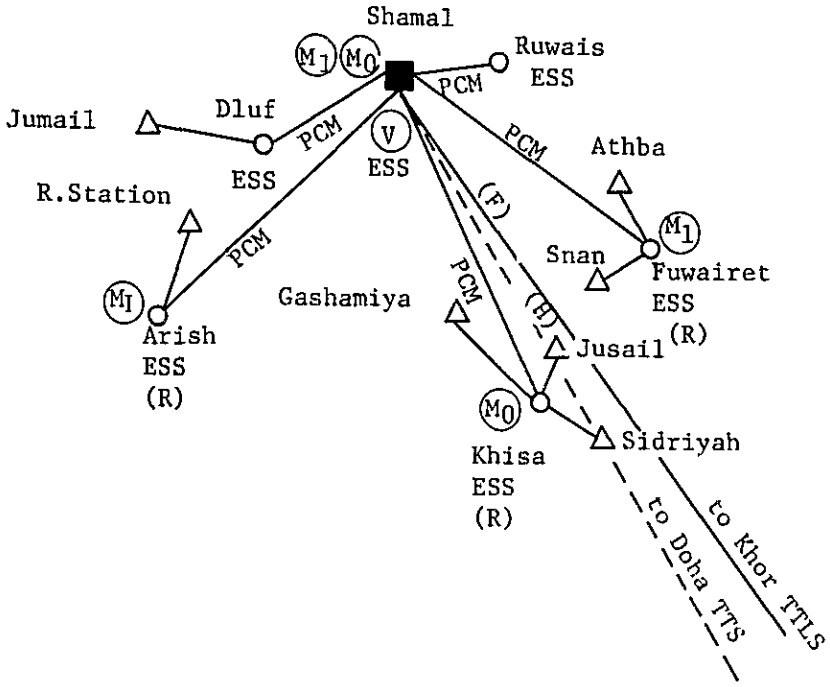
(Phase 1)



(Phase 2)



(Phase 3)



To Al Shamal office, further, the video telecommunication system is introduced.

In case demands arise with the progress of national development project for this area, an independent digital switching system may be implemented in the semi telephone office service area "83" (see Fig. 7 Area "81").

8. Works requiring continuous examination by the time of project settlement

(1) Synthetic planning and adjustment of the whole communication network design

(2) Cable routing plan (subscriber's cable, local and toll junction cable and leased line)

(3) Technical standard (traffic engineering standard, switching performance, loss probability distribution, post dialling delay in full automatic service, transmission engineering standard) and compensation technique in the communication network

(4) Transmission system network plan (FDM or PCM)

(5) Communication network interface design (on an area basis)

(6) Forecast of the number of trunks and lines (on an area basis)

(7) Switching stage hierarchy and trunk class setting

(8) Design of rural telecommunication system connected as a branch to the basic telecommunication system

(9) National wide area mobile telecommunication system design

(10) Service trunk design and data communication network introduction plan (on an area basis)

(11) Maintenance and operation management system introduction plan (staff, system, function, managing procedure, etc.)

(12) Investigation, research and development system (examined in relation to the activities of other gulf countries)

(13) System plan to aim at nationality balance power, technology assimulation and development, and long-term staff employment and training plan based on the past and present situations of school education system

(14) Long-term investment plan for office buildings and facilities (including preceding investment for purchase of sites)

(15) Test of devices and equipment upon purchase, and final acceptance

test of the same devices and equipment after installation

(16) Process management of construction work

(17) Material management

(18) Management items, management standard and management scheme for the project management on the base of telephone office as well as the total system

Listed above are the important works thought out for the present time. To impart the technical knowledge through steady practice of these works with on-the-job training, it is desirable to take the following procedure.

The system should be started with one able member experienced in planning and practicing a whole communication network, three members of technical staff (experienced in switching system network, transmission system network and cable network respectively) and some members of Qatar government agencies, who are capable of absorbing techniques and useful for negotiation with the staff of other related departments. With the progress of work, the staff should be intensed on appropriate occasions.

9. Conclusion

The contents of this report, the Annex included, are summarized in the following:

(1) The telephone density in Qatar is forecasted in three levels, based on the forecast of telephone density levels in some typical counties in the world.

(2) The population forecast (until 2000) is reduced to half of the value presented in the study report (1).

(3) Corresponding to the above population forecast, the subscriber's line demand per zone is calculated for each level of telephone density. In the relation to various development plans, it is proposed to set the demand in 2000 to at least the level P_1, namely, more than 50 telephone sets per 100 population.

(4) There are described the principles for the settlement of implementation plan, definite sites of offices and the scale of system. A reference is made to the advantages of system expansion performed every other year.

(5) There are described the principles for the establishment of digital switching and transmission network, charging and new service network, and maintenance and operation management network in the national capital region, with definite network diagrams given. It is also mentioned that continuous examination is necessary for the functions to be implemented and hardware configuration.

The problem of the maintenance and operation management network, especially, has multi-dimensional connection with the future employment and training of Qatari technicians and engineers, organizing of technical investigation: research and development center in reference to the curriculum of university and so on.

Therefore, it is declared that to make a practical and definite reference to external conditions is difficult unless technical specialists stay relatively long in Doha to establish a project for the examination of basic plan.

(6) The national communication network development plans are examined on the particular example of zone "8". Since the problem of rural

communication involves factors closely related to the local adminisyration and the national development plan, it is proposed to boil down the external conditions in the process of discussion among specialists of various fields staying in the site.

(7) Various items which must be examined prior to the settlement of implementation plan are listed.

To forecast a future communication network, settle a plan, and practice the plan from a nationwide, long-range point of view, it is required of the people engaged in the project the constant, self-active study, capability to cope with any change, accumulation of technical knowledge in every phase for future application, and mutual reliance; further, it is important to guarantee for these people the worth-working conditions and sufficient livelihood.

It will be true that Qatar is now entering the greatest turning point in the history of the communication network establishment. Success depends only upon whether Qatar will or will not find a truly reliable party for technical inter-change.

Annex

1. Development progress in Qatar

The table lists the yearly outline of development plans and their achievement, pertaining to the infrastructure, industry, agriculture, fisheries, etc. according to the "Year Book".

The steelmaking industry (iron scrap disposal and reproduction included) is a trait to distinguish Qatar from other gulf countries. On the analogy of the cases of forward countries, it can easily be supposed that this trait will make what is called the "mining effect" in the near future, together with the other industrial activities by the effective use of such underground resources as oil and gas. The mining effect will result in what is called the "manufacturing effect" in the combination with the aluminium, cement and petrochemical industries.

Now let us express the number of main telephone sets in Japan in index, setting the number in 1970 (when the mining effect became remarkable) to the base index and representing that in each year of 10 years before, 5 years after, and 10 years after 1970 by an index related to the base index. If the base index is applied to the number of main telephone sets in Qatar in 1981 (when steelmaking industry will be in full operation), the numbers in 10 years before, 5 years after, and 10 years after 1981 are calculated to 46K, 138K and a little over 320K respectively. These values give substance to the previous forecast that the value will be intermediate between levels P_1 and P_2.

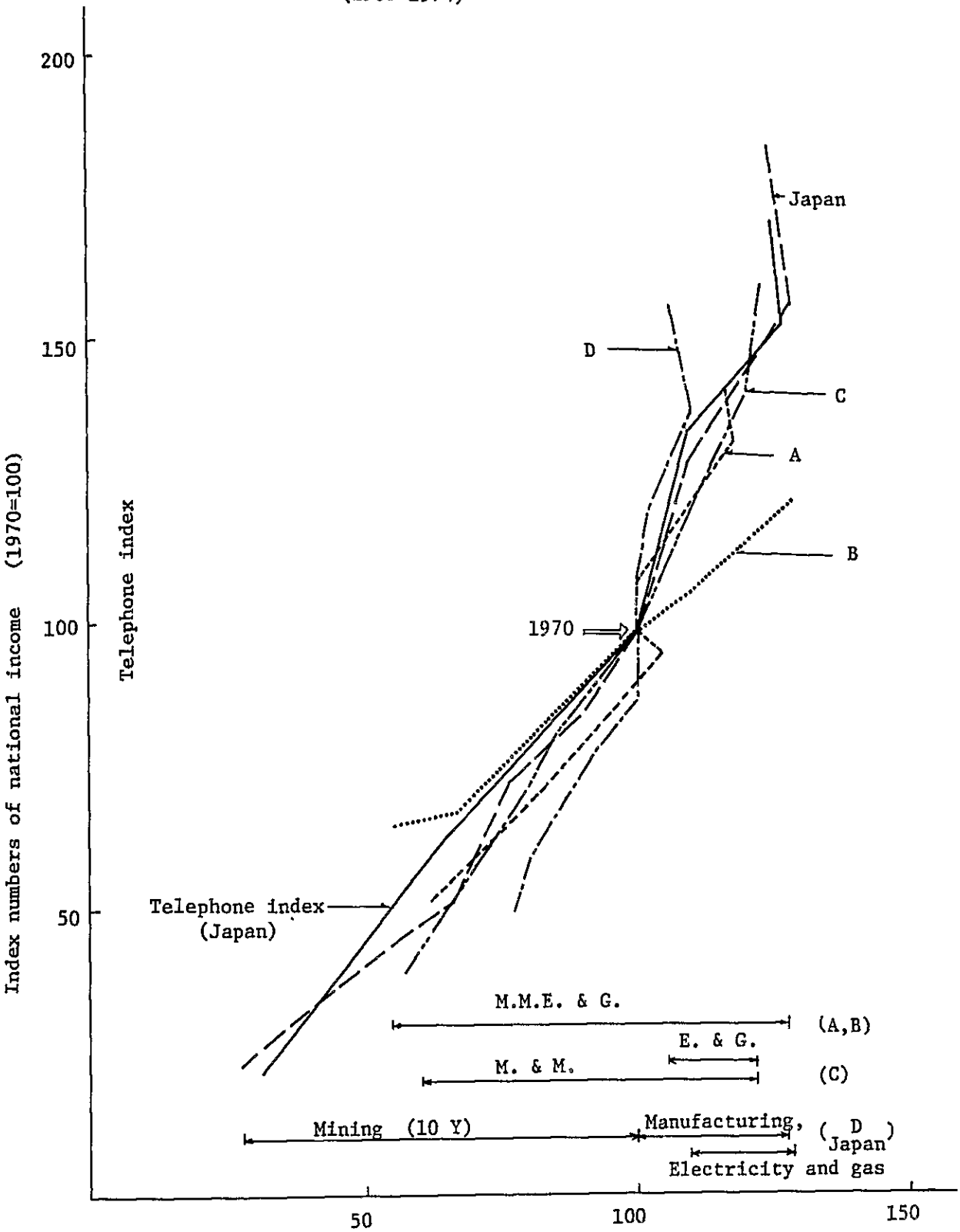
The above result forecefully suggests that it is desirable to set the telephone density to level P_1 upon the settlement of long term telephone system expansion plans, including the 5-year telephone system expansion project which must be settled in the near future.

Table 1 Number of Telephones Corresponding to Development Progress in Qatar, in the Comparison between Forecasts Based on Annex and Based on Table 2

Telephone Lines	1981	1990	1995	2000
Based on Annex (K)	46	138	230	320
Based on Table 2 (K)	46	109	183	282

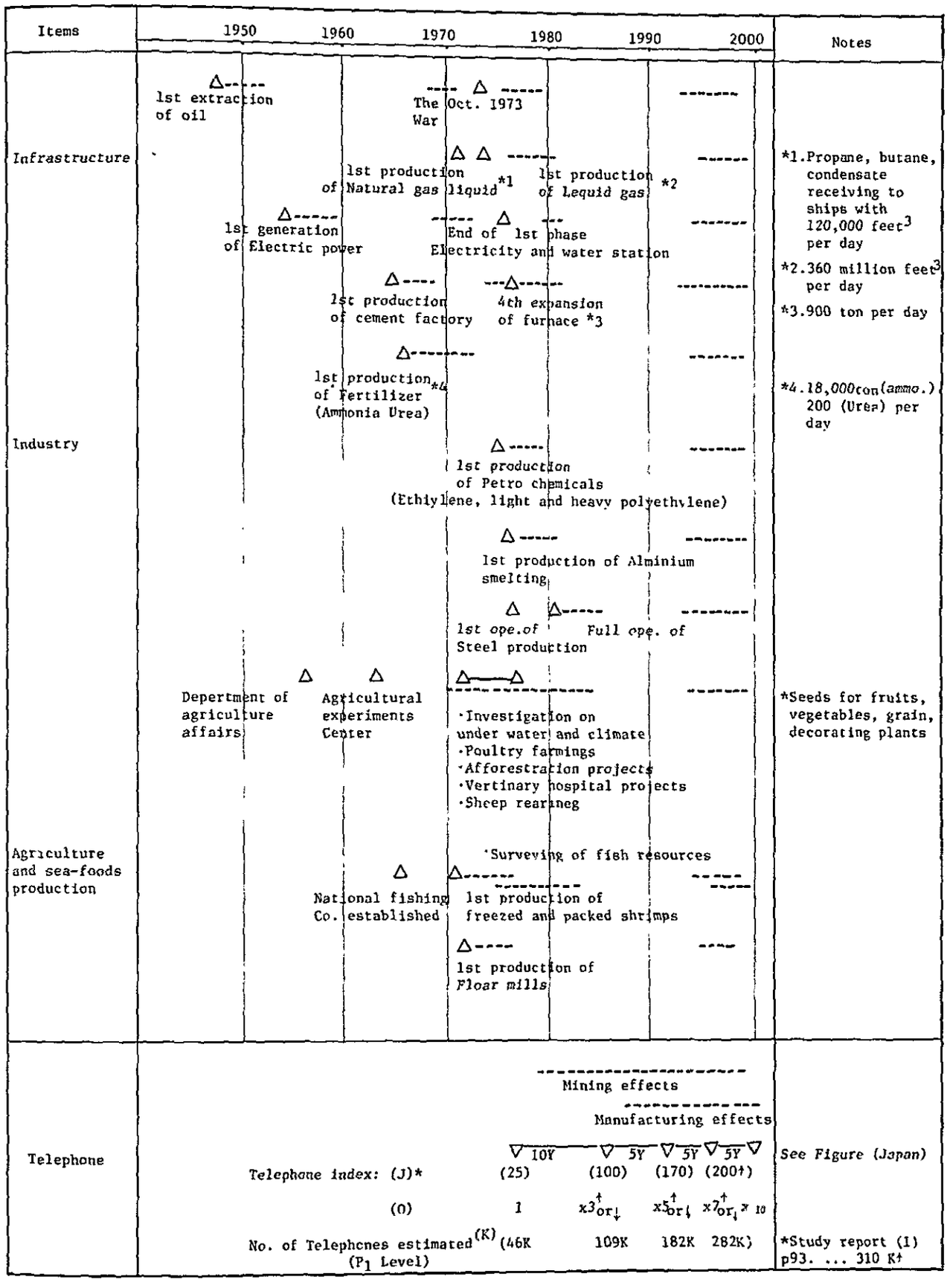
Using for Potential growth in telephone forecast

Fig. 1 Index numbers of industiral production and National income (1960-1974)



(Note) A-D : The industrially proceeding countries

Table 2 Development progress in Qatar



2. Communication network zone system forecast from 2000 till 2025 and center site setting in each zone

On a minute observation of inhabitants of desert, no one can say that a district now containing scarce population will remain as it is after 50 years or 100 years.

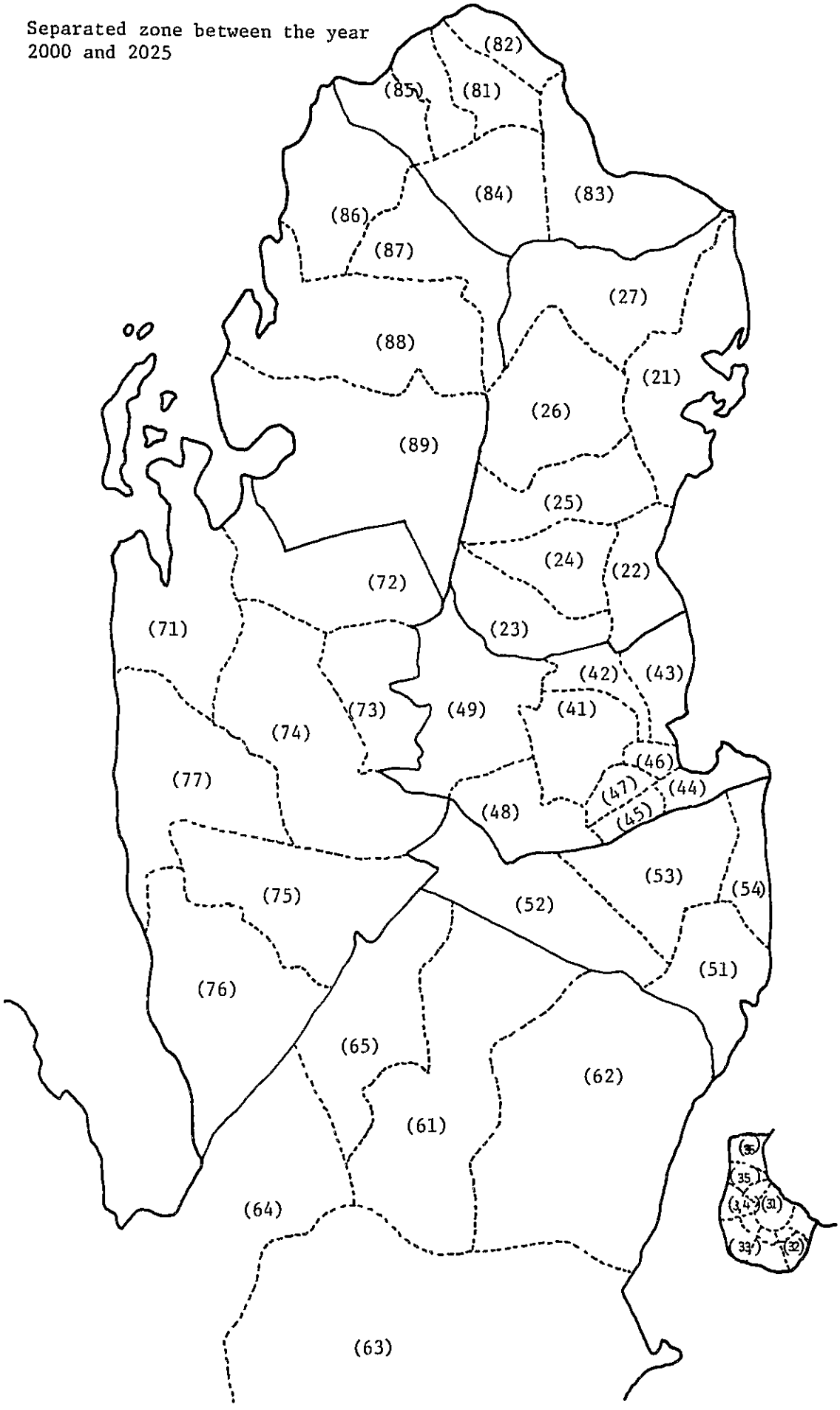
In the same manner, if a part or considerably large part of the land is excluded from the telephone office site setting and service area assignment plan merely because there exists a desert, it may be proved to be a serious miscalculation in the future.

From the above point of view, the zone system in this report regards every district as equal in the long range observation, though their environment and inhabitation are different from each other for the present time.

If the zones are allocated to center around roads which have close connection to conditions of human life for the most part, it is made easy to connect or introduce new communication systems to the existing network without any human errors or difficult judgment, no matter when, where, and how demands for new communication systems arise. It also is made easy to settle the numbering plan, charging system, etc.

Figures 2 and 3 show a definite zone system and sites of center offices. Plural sites are proposed for some areas since we did not have enough time to select the most suitable one in the investigation up to this time.

Fig. 2 Separated zone between the year 2000 and 2025



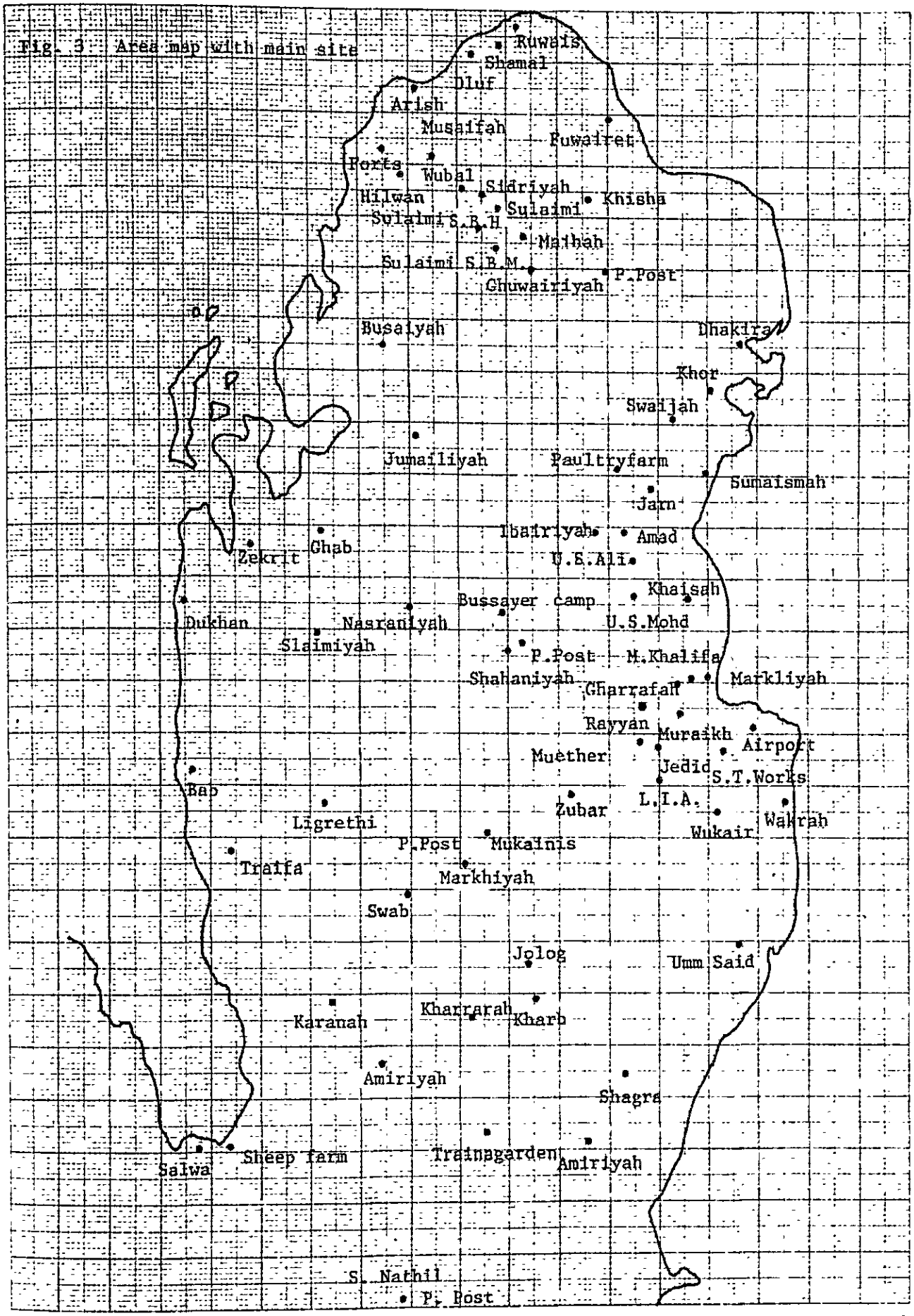


Fig. 3 Area map with main site

3. Correspondence of numbering plan with zone system

Needless to say, it is of great importance to decide whether or not to make the numbering system correspond to the zone system, since the numbering has close relation to charging, call connection, and signalling system desiging, etc.

What we call the "Gulf International Numbering Plan" (see Fig. 4) which is agreed only among the Middle Eastern Arabian countries has an individual view on the correspondence of numbering system to the zone system.

The following paragraphs discuss the numbering plan of national network.

As mentioned in the study report (1), code A level "0" is reserved for the identification of gulf country calls and international calls, while levels "1" and "9" are reserved for manual calling and miscellaneous calling respectively. Accordingly, the remaining levels "2" through "8" of code A are applied to calling in the national network.

Since the present numbering plan has no correspondence with the zone system, there will arise a lot of problems in the determination of interface between communication networks, as we have pointed out and explained some times.

Prior to the assignment of new office numbers, mainly to the switching offices newly implemented in the future, it must be definitely decided whether to maintain the present ringing system based on the 10 PPS technique or to introduce gradually the 20 PPS technique and pushbutton ringing system with the introduction of digital switching system.

Assume that the pushbutton ringing system will be introduced as is an international trend. In this case, the national numbers in each zone must be formed in the combination of levels within the range from "2" to "8", i.e., the other levels than those reserved for other uses described previously, and the function codes (symbols * and #).

To use the code A levels "2" through "8" for national number identification and to assign the national numbers so that none of them will be changed or affected for more than 50 years in the future, no matter where new switching offices are implemented, a separate number must be assigned to each zone, and this number must be equal to the address number generated by a subscriber,

Fig. 4 Gulf International numbering plan

(Gulf International Zone 9)

T \ U	0	1	2	3	4	5	6	7	8	9
0				Turkey						
1				India (Republic of)						
2				Pakistan						
3				Afghanistan (Republic of)						
4				Sri Lanka (Republic of)						
5				Burma (Socialist Rep. of the Union of)						
6		Lebanon	Jordan H.K. of	Syrian A.R.	Iraq Rep. of	Kuwait State of	S.A. King of	Yemen A. Rep.	Oman Sult. of	Yemen P. Dem. Rep. of
7		Fujairah	Ajman	Bahrain State of	Qatar State of	Sharjah	Umm Al Quwain	Ras Al Khaimah	Dubai	Abudhabi
8				Iran						
9										

In Fig. 5, code A level "2" is assigned to Khor, Level "3" to Doha, level "4" to Rayyan, and so on; thus every level up to "8" is assigned to a site. Though we have tried to assign code B and subsequent codes to the above code A area in connection to the Annex, we could not complete the work as not having enough time in such a short stay in Qatar. Therefore, the assignment of these codes are omitted from the report.

Fig. 5 Qatar national numbering plan (idea)

*1 (Unchange during the next 50 years)

2.C / 1.C	1	2	3	4	5	6	7	8	9	0	*	#
1		(Manual & Miscelleneous Call)										
2		(Area		Al	Khor)							
3		(Area		Al	Doha)							
4		(Area		Al	Rayyan)				*5	*2		
5		(Area		Umm	Said)							
6		(Area		Al Kharrarah)								
7		(Area		Dukhan)								
8		(Area Al Shamal, Al Ghuwairiyah)										
9			(Miscelleneous Call)*4									
0			(I.S.D.		Call)					*3		
*												
#												

(Note)
1) 1ry code and 2ry or more code
2) Keeping special service codes in the special zone
3) Outside Gulf area (in the present)
4) Including with Mobile call
5) Zone and local call (continued)

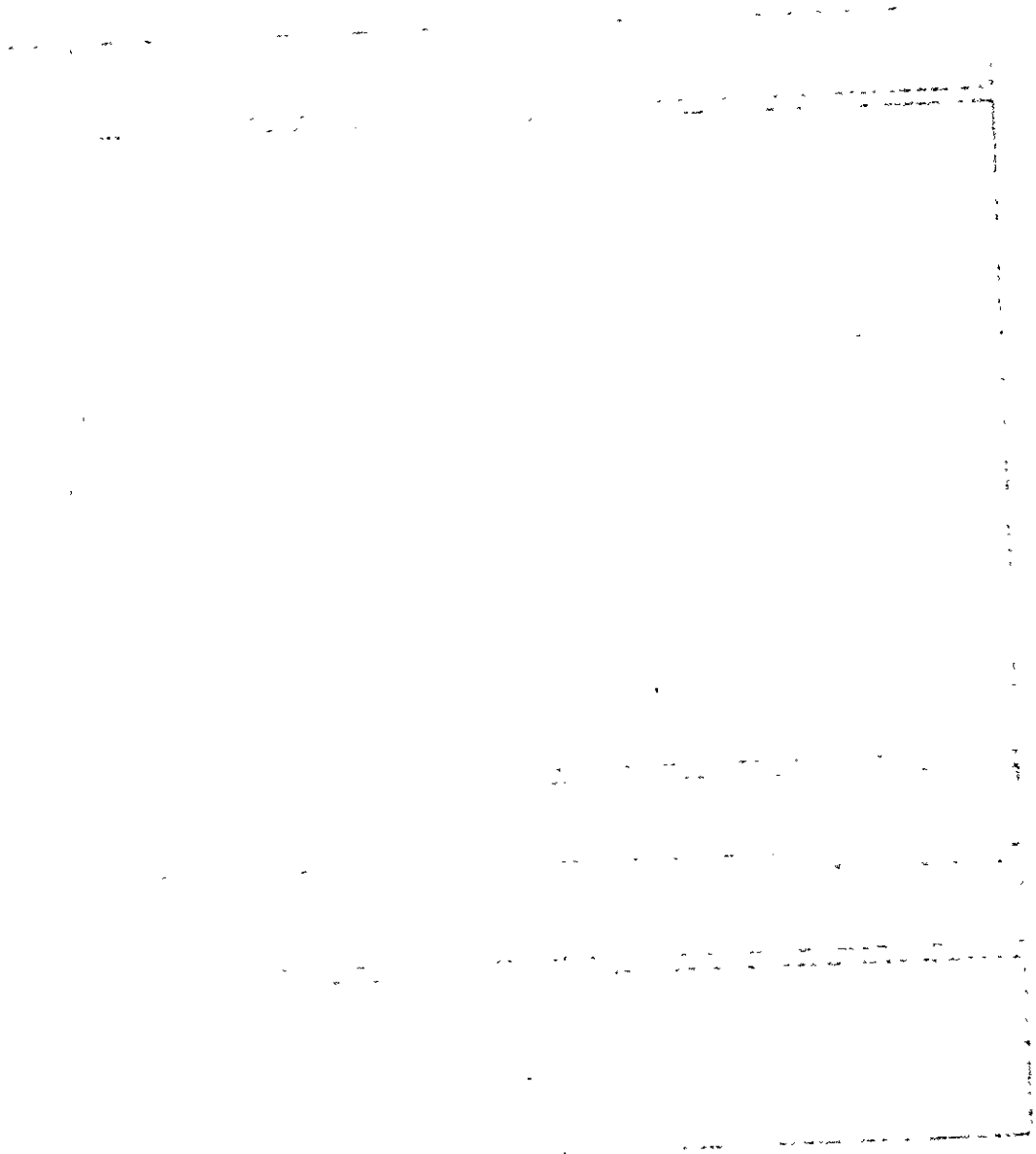


Fig. 6 and 7 show Telecommunication buildings mainly in zone 3 in the roughly sketch. The main object of those figures are not aimed at showing the kind of building scheme exactly but giving the future image to be extended in the middle of 2000s. The buildings, except for MOC, may have some modular composition so as to profit the modularized TDM systems introduction.

Fig. 6 Telecommunication network with various kind of Buildings

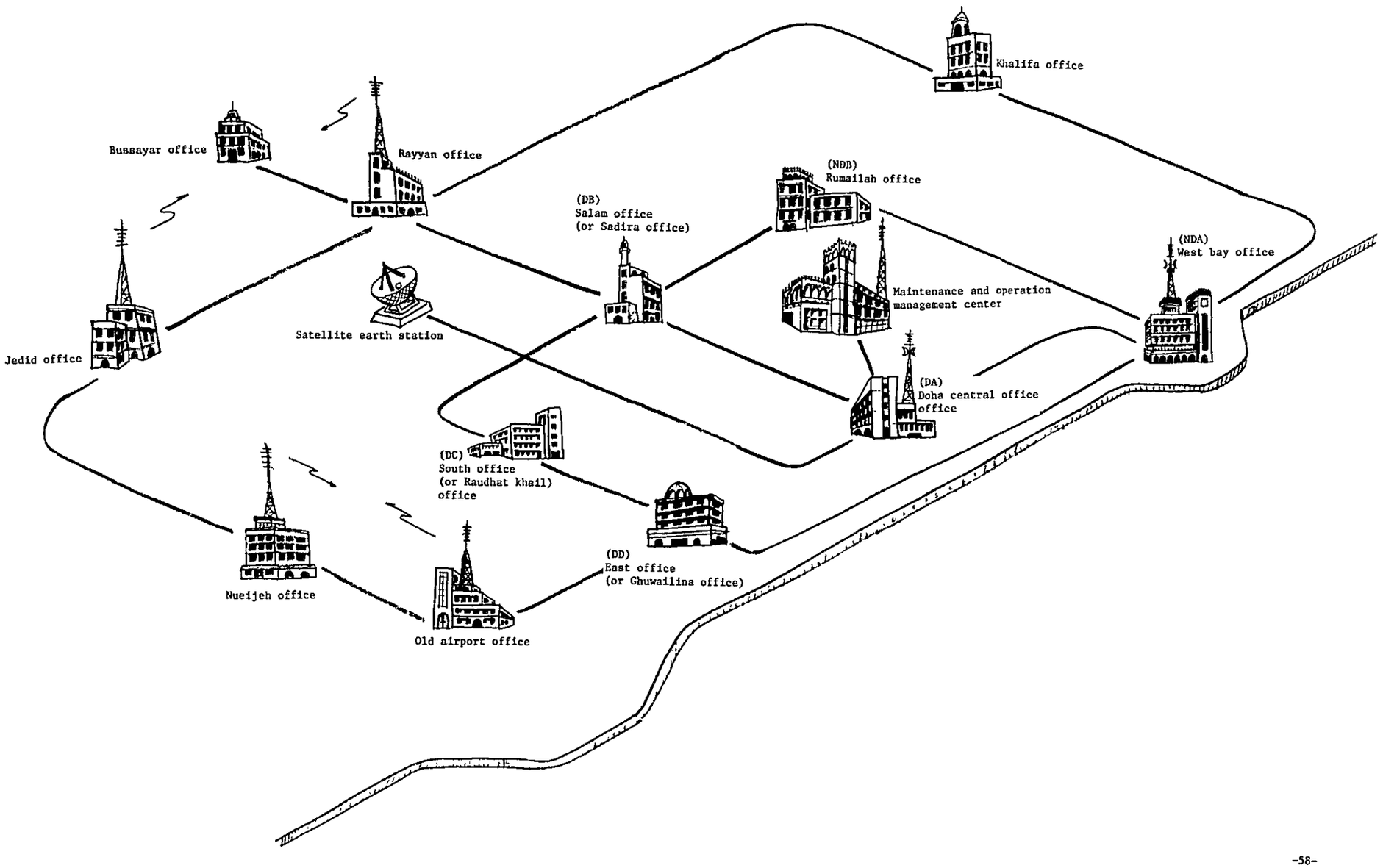
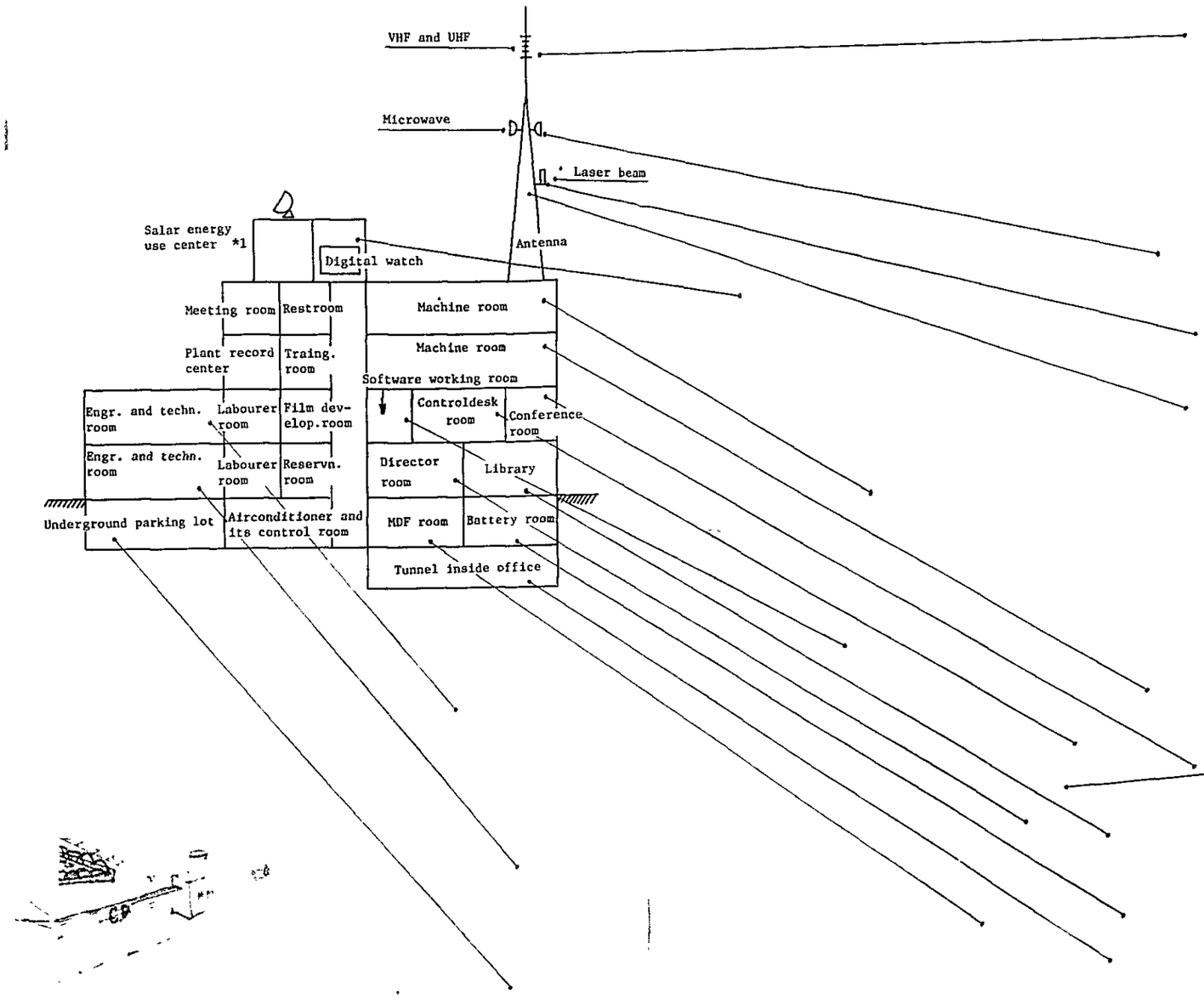


Fig. 7-1 Maintenance and operation management center (1/3)



(Note)

1. Solar energy-use center will be deployed when its scale out. The Battery room can connects the center through special ducts showing in the flour location figure.
2. Display scope
   (1) By operating the control and operation desk, it can be obtained that No.1 Display (the central) shows mainly Block diagrams or circuits, and that No.2 Display (the left hand side) shows tables concerning to the things to be projected by No. 1.
   (2) The right hand side map shows the status of the telecommunication and transmission system usage.

Main display-scope films

No.	Record-name	No.	Record-name
1	Transmission network map	7	Transmission link failure map
2	Interswitch trunk map	8	Trunk failure map
3	New service and billing process	9	MOC system map
4	Subscriber cable network map		
5	Diagnosis map		
6	Traffic condition status map		

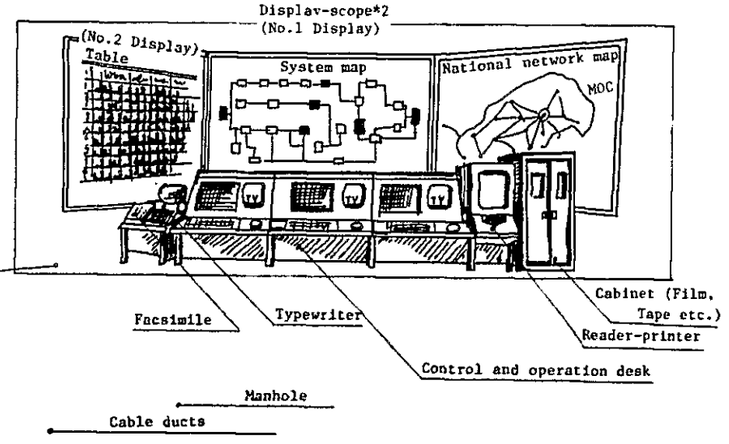


Fig. 7-2 Maintenance and operation management center (2/3)

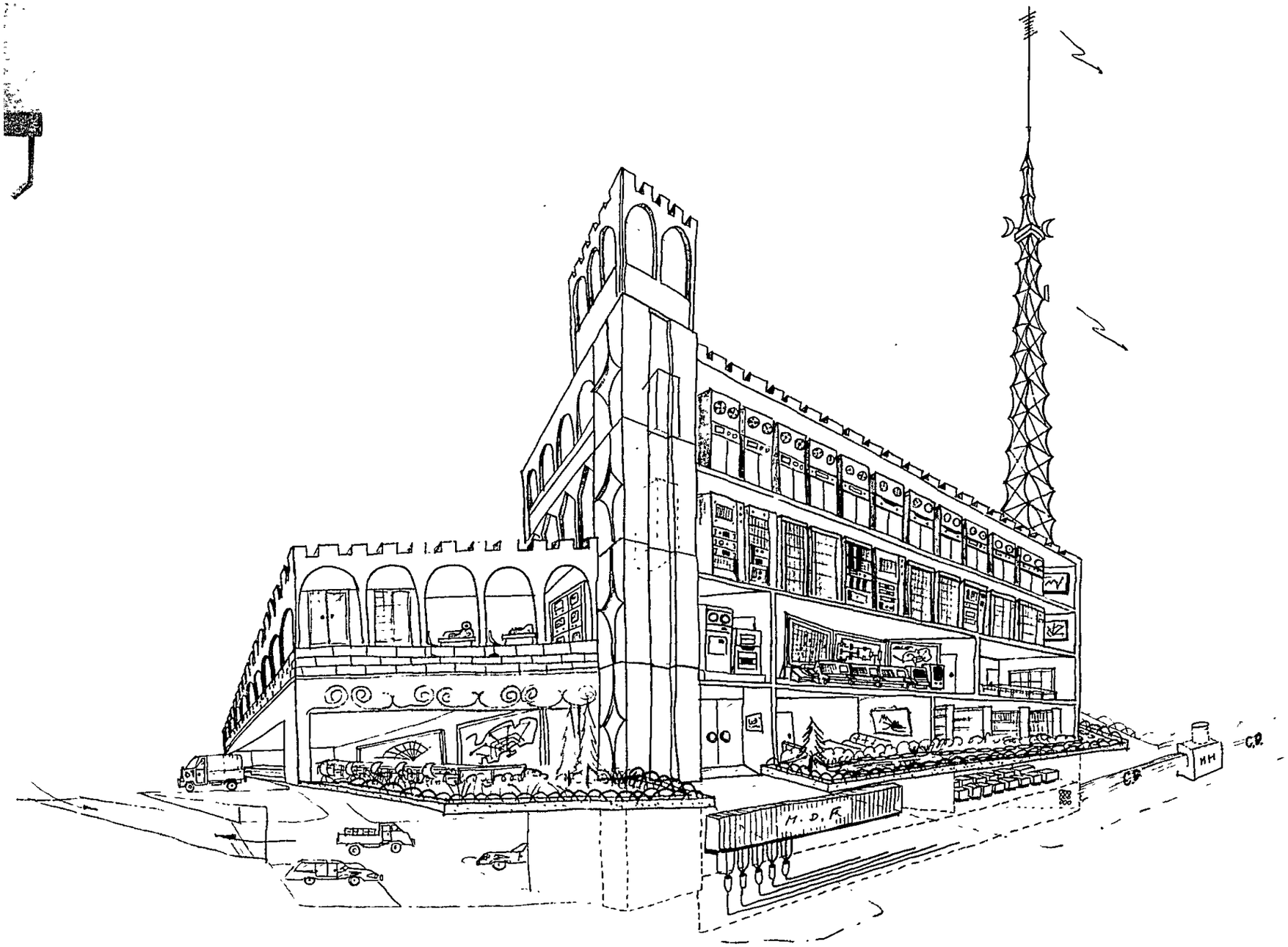
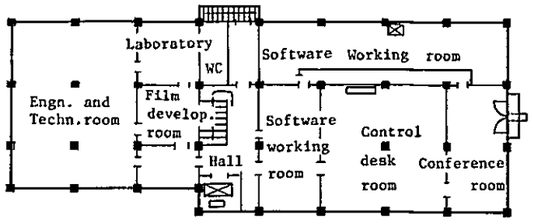
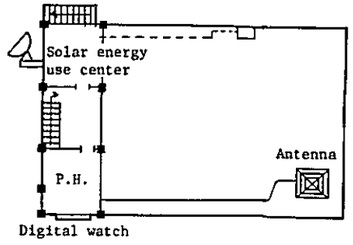
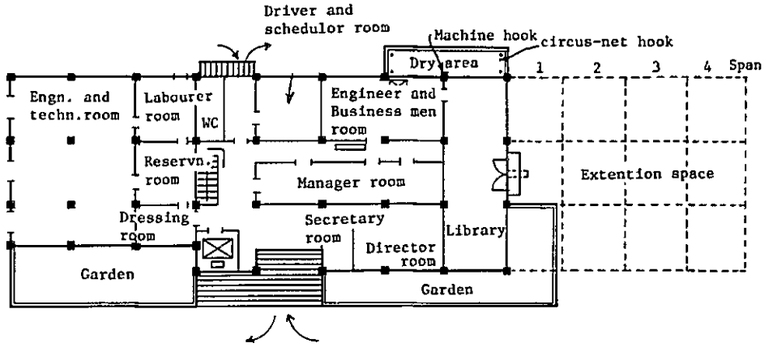
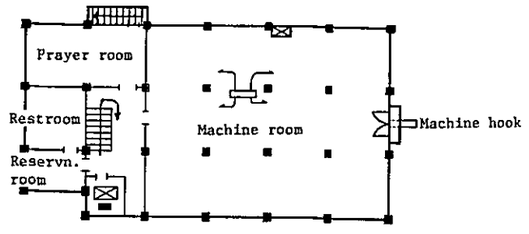


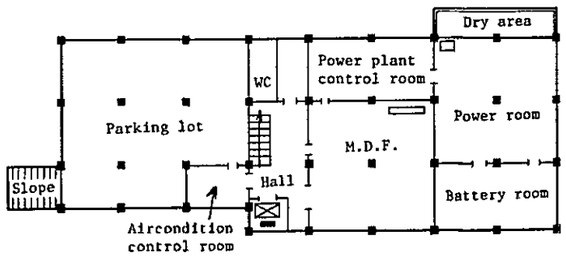
Fig. 7-3 Maintenance and operation management center (3/3)

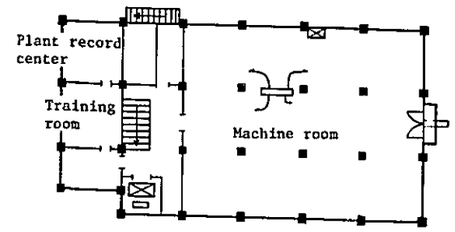


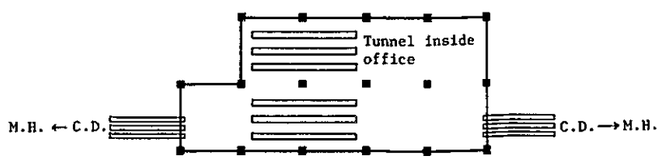












4. Technical interchange and assimulation involved in the introduction of advanced scientific techniques and modernization

Qatar has such a problem as the practice of various development plans involving population, budget and infrastructure, that contains a lot of fluctuating factors. Qatar, on the other hand, is required to introduce various techniques of each field for the modernization of state and to assimulate the techniques, thus substantially developing the independent, comprehensive faculties of Qatari staff in a steady progress. Though time, effort, and patience are necessary for this purpose, this problem must be overcome not only for the Qatari people themselves but also for their descendants.

In the following are listed questions which should be considered, including those naturally expected to be already taken into consideration.

(1) Regular employment of an excellent specialist capable of systematic approach (including statistical scheme and management scheme common to plural techniques), in other words, an excellent specialist having multi-dimensional knowledge, eagerness and capability to give practical advices; sufficient guarantee of social status, livelihood and rest must be given to this specialist.

(2) Employment of Qatari staff who can work together with the above specialist in human reliance (this condition is also applicable to the specialist himself).

(3) Learning of management scheme common to plural techniques, rather than the details of techniques themselves, and systematic approach, by experience.

(4) Substitution of technqiues by new Arabian techniques (if necessary) under the backup of the specialist, and standardization and systematization of the new techniques.

(5) Backup system and acceptance system to support the systematical intensification of subordinates and juniors directly instructed by the above staff, as the staff themselves are improved.

(6) Establishment and activity of an investigation, research and development center including a part of the trained staff, which acts individually or in cooperation with other institutions (Note: see section 6 and Fig. 9).

(7) Development of Arabian scheme of work standardization to establish such a working system as to enable the instruction of succeeding staff members and not to throw them out of work, with improvement of general working standard by the propagation of this system.

(8) Preparation of surrounding facilities to encourage efforts and patience for long time until the accomplishment of full automatization, with adult education (pertaining to culture, sentiment and physical training).

Unless serious efforts are made for the adoption of the above propositions, introduction of modern techniques and systems will be proved to be meaningless, and it will be hardly expected that the techniques and systems are steadily assimulated for development of independent technical faculty.

In the early ninth century, Arabian specialists on a high intellectual level and their group in various fields began to translate and study the Greek science, which afterwards brought forth the development of the Arabian science. Japan, on the other hand, has developed a high educational standard and propagation through many years, and after everything had been reduced to ruins in the World War II, Japanese people started to make a long effort over 25 years, to develop the country in the individual manner.

These cases prove that it is possible to assimulate scientific techniques and develop independent technical faculty for the modernization of state.

Quantitative references are omitted from the above description, mainly because such references must involve the problems related to such factors as analysis of educational condition, reported plan of establishing a university near the airport, and possibility to implement an independent or cooperative investigation, research and development center mentioned previously.