

ARAB REPUBLIC OF EGYPT

FEASIBILITY STUDY

FOR

NEW ALEXANDRIA INTERNATIONAL AIRPORT

CONSTRUCTION PROJECT

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JULY 1985

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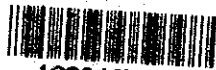
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**ARAB REPUBLIC OF EGYPT**

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**FOR**

**NEW ALEXANDRIA INTERNATIONAL AIRPORT**

**CONSTRUCTION PROJECT**

**JULY 1985**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

国際協力事業団	
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## PREFACE

In response to the request of the Government of Arab Republic of Egypt, the Government of Japan decided to conduct the Feasibility Study on the New Alexandria International Airport Construction Project, and entrusted the study to the Japan International Cooperation Agency (JICA).

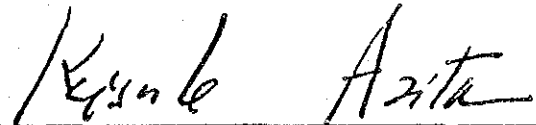
The JICA sent to Egypt a study team headed by Mr. Makoto TANAKA, Pacific Consultants International in July 1984, under the guidance of the advisory committee chaired by Mr. Koichi MASE, Deputy Director of the Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport.

The team held discussions with the authorities concerned of the Government of Egypt on the project and conducted the field survey in the country. After the team returned to Japan, further studies were made and the present report has been prepared.

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

I wish to express my deep appreciation to the authorities concerned of the Government of the Arab Republic of Egypt for their close cooperation extended to the team.

July 1985



Keisuke ARITA

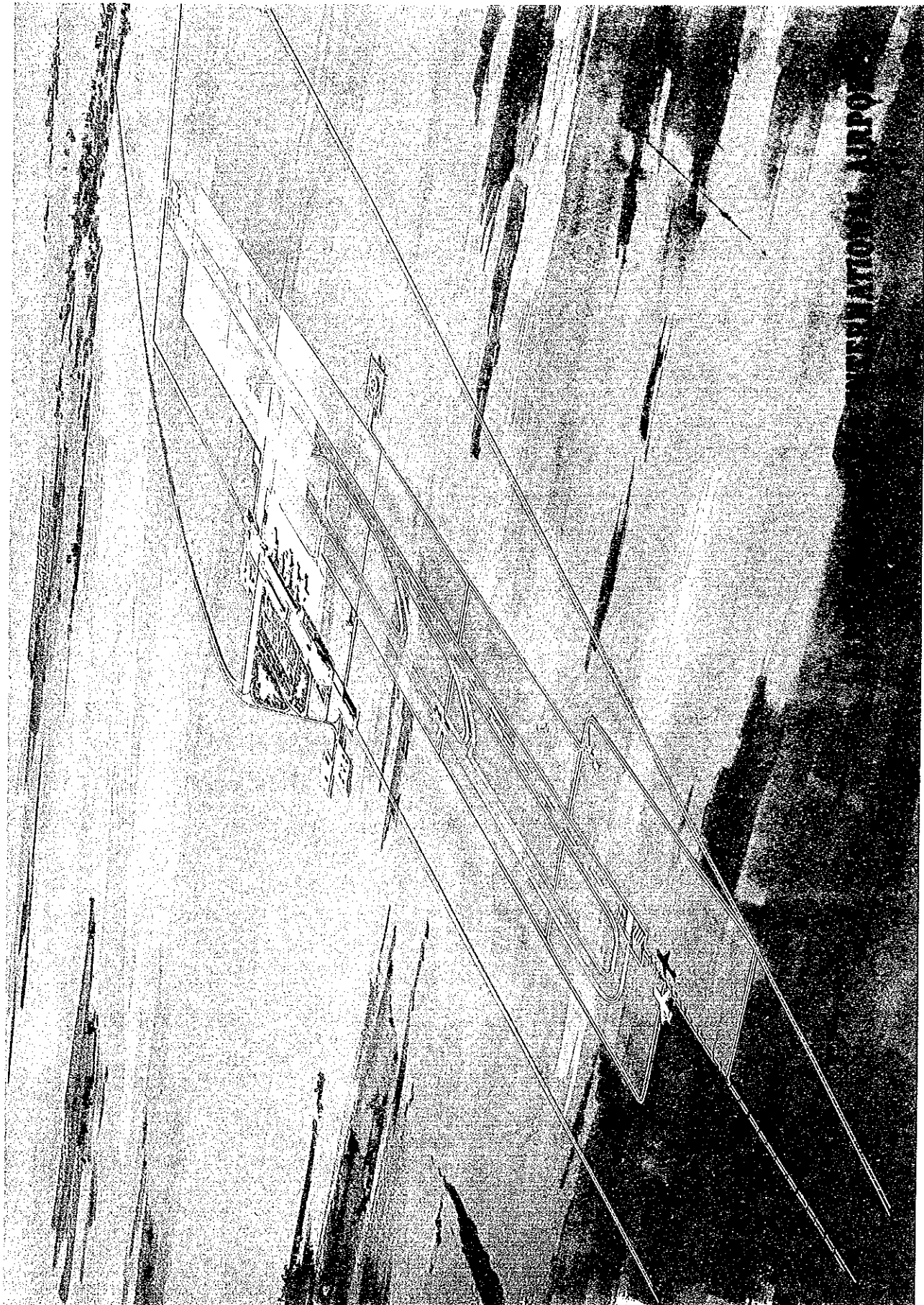
President

Japan International Cooperation Agency

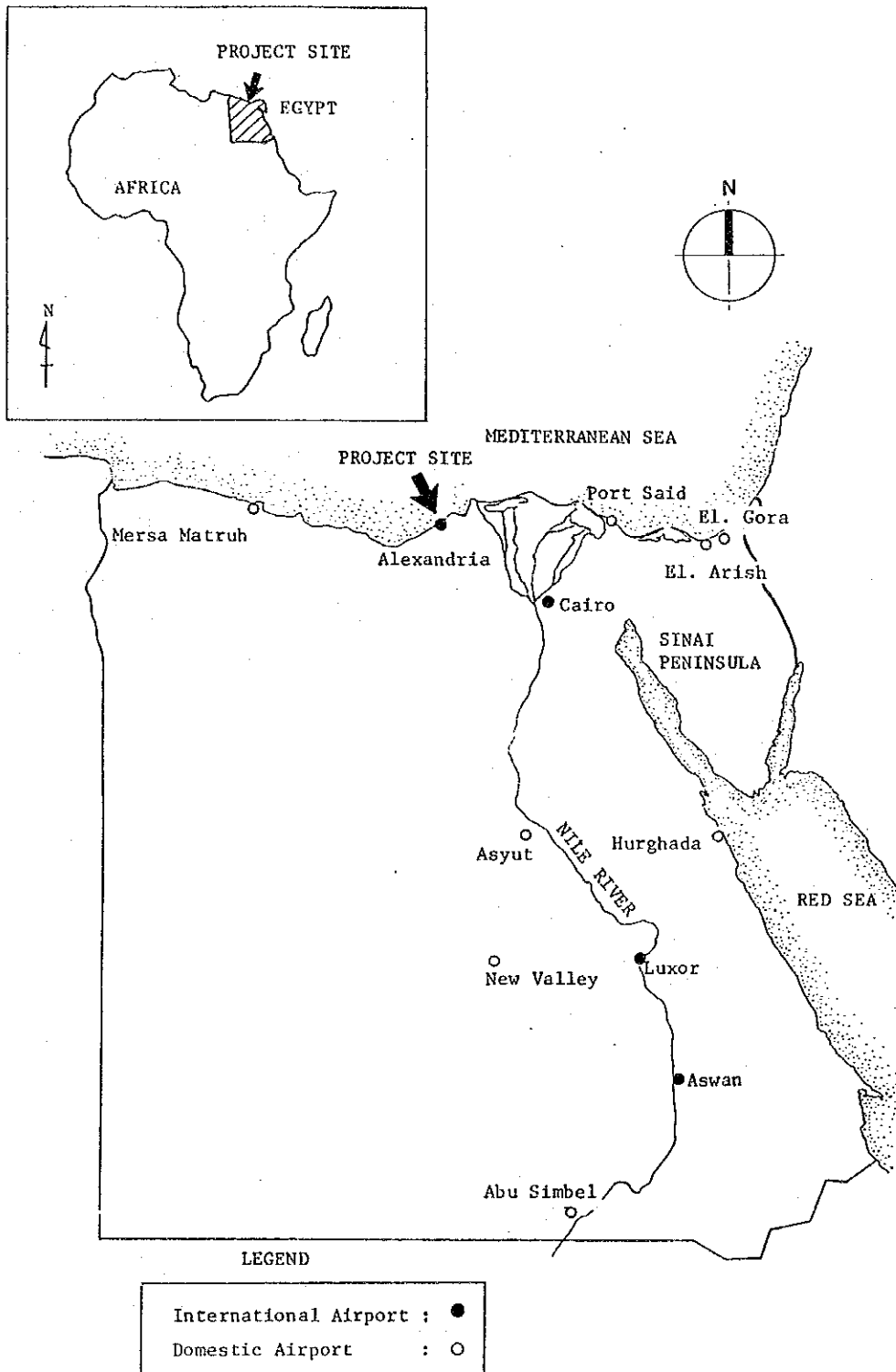




WASHINGTON AIRPORT

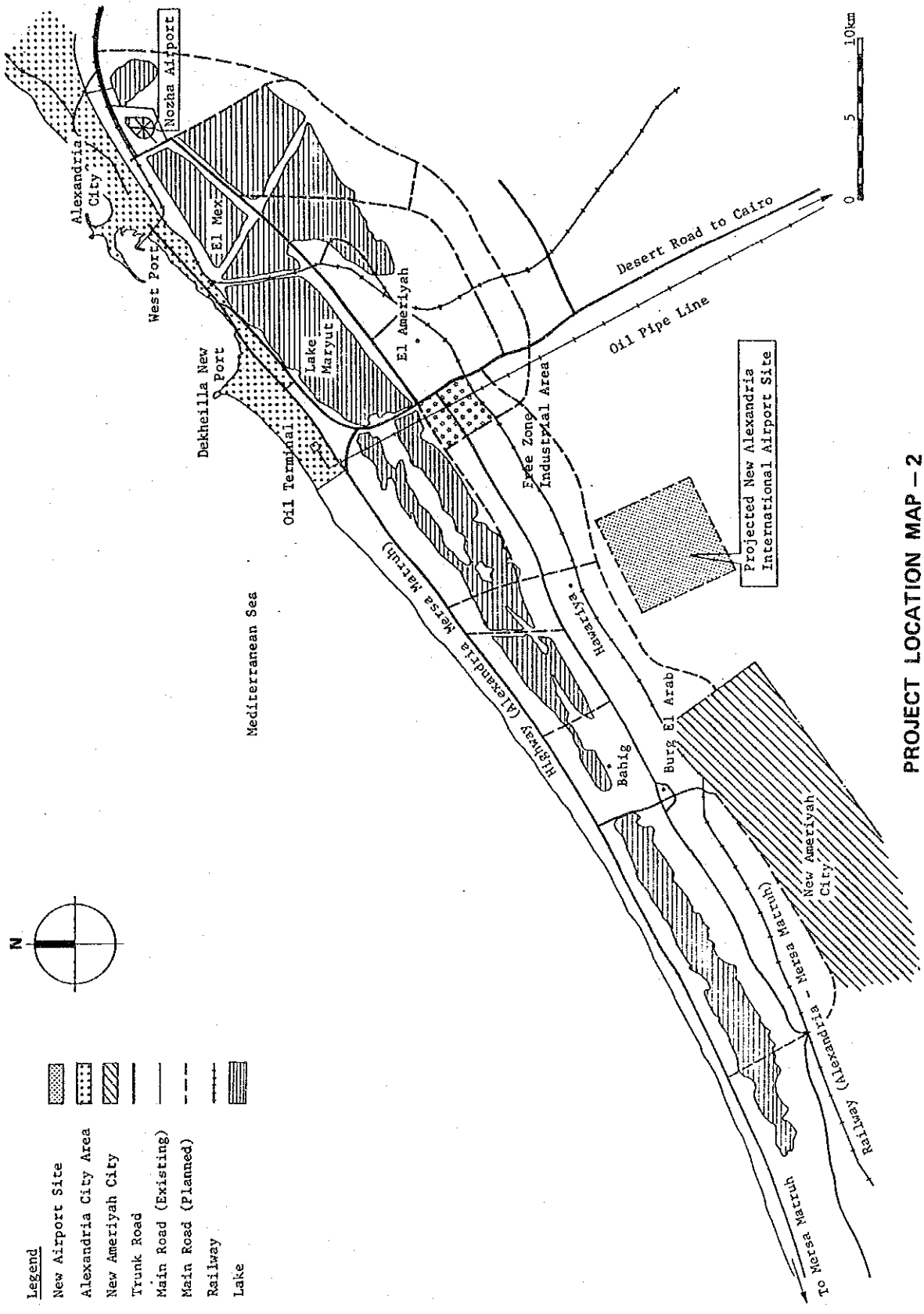






**PROJECT LOCATION MAP - 1**





**PROJECT LOCATION MAP - 2**





**PROJECT LOCATION MAP - 3**





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## **PART I BACKGROUND**



## CHAPTER 1 INTRODUCTION





## CHAPTER 1 INTRODUCTION

### 1.1 General

Alexandria city which is the second largest city in Egypt with a population of approx. 2.6 million is located on the Mediterranean Sea approx. 200 km northwest of the Egyptian capital, Cairo. Alexandria has the largest seaport in the country and is mainly noted for trade, commerce, educational institutions and tourism. The Alexandria region enjoys a moderate Mediterranean climate.

The construction of a new international airport is considered to be indispensable for the promotion of the regional development of the area which faces the Mediterranean Sea, and for the promotion of the development of the new city of Ameriyah (500 to 1,000 thousand population) which is to become the center of the north west coastal region. This regional development plan is one of the most important programs in the Five Year Plan for Economic and Social Development (1982/83 to 1986/87).

The existing Nozha Airport, which has two runways (2,200m x 45m and 1,440m x 30m), is located in Alexandria city, and provides connecting flights to Cairo and to Jeddah by B-737 and F27 aircraft. However, the existing airport was built on reclaimed land on Lake Maryut and is below sea level. For the redevelopment of Nozha airport, further expansion and development will be necessary in order to cope with the increasing air traffic demand and the introduction of wide-bodied jet aircraft. This will require the following construction works which involve larger investment cost and difficulties in the construction works: relocation of the terminal facilities, extension of the runway by reclamation of the lake, overlay of the pavement, improvement of air navigation systems, and various environmental measures to protect the environment of the surrounding area.

Accordingly, the Government has decided to construct a new international airport at a location approx. 45km southwest of Alexandria city. An area of 36km<sup>2</sup> (6km x 6km) has been set aside for this purpose, and the construction project has been listed in the Five Year Plan for Economic and Social Development.

Although many studies have been carried out so far for Nozha Airport and a new international airport, there are as yet no studies which present an overall and comparative evaluation between the two projects or which include financial and

economic analyses of the construction of a new airport. Thus, the necessity for and the priority of a new international airport has not yet been clearly established.

The Government of Japan, in response to a request from the Government of the Arab Republic of Egypt, has decided to undertake the Feasibility Study (hereinafter referred to as the Study) for the New Alexandria International Airport Construction Project. Based on this decision, the Japan International Cooperation Agency (hereinafter referred to as JICA), an official agency responsible for the implementation of the technical cooperation programs of the Japanese Government, was entrusted to carry out the Study. JICA organized the Study Team and officially commenced the Study in July, 1984.

## **1.2 Objectives and Scope of Work**

The objectives of the Study are to select the most suitable airport development scheme from between the redevelopment of the existing airport, the development of a new airport and a combination plan of both, and to prepare its master plan, and, finally, to establish the most economically viable implementation program.

The study comprises the following twelve (12) major works which were performed in accordance with the work flow chart indicated in Fig. 1.2.1.

- 1) Meteorological observations (new airport)
- 2) Topographical survey (new airport)
- 3) Soil investigations (existing airport and new airport)
- 4) Air traffic analysis and demand forecast
- 5) Airport requirements analysis
- 6) Redevelopment plan of the existing airport
- 7) Development plan of a new airport
- 8) Comparative evaluation of alternative plans
- 9) Airport master planning
- 10) Land use planning of the area surrounding the airport
- 11) Construction schedule and cost estimates
- 12) Economic and financial analyses

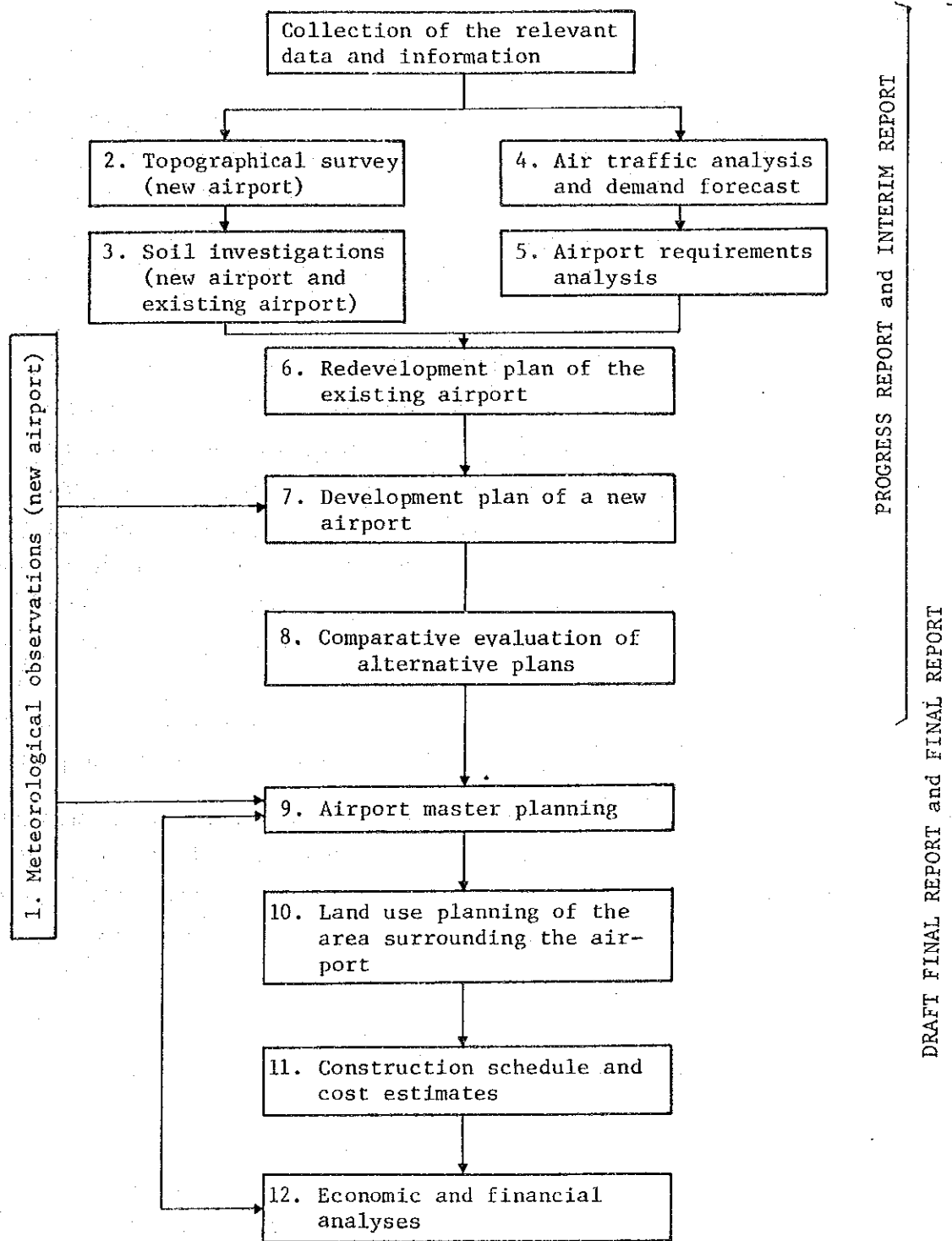


Fig. 1.2.1 Work Flow Chart

### **1.3 Execution Method and Reporting System**

The Study was conducted in accordance with the procedures in the Inception Report accepted in July, 1984.

The Study Team organized by JICA immediately proceeded in Egypt with data collection as well as interviews with the various related organizations after acceptance of the Inception Report by the Egyptian Civil Aviation Authority (ECAA). The Study Team, meanwhile, performed the meteorological observation and the topographic survey at the new airport site, and the soil investigations at both new and existing airport sites. The results of these studies were submitted in the Progress Report in October, 1984.

In order to select the most feasible airport development plan among the redevelopment of the existing airport, the development of a new airport and a combination of both, the Study Team carried out further studies in Japan covering air traffic analysis and demand forecast, airport requirements analysis, redevelopment plan of the existing airport, development plan of a new airport, combination plan of both, preliminary economic and financial analyses, and comparative evaluation of the airport development plans. These studies were performed with the close cooperation of the Egyptian counterpart official. The Interim Report containing the result on the selection of the most suitable airport development plan was submitted to ECAA in December, 1984, and was accepted. The contents of the Interim Report are included as PARTs II and III of this Report.

The master plan for the selected airport development scheme, Alt-C, was drawn up along the line of the results of the Interim Report, incorporating ECAA's comments. The Draft Final Report which was made by adding PART IV to the Interim Report contains the comprehensive results of the study for New Alexandria International Airport Construction Project. The Draft Final Report was submitted to ECAA in March, 1985, and was accepted.

The Final Report consists of "Summary", "Main Report" and "Appendix".

### **1.4 Study Organization**

The Study was carried out by the Study Team organized by JICA under the supervision of the Japanese Advisory Committee and with the close cooperation of their counterparts officials of the Egyptian Civil Aviation Authority. The organization chart is shown in Fig. 1.4.1.

The members of the Japanese Advisory Committee, Study Team and Egyptian Civil Aviation Authority are presented in the following list.

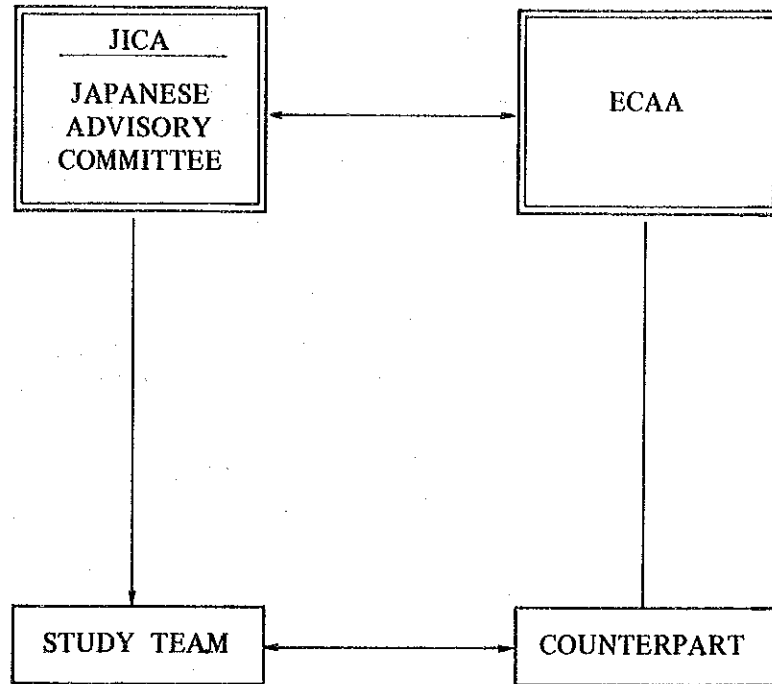


Fig. 1.4.1 Organization Chart

Members of the Japanese Advisory Committee

Mr. Koichi MASE	Deputy Director Construction Division Aerodrome Department Civil Aviation Bureau Ministry of Transport
Mr. Hidenori SASANUMA	Deputy Director Construction Division Aerodrome Department Civil Aviation Bureau Ministry of Transport
Mr. Tadashi EGAWA	Special Assistant to the Director International Cooperation Division Bureau of International Transport and Tourism Ministry of Transport
Mr. Koji WADA	Chief of Planning Section Flight Standard Division Technical Department Civil Aviation Bureau Ministry of Transport
Mr. Takao KAIBARA	1st Development Survey Division Social Development Cooperation Department Japan International Cooperation Agency (JICA)
Mr. Takaaki OHIWA	Ditto

Members of the Study Team

Mr. Makoto TANAKA	Project Manager/General Management
Mr. Ryuji TAGUCHI	Airport Planner
Mr. Tadimitsu ITO	Aircraft Operations and Nav aids Planner
Mr. Yoshiteru SUNAGO	Traffic Forecast and Economic/Financial Analyst
Mr. Keiichi TAKEDA	Airport Planner
Mr. Tsuyoshi ISADA	Natural Conditions Surveyor
Mr. Kazuo HAYASHI	Airport Civil Engineer
Mr. Shota MORITA	Airport Construction Planner

Members of the Egyptian Civil Aviation Authority

Dr. Fouad K. Moursy	Advisor to the Ministry of Civil Aviation Ex. Chairman Egyptian Civil Aviation Authority Ministry of Civil Aviation
Mr. Aly Osman Ziko	Chairman Egyptian Civil Aviation Authority Ministry of Civil Aviation
Mr. Naim Abdoh Salem	Chairman Central Department of Engineering Affairs Egyptian Civil Aviation Authority Ministry of Civil Aviation
Mr. Ibrahim Abd El Fattah	General Director Airport Planning Department Egyptian Civil Aviation Authority Ministry of Civil Aviation
Mr. Mohamed Saleh Tehaimer	Manager Airport Planning Department Egyptian Civil Aviation Authority Ministry of Civil Aviation
Mr. Nagi Yousef	Manager Airport Planning Department Egyptian Civil Aviation Authority Ministry of Civil Aviation
Mr. Abbas Tolba Abbas	Chief Airport Planning Department Egyptian Civil Aviation Authority Ministry of Civil Aviation





## **CHAPTER 2 BACKGROUND OF THE PROJECT**



## CHAPTER 2 BACKGROUND OF THE PROJECT

### 2.1 Socio-Economic Conditions in Egypt

#### (1) General Situation

a) Egypt is situated in the northeast part of the African continent. Egypt covers a part of the Sinai Peninsula and faces the Mediterranean Sea in the north and the Red Sea in the east; desert lies to the west and south. The Nile River passes through Egypt from the south to the north, creating a giant delta at the estuary which pours into the Mediterranean Sea. The land area of Egypt is about one million sq.km, about 2.7 times that of Japan. However, a barren desert covers 97% of the land. The area of cultivable land is no more than about 28.5 thousand sq.km along the Nile.

b) The climate throughout Egypt is dry and hot with negligible rainfall. Annual precipitation in the Northern Mediterranean coastal area is about 200mm of maximum. The central and southern areas have rainfall of only 25mm in a year. In general, the more southern and inland, the greater becomes the difference between the daily and seasonal maximum and the minimum temperatures.

c) Egypt is an important transportation crossroads between Central African and European countries, and between Middle East and European countries due to its location in Africa. Egypt is proud of its culture and history of over seven thousand years and of its famous and historical universities, especially Islamic University. Egypt became independent in 1922 which was earlier than many other African and Middle East countries. Since then, Egypt has endeavored to reform its domestic economy and to develop its domestic resources.

Egypt acts as a model of development for its African neighbors and as a center of education and culture for Middle East countries.

#### (2) Population

a) The population was estimated to be 43.0 million as of 1982, and the average annual growth rate has been 2.7% since 1975. The inhabited area is

concentrated along the Nile and the delta over 36,000 sq.km, or on only 4% of the total land area. In this region, the population density exceeds 1,100 persons/sq.km which is one of the highest densities in the world.

b) As the population is concentrated in the limited area described above, housing and transportation are major issues. Urban development has not solved the above issues since the most fertile agricultural land is limited and precious in the country. Therefore urban policy has been adopted to construct new communities in a desert like New Ameriyah City and Sadat City which have not only residential districts, but also industrial and agricultural districts, and then to transfer population from the old urban areas to the new communities.

### (3) Economy

a) The Egyptian national economy up to the first half of the 1970's had been stagnating due to high military expenditures arising from turbulent situation in the Middle East and the continuous high rate of population growth. However, since the second half of the 1970's, the economy has grown at a rate of 7.4% p.a.

The "Open Door Policy" established in the first half of the 1970's, which increased production of petroleum, Suez Canal revenues and remittances from Egyptians residing abroad have greatly contributed to the growth of the national economy.

b) The Gross National Product (GDP) grew at an annual rate of 6.9% for the five years of the former Five Year Plan for Economic and Social Development from 1977 to 1982. GDP reached 20.7 billion Egyptian Pounds in 1981/82. Growth of the service sector greatly contributed to the national economic growth. On the other hand, the industrial sector excluding petroleum and its related industries has not been able to reach the target rate in the plan.

Per capita GDP has also grown at an annual rate of more than 5% in parallel with the national economic growth, and is estimated to be more than 600 US dollars in 1983/84, using the 1980 Egyptian Pound exchange rate to US dollar.

Exports of petroleum, the country's most important export, reached 1,460 million Egyptian Pounds in 1981 and accounted for 64.4% of total exports. Cotton followed petroleum; exports were 320 million Egyptian Pounds or 14.1% of total exports in the same year. As for imports, imports of fuel, raw

materials and plant investments have increased in parallel with the national economic growth and recently imports of consumer goods have increased remarkably. The imbalance of trade tends to be expanding year by year and was estimated to be 4,170 million Egyptian Pounds in 1982. Both wholesale and consumer prices have increased at an annual rate of 12 - 13% since 1976.

c) The current Five Year Plan for Economic and Social Development 1982/83 - 1986/87 has the target of expanding the economy at the rate of 8.5% p.a. so that the standard of living can be increased by at least twice the rate of population growth. The following development strategies are enumerated in the plan:

- Maintenance of high priority to agriculture and industrial sectors
- Expansion of the construction capacity and basic services
- Increase of manpower productivity through training programmes
- Allocation of adequate funds for housing
- Eliminating the balance of payments deficits

d) For the term of the current five year plan, it is expected that the national economy will continue to grow at a rate of around 8% due to the management of the economy based upon the plan. However, it is forecast that the long-term annual growth rate will decrease to 5-6%. Future economic growth will depend not only on the expanding exports of industrial goods in addition to the export of raw materials and invisible trade revenue, but also on the improvement of labor productivity.

## **2.2 Socio-Economic Conditions in Alexandria and its Surrounding Areas**

### **(1) General Situation**

Alexandria Governorate is situated about 224 km north of Cairo. It faces the Mediterranean Sea and has a moderate climate. Alexandria is not only the largest resort area for the Egyptian people but also one of most favourable areas to construct new communities due to its moderate climate and coastal area.

Alexandria Governorate had a population of 2,640,000 in 1982, ranking among the nation's twenty five governorates. However, the population density in the inhabited area is the second highest following Cairo Governorate.

## (2) Industries

Industrial production in Alexandria Governorate as of the second quarter of 1977 was 148 million Egyptian Pounds or 17.7% of the total industrial production in Egypt: the second largest following Cairo Governorate. The amount of added value in the industries was 115 million Egyptian Pounds in 1973, 25.1% of the total amount and also the second greatest following Cairo Governorate.

Only Alexandria and Cairo Governorates have a wide range of sub-industries from food processing to manufacturing. The size of the leather, printing, oil refinery, rubber-plastic, non basic metals and transport equipment industries in Alexandria Governorate exceed the average for the nation.

It is pointed out from the size of industries and their structure that Alexandria Governorate is the second largest industrial region following Cairo Governorate.

## (3) Regional Development Plans

Construction of New Ameriyah City, development of the tourism resources and industrial development are being promoted in Alexandria and its surrounding areas. The outline of such development plans is as follows:

a) New Ameriyah City is under construction in the desert about 50 km west of downtown Alexandria. Its aim is to accommodate the expected overflow of population from the downtown area. The city is designed for a population capacity of 500,000 inhabitants at final phase completion around 2010. Along with the construction of the residential area, industrial and agricultural developments are planned in the city, since the city is designed to be self-sufficient. As of August 1984, the overall ratio of the progress of construction was in the range of 3-4%.

b) Tourism resources are being developed both in Alexandria Governorate and its surrounding area (Matruh Governorate). The development plan in Alexandria aims to increase tourists to the Governorate from the recent estimate of more than one million tourists. The plan for the North West Coast region (Matruh Governorate) expects to attract 1,080,000 tourists by the year 2000. The North West Coast, which is around 500 km long and extends from the boundary of Alexandria Governorate to the national border with Libya, is divided into ten planning zones. At present, development in the first planning zone is in progress.

c) Industrial development in the area is progressing in the form of construction of a Free Zone and establishment of Industrial Zones. The Free Zone has been constructed around twenty nine km west of downtown Alexandria over an area of 6.3 million sq. m. The target of the Free Zone is to promote exports and to increase employment opportunities. As of August 1984, there were one hundred and nine industries either under construction or which have started production, creating 6,600 jobs for Egyptians. Of the capital invested in the Zone, 42% has been introduced from abroad.

The establishment of the Industrial Zone aims to encourage companies that are oriented to serving the Egyptian domestic market. Many factories are under construction in the zone from Dekheilla district to the Free Zone. Of the capital invested in the zone, 28% has been introduced from abroad.

#### (4) Transport

a) As described earlier, population and industries are concentrated in the delta region of land from Cairo and its surrounding areas to Alexandria Governorate. Reflecting this situation, Alexandria has the biggest seaport in the country and between Alexandria and Cairo, two trunk roads (the Desert Road and the Agriculture Road) are well maintained; the national railway also offers a very good service on this route. In fact the section between Alexandria and Cairo has the most well-equipped transport service in the country.

b) In 1979, an average of 1,670 vehicles per day travelled between Alexandria and Cairo on the Desert Road. Twenty eight trains operate daily between Alexandria and Cairo. It takes about three hours either by vehicle along the trunk roads or railway.

c) In the future, air service will be rapidly expanded along with improvement of the roads and the railway. It is therefore expected that the travel time between Alexandria and Cairo will be reduced.

#### (5) Future Economic Development

It can be considered that the regional economy in Alexandria and its surrounding areas will grow at a higher rate than the average in Egypt due to the distribution and development of its industries and the scale of regional development described

above. However, as described in the current Five Year Plan for regional development, the activities in Alexandria and Cairo regions are to be adjusted or rearranged rather than promoted.

Therefore, the tempo of the regional economic growth in Alexandria region is expected to be the same as that in the rest of the country.

## **2.3 Air Transportation in Egypt**

### **2.3.1 Airports and Air Routes in Egypt**

#### **(1) Airports in Egypt**

There are 18 airports in Egypt which include 17 airports operated by the Egyptian Civil Aviation Authority (ECAA), and Cairo International Airport by Cairo Airport Authority (CAA). Half of them (i.e. 9 airports) provide scheduled flight services and are further divided into 4 international airports (including Cairo, Luxor, Aswan and Alexandria) and 5 domestic airports (including the airports with scheduled/non-scheduled services and airports for small aircraft).

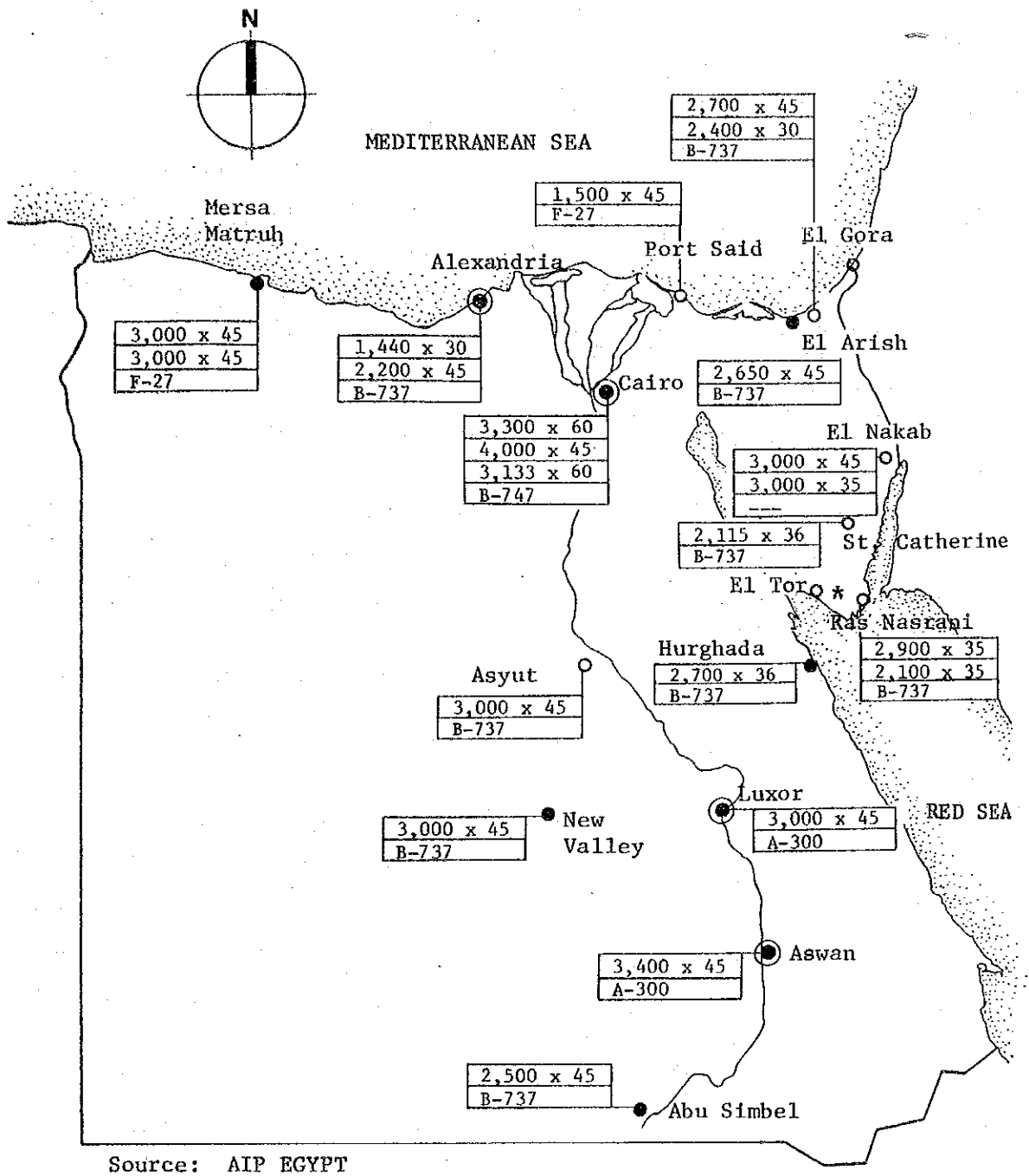
There are 11 airports with runways longer than 2,500m as shown in Fig. 2.3.1. However, only three airports out of the above airports (i.e. Cairo, Luxor and Aswan) are capable of accommodating large jet aircraft including A300 due to insufficient pavement strength at the other airports.

According to the Five Year Plan for Economic and Social Development (1982/83 - 1986/87) issued in December 1982 by the Government of Egypt, 116 million Egyptian Pounds are appropriated in the budget for development of the airports and the related facilities under control of the ECAA, and 104 million Egyptian Pounds for the facilities under CAA. In the budget for CAA, 77 million Egyptian Pounds are allocated for the implementation of a second passenger terminal building now under construction at Cairo airport as a high priority project. The project is scheduled to be completed in the Five Year Plan period.

Of the existing airports other than Cairo airport, 14 million for Luxor and 10 million Egyptian Pounds for Aswan are budgeted. As for new airport projects, 15 million Egyptian Pounds are included in the budget for the new airport in the Sinai Peninsula and 12 million Egyptian Pounds for the Ameriyah region (Alexandria) airport.

For Nozha airport, 3 million Egyptian Pounds will be spent on improvements during the Five Year Plan period.





Source: AIP EGYPT

**LEGEND**

- International Airport
- Domestic Airport
- \* Under Construction

Runway (Length x Width)
Ditto
Max. Operating Aircraft

Fig. 2.3.1 Airport Layout of Egypt

## 2.3.2 Air Routes

### (1) International

At Cairo international airport as of 1983, there were 55 airline companies in service. Egypt is connected with 57 countries by scheduled international routes. According to the air traffic record for 1983 at Cairo airport, international scheduled flights totalled 47,831 flights in that years (an average of 131 flights daily) and non-scheduled flights 5,261 (14 flights daily).

Fig. 2.3.2 indicates the international routes served by Egypt Air.

The following are the international routes from airports other than Cairo airport.

Alexandria	- Jeddah	(by Egypt Air, 5 flights weekly)
Luxor	- Jeddah	(by Egypt Air, 2 flights weekly)
Aswan	- Khartoum	(by Sudan Airways, 1 flight weekly)

A total of 52,000 passengers were handled by the above routes in 1983.

### (2) Domestic

Domestic scheduled air service in Egypt is performed by Egypt Air and Air Sinai. Air Sinai is a subsidiary organization of Egypt Air established mainly for air services in Sinai Peninsula.

According to the timetable of Egypt Air (as of summer 1984), there are 10 air routes for scheduled flights as shown in Fig. 2.3.3 with 95 flights operated weekly (an average of 14 flights daily). The major aircraft is B-737 with a share of 73 percent (69 flights weekly) and F-27.

However, in winter which is the peak season for the upper Egypt, 9 flights using A300 were operated weekly between Cairo, Luxor and Aswan in 1983 and 1984.

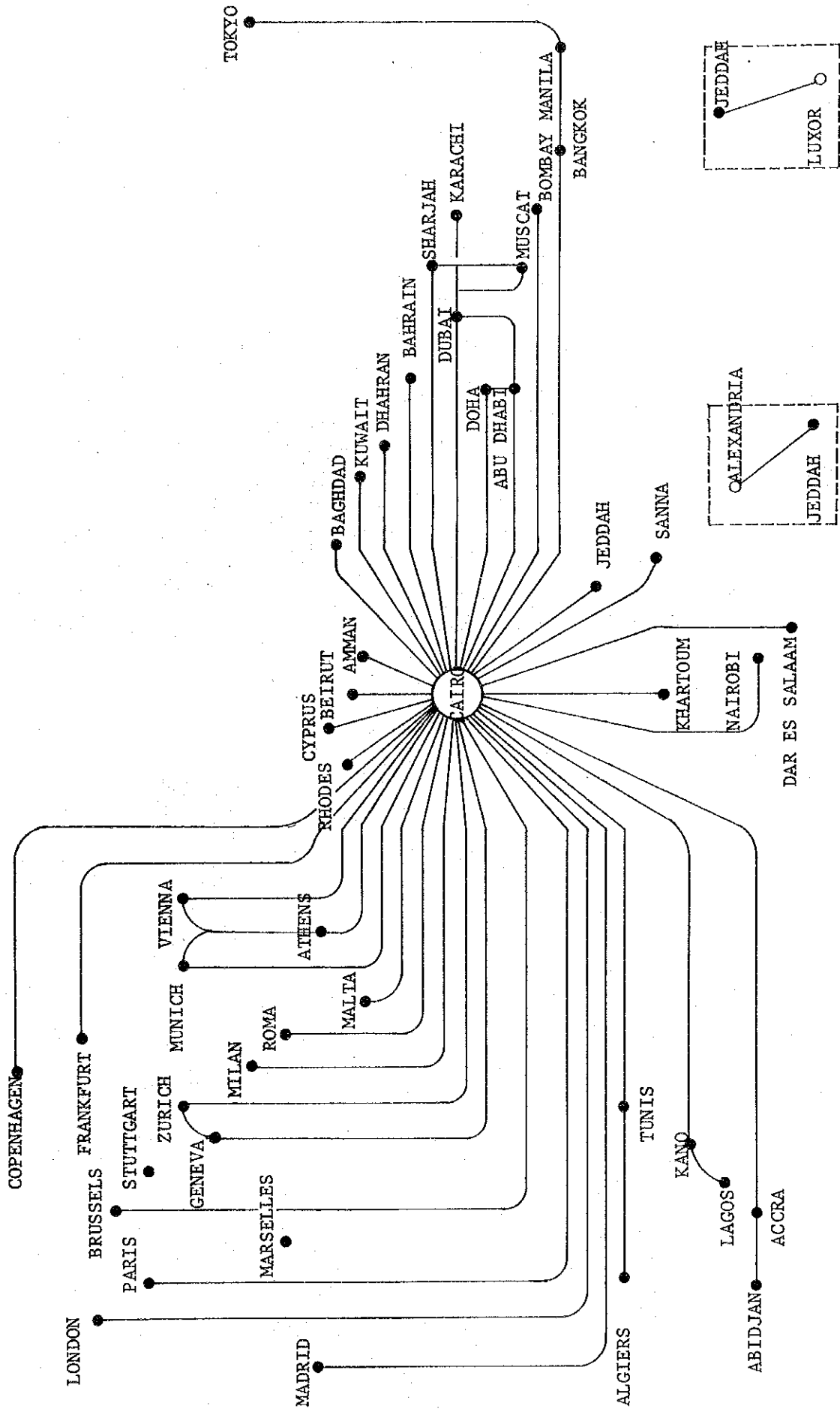
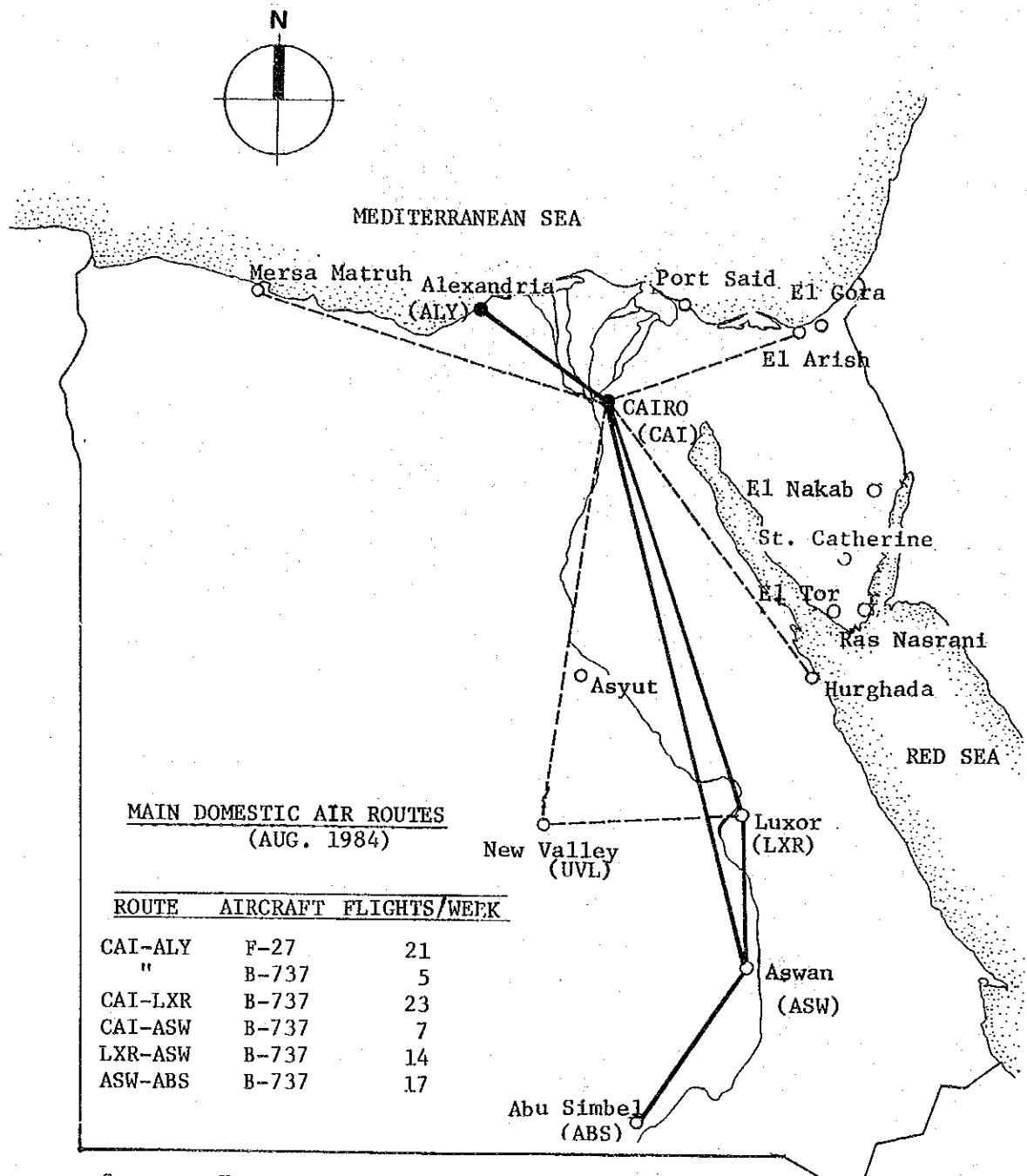


Fig. 2.3.2 International Routes Served by Egypt Air



Source: Egypt Air

LEGEND  
 ——— MAIN ROUTE  
 - - - - OTHERS

Fig. 2.3.3 Present Domestic Air Route Structure in Egypt

### 2.3.3 Airline Companies

At present the following airline companies operate in Egypt.

<u>Company</u>	<u>Ownership</u>
Egypt Air (including Air Sinai)	: Public establishment under the Ministry of Civil Aviation
Egypt Air Cargo	: A subsidiary organization of Egypt Air specialized in air cargo transportation.
ZAS Air	: Private airline company specialized in air cargo transportation.
MISR Overseas	: Private airline company for non-scheduled flight service.
Pyramid Air Line	: Ditto

Since the airline companies other than Egypt Air have very small fleets, they transport only a small percentage of traffic as compared to Egypt Air.

The number and type of aircrafts owned by Egypt Air and the future fleet plan are shown in Table 2.3.1.

In addition to the above, Egypt Air has leased about 5 aircrafts every year in the last 4 to 5 years in order to cope with the excess demand during peak season. The number of scheduled flights operated by Egypt Air in 1983 totalled 18,000 international flights and 7,000 domestic flights. These flights account for one fourth of the total flights in Egypt. The passenger load factor for international services has been in the range of 55 to 59 percent since 1980. The load factor for domestic service increased to 73 percent in 1983 from 67 percent in 1980.

Table 2.3.1 Fleet Plan of Egypt Air

Aircraft \ Year	1984	1985	Remarks
B747	(1)	2	( ) leased
B-300	8	8	
B-767	3	5	
B-707	7	6	
B-737	7	7	1 aircraft for Air Sinai
F-27	3	3	all aircraft for Air Sinai
Total	28 (29)	31	

### 2.3.4 Air Transport Trend

#### (1) International Passengers

The actual international passenger traffic from 1975 to 1983 in Egypt is as shown in Table 2.3.2. The annual growth rate of passengers in Cairo during the above 8 years averaged 11.8 percent for the scheduled flights at Cairo airport, 12.4 percent for the total Cairo airport, and 12.5 percent for the total Egypt. International services are mostly operated at Cairo airport as indicated in Table 2.3.2.

Opening of a new international route between Luxor and Kuwait is scheduled and Hurghada airport is planned to become an international airport in the future. Therefore, it is likely that the number of international passengers will gradually be dispersed to other airports in the future. Figs. 2.3.4 and 5 show the trend of international passengers in the major cities near Egypt compared with Cairo.

Table 2.3.2 International Passenger Volume in Egypt

(x 1,000)

Year	Cairo Airport			Other airports	total
	Scheduled	Non-scheduled	Total		
1975	2,209	151	2,360	-	2,360
1976	2,732	228	2,960	-	2,960
1977	3,065	267	3,332	-	3,332
1978	3,242	361	3,603	-	3,603
1979	3,527	513	4,040	-	4,040
1980	3,953	355	4,308	5	4,313
1981	4,386	438	4,824	15	4,839
1982	4,795	798	5,593	N.A	5,593
1983	5,398	621	6,019	52	6,071

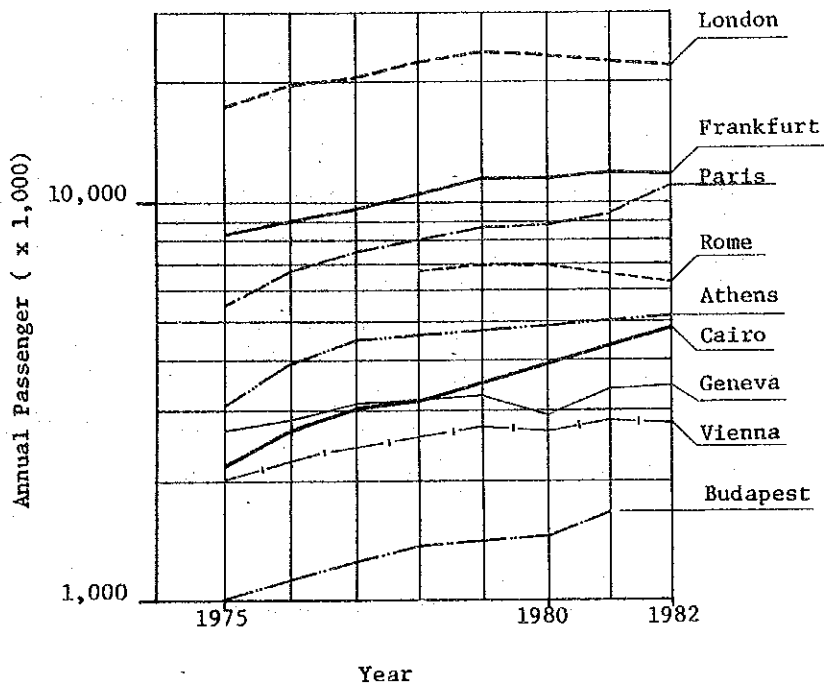


Fig. 2.3.4 Trend of International Passenger Traffic (European region)

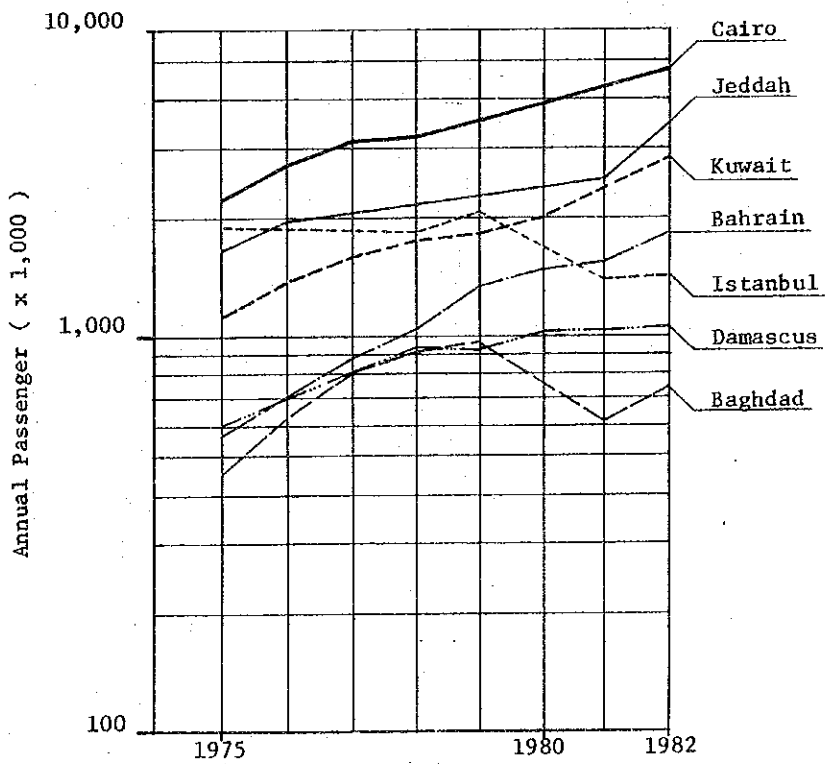


Fig. 2.3.5 Trend of International Passenger Traffic (Middle East region)

(2) Domestic Passengers

The trend of domestic passenger traffic in Egypt is shown in Table 2.3.3. The total domestic passenger traffic was 2,205,000 in 1983. The growth of passengers increased at a relatively high rate of 18 percent during 8 years from 1975 to 1983. Especially at Luxor, Aswan and Abu Simbel airport in the upper Egypt region, the annual growth rate was recorded to be 20 percent during the above period. The domestic passenger traffic at the above three airports were about 1,400,000 in 1983 which was about 63 percent of all the domestic passenger traffic in Egypt. Domestic airports in other areas handle annual passenger volume of less than 100,000. According to data from Egypt Air, the passenger load factor for domestic service increased from 66.9 percent in 1980 to 73.2 percent in 1983.

Table 2.3.3 Domestic Passenger Volume of Egypt

Year	Domestic Passengers (x 1,000)	Average Annual Growth Rate (percent)
1975	577	-
1976	649	112
1977	746	115
1978	983	132
1979	1,120	114
1980	1,584	141
1981	1,943	123
1982	2,013	104
1983	2,205	110
	1975 - 1983	18.2
	1975 - 1979	18.0
	1979 - 1983	18.5



## 2.4 Other Transportation Systems

### 2.4.1 Road Transportation

The road network in Egypt is developed mainly along the Nile Delta area, Mediterranean Coastal area and Nile Valley area. The Egypt National Transport Study reported the total length of roads in 1979 as 28,500 km of which 15,000 km or 53 percent of the total was paved and is in good condition.

The passenger volume using land transport in 1979 was estimated as 34.5 billion person-kilometers of which 60 percent was handled by road and 40 percent by railroad. The average transportation distance by road (51 km) was shorter than that by railroad (79 km.)

The cargo handling capacity of land transport in 1979 was estimated as 15.3 billion ton-kilometers of which 71 percent was by road. The average transportation distance was 147 km, the shortest distance as compared with other cargo transport means. Roads are expected to transport 77 percent of passenger traffic and 68 percent of cargo traffic by the year 2000. The role of roads in the passenger transportation sector is anticipated to increase.

Two state roads, the Agriculture and the Desert Road have 4 paved lanes between Cairo and Alexandria over about 224 km taking about 3 hours in either direction.

Trip time is expected to be reduced by the development of access roads to both Cairo roads in the future.

### 2.4.2 Railroad Transportation

The railroad transport network in Egypt was developed many years ago to serve not only major cities, but also small towns. Improvement and development works for railroad transport is underway. The total service length of railroads was 4,400km in 1981/82 which is 1.8 times the length of 2,400 km in 1951/52. The passenger volume is increasing yearly because of the improved network. Passenger volume increased from 3 billion passenger-kilometers in 1951/52 to 12.5 billion passenger-kilometers in 1981/82. Cargo volume is declining through diversion to road vehicles because of insufficient capacity due to increase of passenger volume, and superannuated facilities.

According to the Egypt National Transport Study, the share of passengers transported by railroad in 1979 was 40 percent and of cargo, 11.8 percent.

Table 2.4.1 Railroad Transport

Item \ Year	1978	1979	1980	1980/81	1981/82
Passenger Traffic (Mill. Pass. km.)	9,490	10,941	14,160	11,000	12,479
Freight Traffic (Mill. T. km.)	2,302	2,459	2,480	2,170	2,950

Source: Statistical Yearbook 1952-1982 (August 1983)

The share of railroad transport in the year 2000 is expected to handle 23 percent of passenger volume and 13 percent of cargo volume. Twenty eight (28) trains operate daily between Alexandria and Cairo taking about 3 hours at a maximum charge of 4.9 Egyptian Pounds per person.

#### 2.4.3 Sea Transportation

The main ports are Alexandria and Port Said on the Mediterranean Sea serving as commercial ports, and Suez on the Red Sea serving as an industrial port. The handling volume of Alexandria Port in the year 1981 was 2.30 million tons loaded and 25.34 million tons unloaded. This amounted to about 80 percent of total volume handled by all major ports in Egypt.

Table 2.4.2 Maritime Cargo Volume

Port \ Year	1978	1979	1980	1981
Alexandria *1	19,414	18,954	23,211	27,640
Port Said *2	2,364	2,488	5,347	3,771
Suez *2	1,098	706	811	522

(x1,000 ton)

Sources: \*1 Alexandria Port Statistics, Alexandria Port Authority

\*2 Statistical Yearbook 1952-1982 (August 1983)

The share of cargo volume to be handled at Alexandria Port in the year 2000 is expected to decline from 80 to 70 percent owing to the improvement of cargo handling facilities at other ports.

The main commodities to be handled at Alexandria Port in the year 2000 are expected to be coal, iron ore, foods, cotton and wood, the same as at present.

#### 2.4.4 Inland Waterways

There are more than 3,300 km of inland waterways such as the Nile River and Ismailiyah Canal, and 50 percent of this length can be navigated by 200-ton ships.

The main cargo transported are petrochemical products, coal, construction materials and iron ore.

The Egypt National Transport Study reported that the share of cargo transported on inland waterways was 10 percent in 1979 which was about 2 percent smaller than railroads. It is forecast to decline to 6 percent in the year 2000.

## 2.5 Existing Nozha Airport

### 2.5.1 Outline of Nozha Airport

Nozha airport is located about 7.5 km southeast of Alexandria city, which is the second most populous city in Egypt with 2.6 million people. Figs. 2.5.1-2 and Table 2.5.1 outline the conditions of Nozha airport as of August, 1984.

Nozha airport was constructed on reclaimed area on Lake Maryut and started services in 1945. International flights from/to Mediterranean countries as well as domestic flights were served with two 1,500 m runways until 1970. However, the appearance of larger aircraft rendered impossible the continuation of services because of lack of infrastructure, such as runway length and pavement strength of runways and taxiways. Subsequently, the civil air transport services were interrupted in 1970. The government of Egypt decided on the construction of the New Alexandria International Airport and reserved an area of 36 km<sup>2</sup> (6 km x 6 km) for the airport. Preliminary design of the new airport was prepared by NACO (Netherlands Airport Consultants) entrusted by ECAA. However, the development plan has not yet been implemented.

On the other hand, in compliance with the increasing demand for resumption of services, the government entrusted NACO with the study for the redevelopment plan of Nozha airport as an international airport in 1977. However, the study reached a negative conclusion over the redevelopment plan due to the following problems.

- 1) Weak subground condition makes the pavement cost expensive and poses a risk of settlement.
- 2) Extension of the runway and expansion of the terminal area as an international airport are difficult because of the restriction by the existing land use, railways, roads and the former marine airport.
- 3) Obstacle limitation surface conflict with obstacles which are located to the north of the airport.

NACO then proposed a master plan of redevelopment of Nozha airport for a B-737 class domestic airport as an temporary plan until the implementation of the

development plan of the new airport. The master plan includes the extension of runway 04/22 and modification of the terminal buildings.

ECAA decided to redevelop Nozha airport based on NACO's master plan. Pavement overlay of runways (04/22, 18/36) and the aircraft parking apron, as well as extension of runway 04/22 to 2,200 m were completed during 1980 to 1982. Domestic operation was started in July, 1982 and international scheduled flights started operations in December, 1983 to meet the demand of the haji (pilgrimage) season.

At present, Nozha airport provides 5 international flights (B-737) to Jeddah/Saudi Arabia weekly, 3 domestic flights (F27) daily and 5 domestic flights (B-737) to Cairo weekly. The passenger traffic handled in 1983 was 81,436 domestic passengers, and 1,705 international passengers for a total of 83,144 passengers. The current air traffic volume has increased about 5 times over that of 1981 when the regular civil air transport services were re-started.

#### 2.5.2 Problems of Nozha Airport

Ground height of Nozha airport which was constructed on reclaimed land and is about 3.5 m below sea level. It is also about 1.0 m lower than the water levels of Lake Maryut and the former marine airport which are located on either side of the extended line of runway 04/22.

To prevent saturation from external water, drains are constructed around the airport property and compulsory drainage is being performed constantly by three 600 m<sup>3</sup>/hour pumps.

Subground of the airport property is reclaimed by dredged soil of Lake Maryut and comprises soft clayey soil with N value of less than 5 until about 9 m below the surface, this poor subground condition caused the uneven settlement between the VIP building and the passenger terminal building. Extended portion of runway 04/22 which was constructed in 1982 also suffered partial settlement and the pavement was overlaid in 1984.

Summarizing these conditions, external water and settlement prevention will be indispensable for the redevelopment of Nozha airport.

Redevelopment of Nozha airport also requires extension of the runway. Direction of the runway extension can be considered to both sides of runways 04/22 and 18/36, however, each alternative runway direction has respective problems as clarified by NACO's study.

- Extension of Runway 04

Reclamation of Lake Maryut is necessary. Soft clayey soil with N value from 0 to 2 is accumulated below the bottom of the lake to a depth of 6 to 7 m. Careful consideration on the prevention of settlement by, for example, the replacement of the soft clay with good fill is needed. Removal of the Desert Road is also necessary to a location where the lamp posts do not conflict with the obstacle limitation surfaces.

- Extension of Runway 22

Reclamation of the former marine airport is necessary. Condition of the subground of the bottom of the lake is expected to be poor, the same as at Lake Maryut. Prevention of settlement must be considered. Compensation for removal of the fish pond and marine club is also required.

- Extension of Runway 18

Nozha airport adjoins the city area on its northern part and the extension in this direction is difficult. Various obstacles such as mosque, palace and chimneys also render such extension impossible.

- Extension of Runway 36

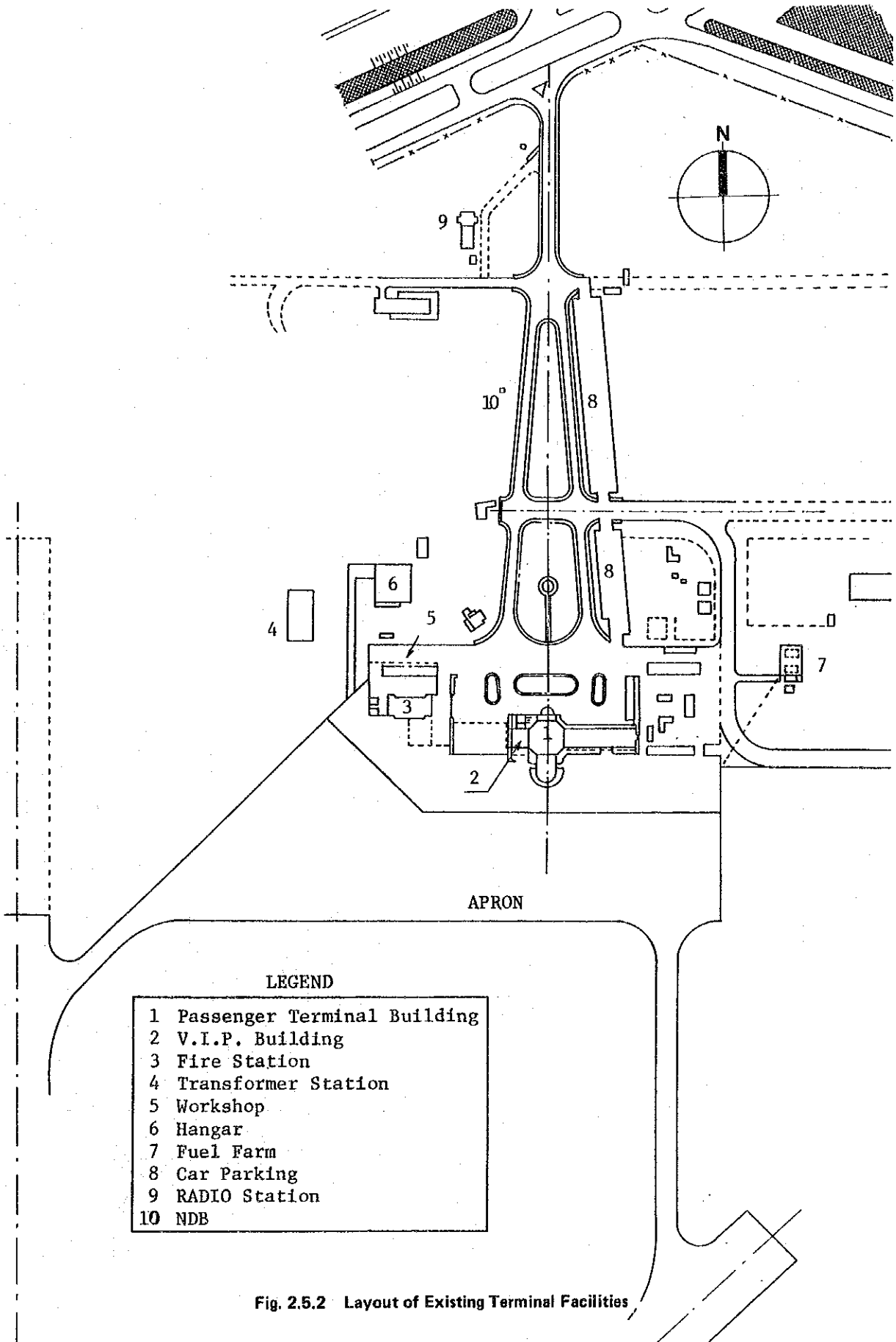
In order to avoid runway 18 side obstacles, runway 18 threshold should be moved by 600 m toward the 36 side. Therefore, runway extension of 2,200 m is required for the assumed runway length of 3,000 m. Accordingly, about 105 ha of paddy field should be acquired and compensation paid. Air route to/from runway 18/36 poses serious noise problems for the residential area of the city.

With regard to the terminal area, the existing terminal is located between the two runways and allows no room for large expansion. The removal to the vacant area is necessary for the redevelopment.

As described above, Nozha airport has various problems in its operation and future layout plan which would not be the case for the new airport. However, the study by NACO in 1977 did not provide a concrete plan for redevelopment, nor grasp the above-mentioned problems quantitatively. Therefore, it is necessary to clarify these problems and evaluate the redevelopment plan of Nozha airport in contrast with the development plan of the new airport.







- LEGEND**
- |    |                             |
|----|-----------------------------|
| 1  | Passenger Terminal Building |
| 2  | V.I.P. Building             |
| 3  | Fire Station                |
| 4  | Transformer Station         |
| 5  | Workshop                    |
| 6  | Hangar                      |
| 7  | Fuel Farm                   |
| 8  | Car Parking                 |
| 9  | RADIO Station               |
| 10 | NDB                         |

**Fig. 2.5.2 Layout of Existing Terminal Facilities**

Table 2.5.1 Outline of the Existing Alexandria Airport

"O" indicates "Plan or under construction"  
 "X" indicates "Implemented or services provide"

Country	Name of Airport	INT./DOM. ICAO CODE	Commement of Services	Airport Total Area	Aerodrome Ref. Point	Elevation	Runway/ Orientation	Aerodrome Ref. Temp.	Operation Hours	Seasonal Availability	Note: Control Agency: Egyptian Civil Aviation Authority																																																
												INT./DOM. ICAO CODE	Commement of Services	Distance to Airport	City/Town	Population	Distance to Airport	City/Town	Population	Distance to Airport	City/Town	Population																																					
Arab Republic of Egypt	Alexandria (Wahat)	4C	1945	354 Ha.	31°11'00"N 29°56'45"E	-3.35 m (-11 ft)	M43°30'E(MN) N176°10'E(MN)	30.6° C	0500(GMT)+ Sunset	All Seasons																																																	
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## **PART II BASIC ASSUMPTIONS**



## **CHAPTER 3 AIR TRAFFIC ANALYSIS AND DEMAND FORECAST**



## CHAPTER 3 AIR TRAFFIC ANALYSIS AND DEMAND FORECAST

### 3.1 General

Air traffic demand is forecast from 1990 to 2010 at five-year intervals to cover the following categories:

- Domestic passengers
- International passengers
- Domestic cargo
- International cargo

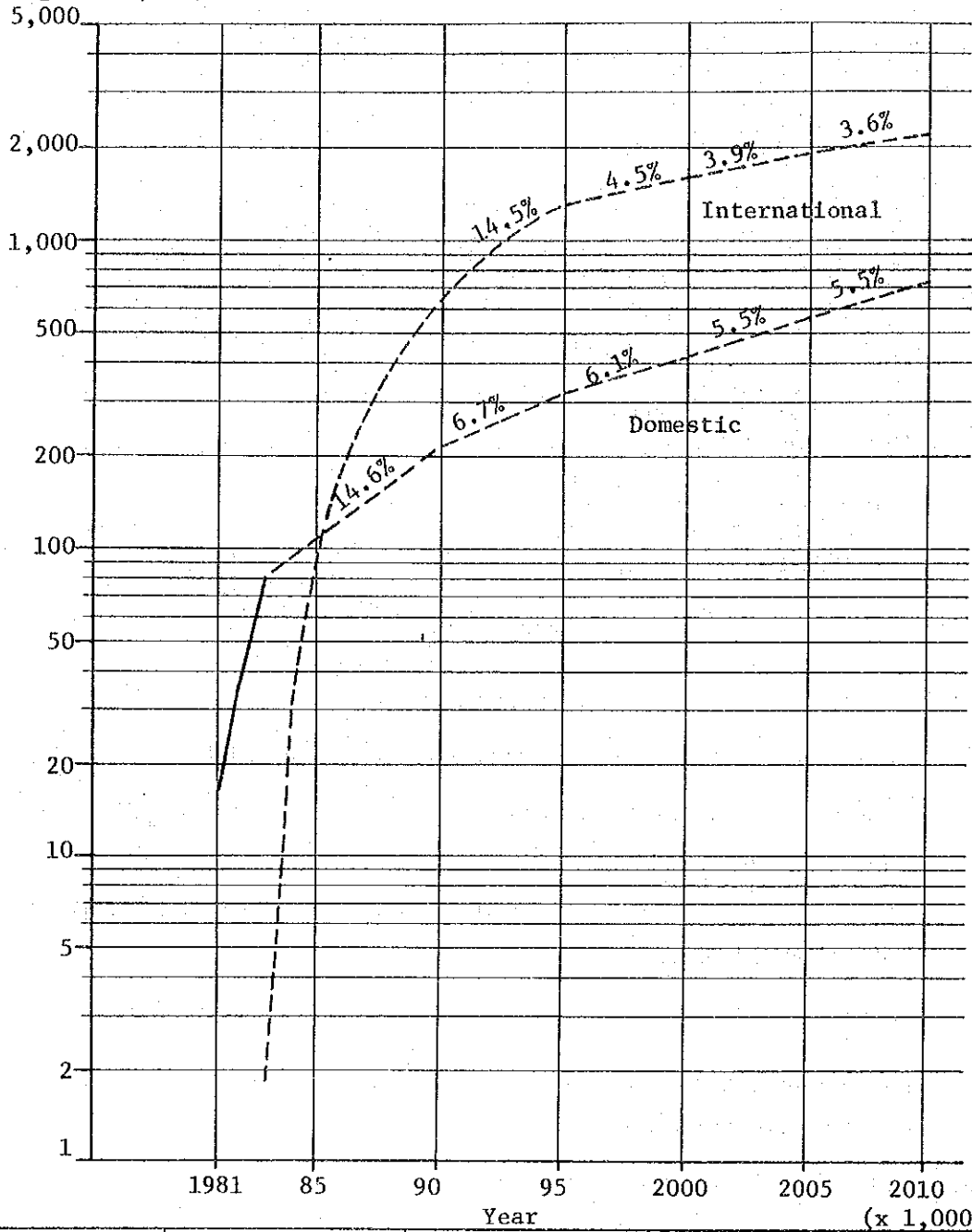
The forecasts are made in the following steps.

- Analysis of the past air traffic demand in Egypt
- Analysis and projection of the population and GDP of Egypt
- Forecast of air traffic demand in Egypt based on the results of analyses mentioned in the above
- Distribution of air traffic demand to Alexandria International Airport based on relevant indices
- Forecast on air traffic demand by air route (only for passengers) demand

The demand forecasts prepared in accordance with these steps are described in detail in 3.2 and later sections.

The results of the demand forecast are summarized in Figs. 3.1.1 and 3.1.2.

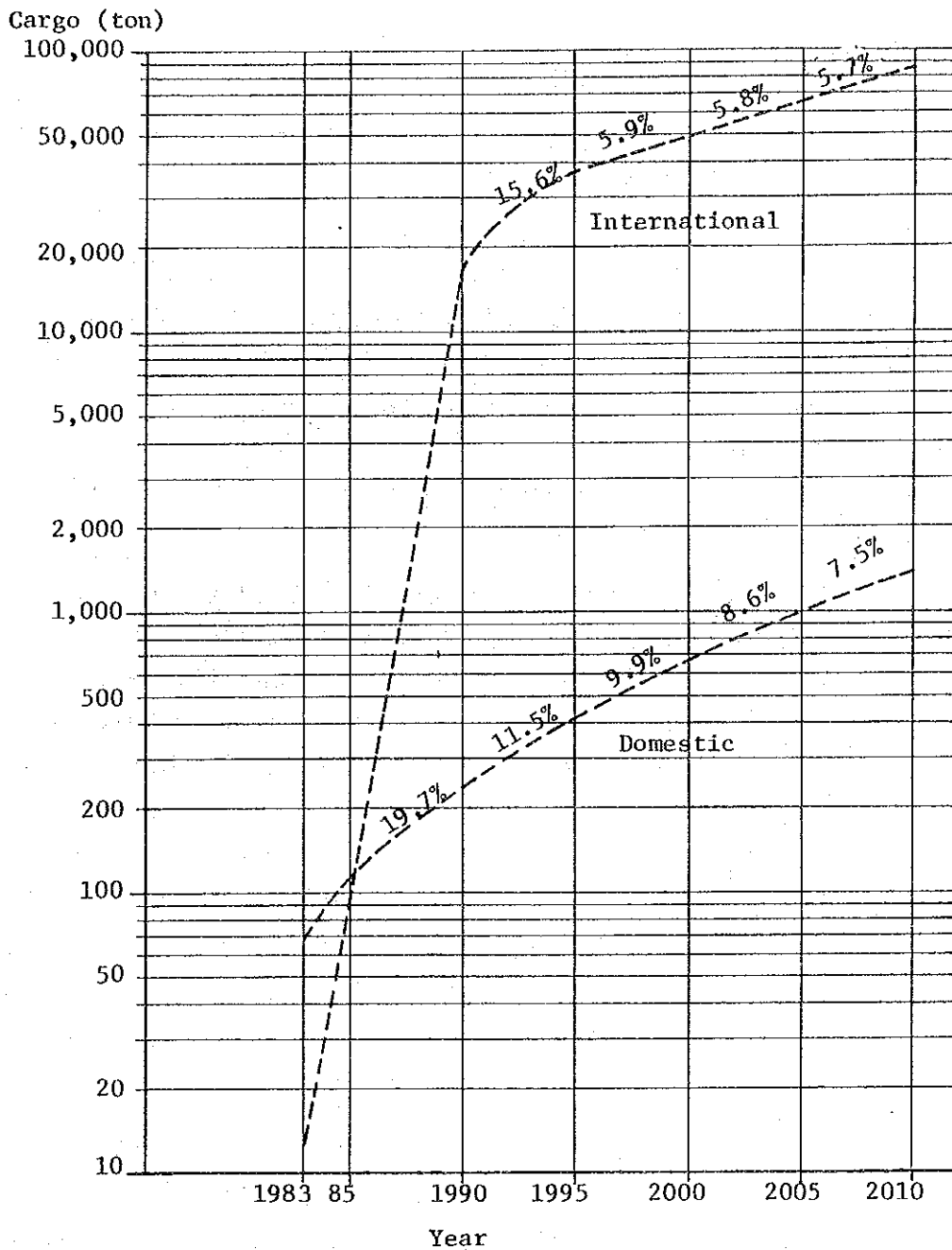
Passenger (x1,000)



Year Category		Actual		Projected				
		1981	1983	1990	1995	2000	2005	2010
Embarcked and disembarcked	Dom.	16	81	230	320	420	560	730
	Int'l	-	2	640	1,300	1,600	1,900	2,300
	Total	16	83	870	1,620	2,020	2,460	3,030
Transit		-	-	25	45	55	65	80

Fig. 3.1.1 Projected Passenger Demand at Alexandria International Airport





Year		Projected					(ton)
		Actual	1990	1995	2000	2005	
Loaded and unloaded	Dom.	68	240	420	670	1,000	1,400
	Int'l	13	18,000	37,000	50,000	66,000	87,000
	Total	81	18,240	37,420	50,670	67,000	88,400

Fig. 3.1.2 Projected Cargo Demand at Alexandria International Airport

### 3.2 Past Trend of Air Traffic Demand

Table 3.2.1 shows the actual records of passenger and cargo traffic volume from 1975 to 1983, both for Egypt as a whole and for Nozha airport.

Although most of passengers at Alexandria are presently domestic passengers, international passengers in Egypt are three times as many as domestic passengers. This tendency is expected to continue taking into account the population and its distribution. Even at Nozha airport which is located not only in the second largest city of Egypt, but also as its northern gateway, international passengers are expected to exceed domestic passengers when its facilities become capable of accommodating traffic demand without restraint. In that event, it will serve as Egypt's second international airport after Cairo.

In Fig. 3.2.1, the past air traffic demand in Egypt is shown in comparison with the rest of the world. Although the world air passenger traffic including both international and domestic services has been stagnant since 1979, air traffic demand in Egypt has shown a remarkable rate of growth since 1975 : International and domestic air traffic demand has increased at an average of 12.5% and 20.7%, respectively. From this, it can be said that air transport in Egypt is in a stage of steady growth. Therefore, it is considered that at least for the next several years, this increasing tendency with a relatively high rate (similar to the present rate) will continue and then enter a mature stage with a slower increase rate.

Origins and destinations of international passengers from/to Egypt are shown together with the respective share in Fig. 3.2.2 : the Middle East has the largest share of 58%, which is followed by Europe with 30%.

The shares of Nozha airport in the total domestic and international passenger traffic of Egypt were about 4% and 0.03% respectively in 1983 (see Fig. 3.2.3).

However, it is considered that international service at Nozha airport is not in the same circumstances as other airports in terms of a relation between demand and supply because of recent start of international service at Nozha in November, 1983. Therefore, this share can not be used as a basis for forecast.

**Table 3.2.1 Past Trend of Air Traffic Demand in Egypt and at Nozha Airport**

Egypt

Passengers

(x 1,000)

	75	76	77	78	79	80	81	82	83
Dom.	419	606	702	983	1,213	1,589	1,945	2,014	2,205
Int'l	2,360	2,960	3,332	3,653	3,835	4,309	4,839	5,593	6,071
Total	2,779	3,566	4,034	4,636	5,048	5,898	6,784	7,607	8,276
Transit	158	179	171	189	204	189	197	185	NA *1

Note: \*1 Not Available

Cargo

(ton)

	75	76	77	78	79	80	81	82	83
Dom.	743	1,195	1,517	1,925	1,999	2,264	3,502	3,457	4,275
Int'l	24,781	29,214	38,263	36,067	42,040	44,361	59,623	85,402	123,228
Total	25,524	30,409	39,780	37,992	44,039	46,625	63,125	88,859	127,503

Nozha airport

Passengers

	75	76	77	78	79	80	81	82	83
Dom.	4,634	-	-	-	4,079	-	16,312	39,283	81,436
Int'l	-	-	-	-	-	-	-	-	1,705
Total	4,634	-	-	-	4,079	-	16,312	39,283	83,141

Cargo

(ton)

	75	76	77	78	79	80	81	82	83
Dom.	-	-	-	-	-	-	-	-	68
Int'l.	-	-	-	-	-	-	-	-	-

Source: Annual Statistical Report, ECAA  
Annual Report, Egypt Air

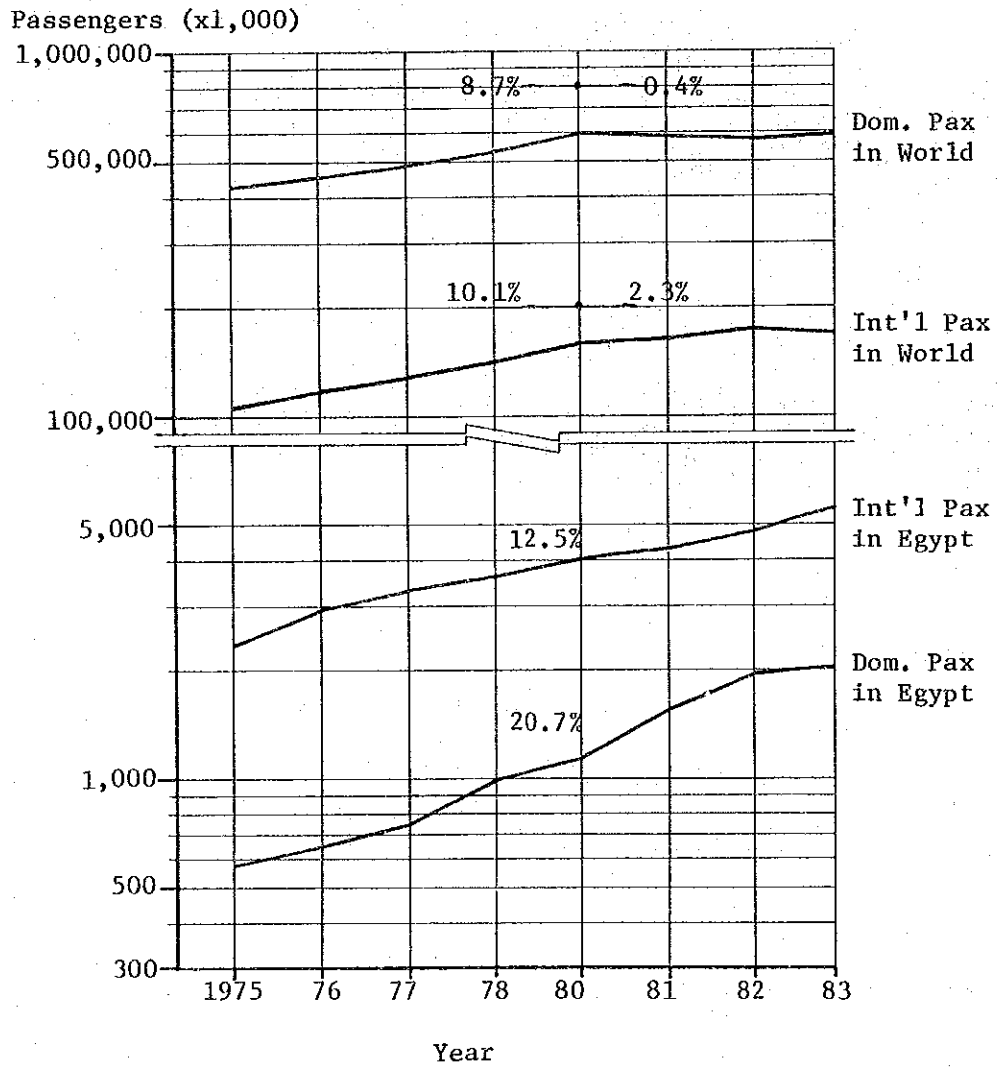


Fig. 3.2.1 Past Trend of Passenger Traffic in the World and Egypt.

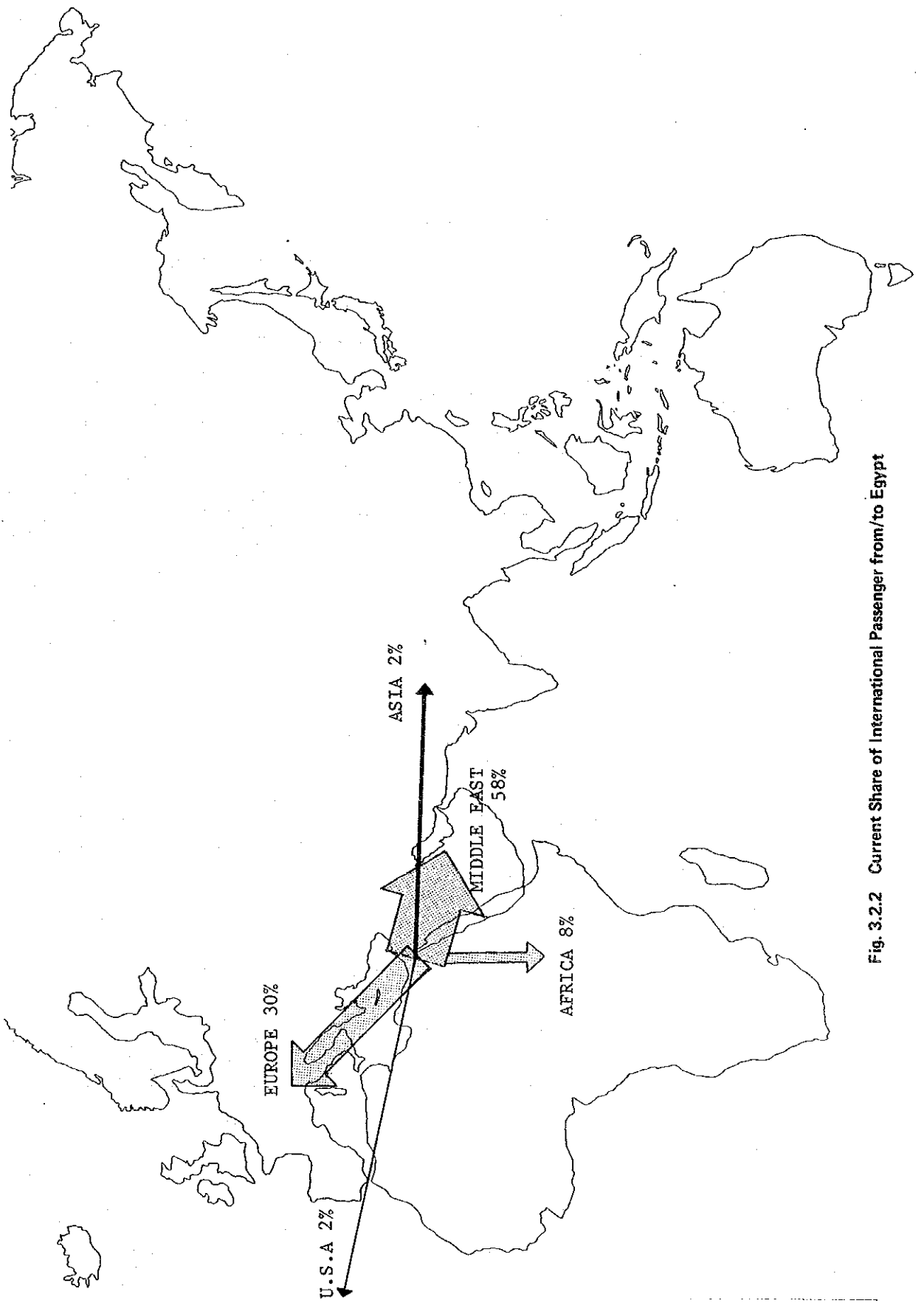


Fig. 3.2.2 Current Share of International Passenger from/to Egypt

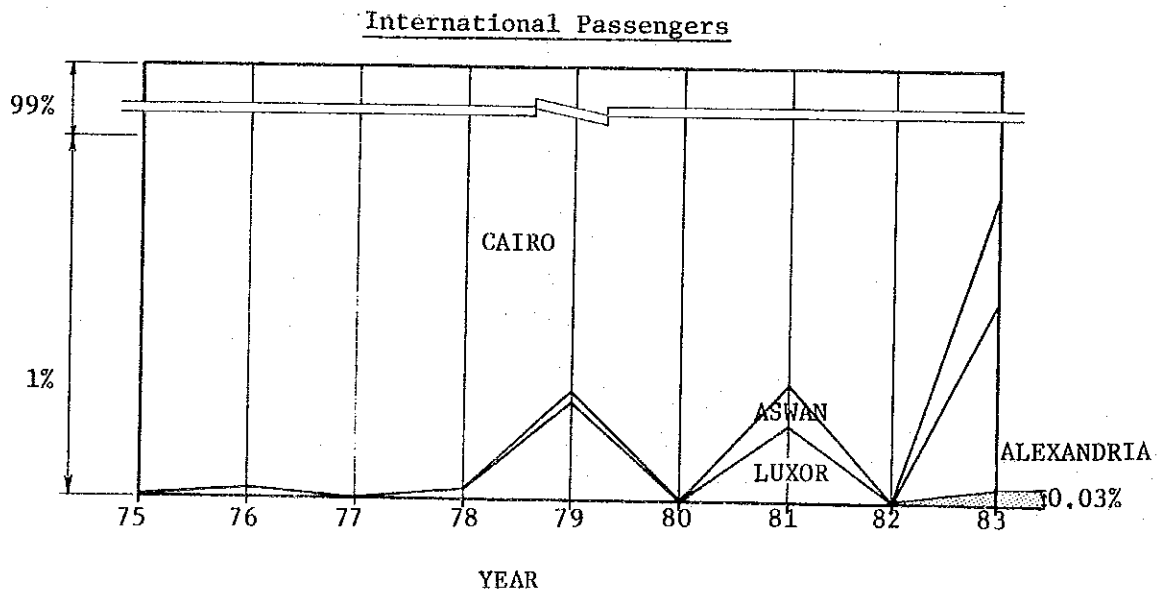
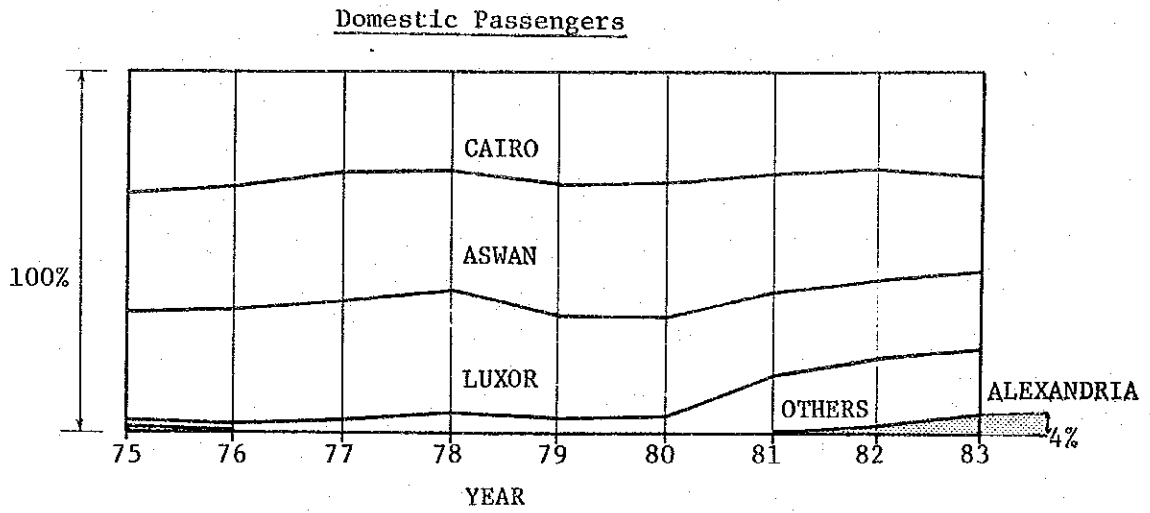


Fig. 3.2.3 Share of Domestic and International Passengers by Airport

### 3.3 Projection of Economic Growth

Air traffic demand is considered to increase with increase of economic activities. In this section, future population and economic growth in Egypt are projected based on the data collected, in order to prepare the bases for forecasts of the air traffic demand.

#### 3.3.1 Projection of Population

As shown in Table 3.3.1, the population of Egypt increased at an average of 2.7% during the period from 1975 to 1982.

Table 3.3.1 also shows the future population of Egypt projected by a growth rate of 2.1% which is forecast by the World Bank. This projection is used as a basis for air traffic demand forecast.

The growth of population in the world and Egypt are shown in Fig. 3.3.1.

**Table 3.3.1 Population in Egypt**

Year	Population *1 (x 1,000)	Annual Growth Rate (%)	Remarks
1975	35,616	2.7 (Actual)	Source: Statistical Yearbook, 1983.  Central Agency for Public Mobilization and Statistics Note: *1 Excluding population abroad *2 Estimate by Central Agency
1976	36,773		
1977	37,350		
1978	38,283		
1979	39,363		
1980	40,548		
1981	41,844 *2		
1982	43,006 *2		
1983	43,900	2.1 *3	Source:  *3 : World Development Report, 1983 World Bank
1985	45,800		
1990	50,800		
1995	56,300		
2000	62,500		
2005	69,400		
2010	77,000		

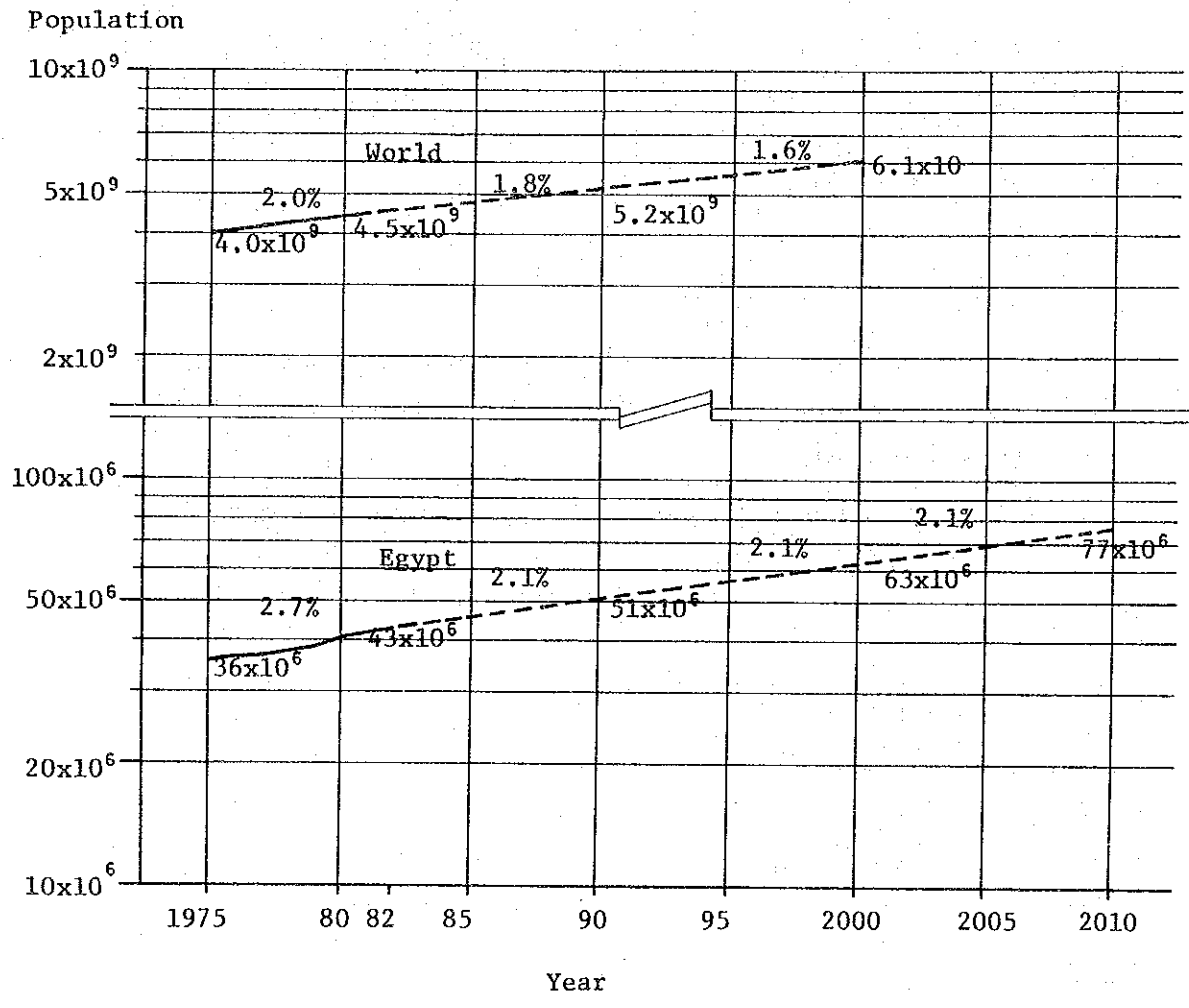


Fig. 3.3.1 Projected Population in World and Egypt



### 3.3.2 Projection of GDP

From 1975 to 1982, real GDP of Egypt grew at an average annual rate of 7.4% as shown in Table 3.3.2.

For future GDP, growth rate was adopted from The Five Year Plan\*<sup>1</sup> for the period up to 1986, and from the National Urban Policy Study\*<sup>2</sup> for the period after 1986. In the National Urban Policy Study more than 3 cases of growth rate were projected, but the lowest annual rate of 5.4% is selected taking into account the objectives of the feasibility study.

The actual records of GDP up to 1982 and its forecast based on the above considerations are shown in Table 3.3.2.

Fig. 3.3.2 shows the actual GDP as well as the World Bank's forecasts on the future GDP for Egypt, middle-income oil exporting countries, and industrialized countries. In this case, middle-income oil exporting countries include Egypt, Iran, Iraq, etc., while industrialized countries include the United States, Japan, EC countries, etc.

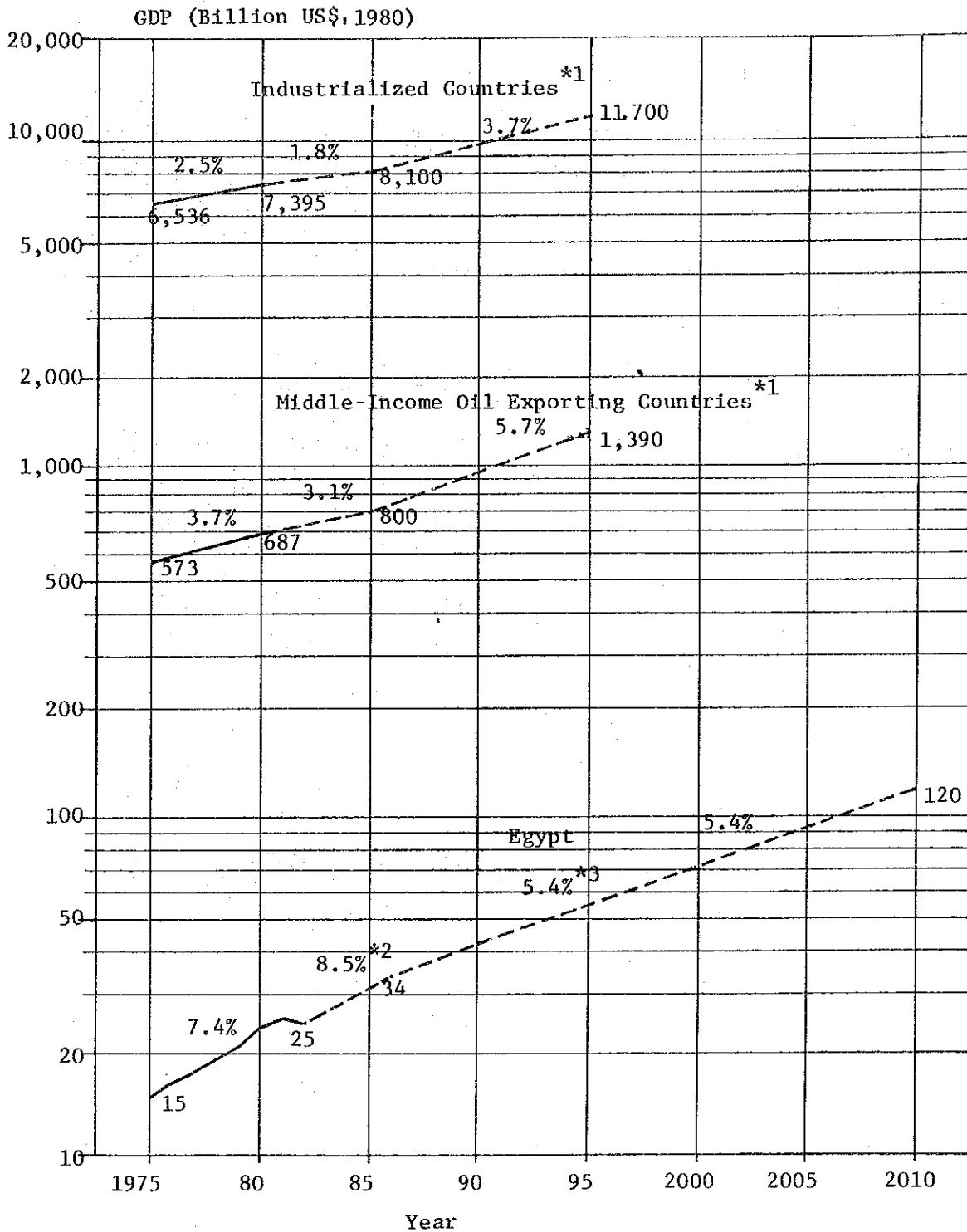
\*1 The Detailed Frame of The Five Year Plan for Economic and Social Development 1982/83 - 1986/87, Dec. 1982  
(Ministry of Planning, Egypt)

\*2 Egypt National Urban Policy Study, Urban Growth and Urban Data Report, Jul. 1982  
(Ministry of Development, Egypt)

Table 3.3.2 Projected GDP of Egypt

Year	GDP *1		Annual Growth Rate (%)	Remarks
	(Million £E)	(Million US\$)		
1975	10,393	14,847	7.4 (Actual)	Source: International Financial Statistics, IMF
1976	11,457	16,367		
1977	12,295	17,565		
1978	13,539	19,342		
1979	14,714	21,020		
1980	16,804	24,006		
1981	17,736	25,338		
1982	17,143	24,490	8.5	Source: The Five Year Plan
1983	18,547	26,496		
1984	20,032	28,618		
1985	21,815	31,165		
1986	23,786	33,981	5.4	Source: National Urban Policy Study
1990	29,400	42,000		
1995	38,200	54,600		
2000	49,700	71,000		
2005	64,600	92,300		
2010	84,000	120,000		

Note: \*1 Constant market prices in 1980



Source: \*1 World Development Report, 1983, World Bank.  
 \*2 The Detailed Frame of The Five Year Plan of Economic and Social Development, 1982/83-1986/87, Dec. 1982, Ministry of Planning, Egypt.  
 \*3 Egypt National Urban Policy Study, Urban Growth and Urban Data Report, Jul. 1982, Ministry of Development, Egypt.

Fig. 3.3.2 Projected GDP in Egypt and Other Countries

### 3.3.3 Projection of per capita GDP

Based on the population and GDP projected in Sections 3.3.1 and 3.3.2, the future per capita GDP together with the actual values in the past years are calculated as indicated in Table 3.3.3.

**Table 3.3.3 Projected per capita GDP of Egypt**

Year	per capita GDP *1		Annual Growth Rate (%)
	£E	US\$	
1975	292	417	4.6 (Actual)
1976	312	446	
1977	329	470	
1978	354	506	
1979	374	534	
1980	414	591	
1981	424	606	
1982	399	570	
1983	422	603	5.8
1985	476	680	6.2
1990	578	826	4.0
1995	678	969	3.2
2000	795	1,140	3.2
2005	931	1,330	3.2
2010	1,090	1,560	3.2

Note: \*1 Constant market prices in 1980

### 3.4 Annual Domestic Passengers

#### 3.4.1 Methodology

The steps involved in forecasting annual domestic passenger demand are shown in Fig. 3.4.1.

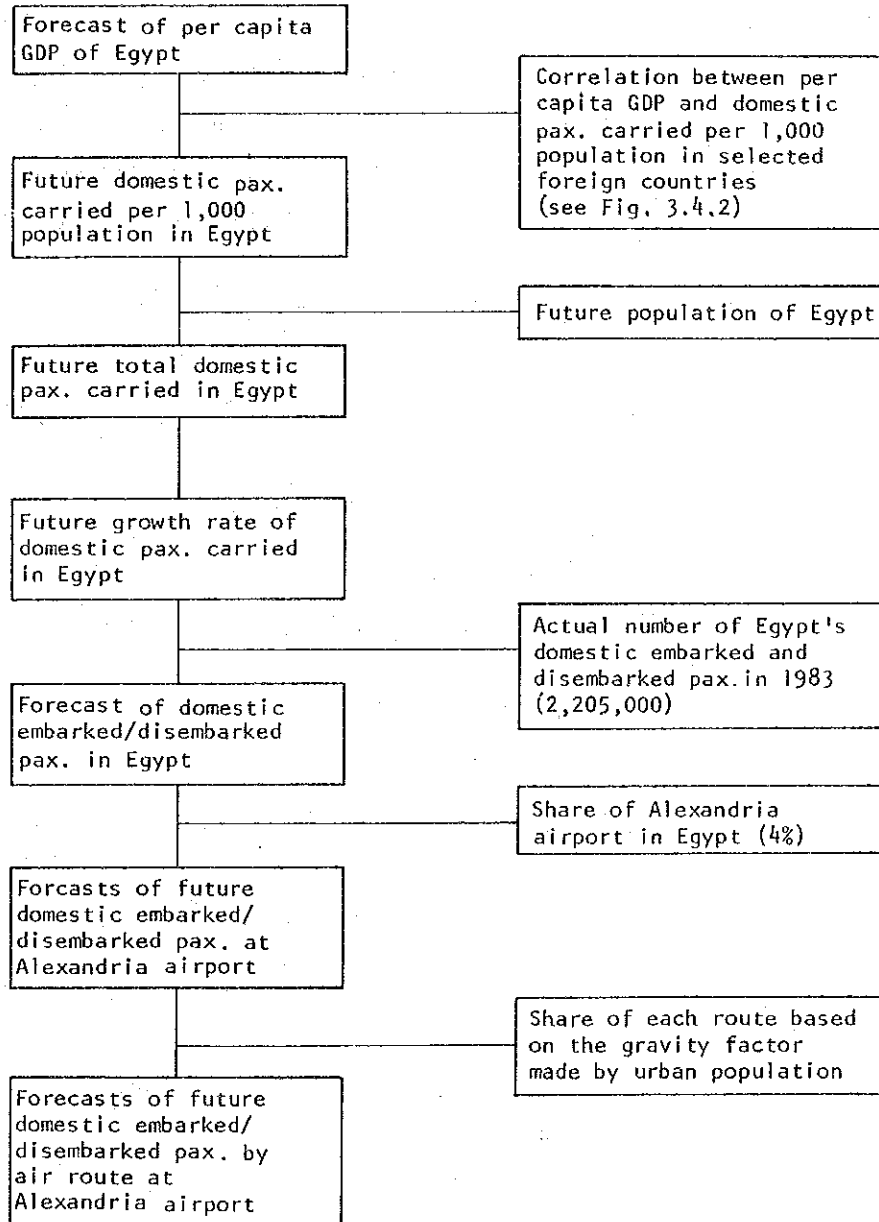


Fig. 3.4.1 Flow Chart to Forecast Domestic Passenger Demand

It is supposed that the level of air transport development is influenced by a country's level of economic growth as well as by its geographical characteristics, and that there is an optimum level of air transport activities for each country depending on these economic and geographical conditions.

The optimum level of air services is determined in such a way that the level of air traffic activities are commensurate with the other sectors of the economy in order to maximize the general economic welfare at the least cost with given resource constraints and price structure.

In the early stage of air transport development, air traffic volume tends to increase rapidly in order to bridge the gap between the actual level and the optimum level of air transport. In the adjustment stage as the air transport activities are further developed and improved, the actual level of transport is brought closer to the optimum level.

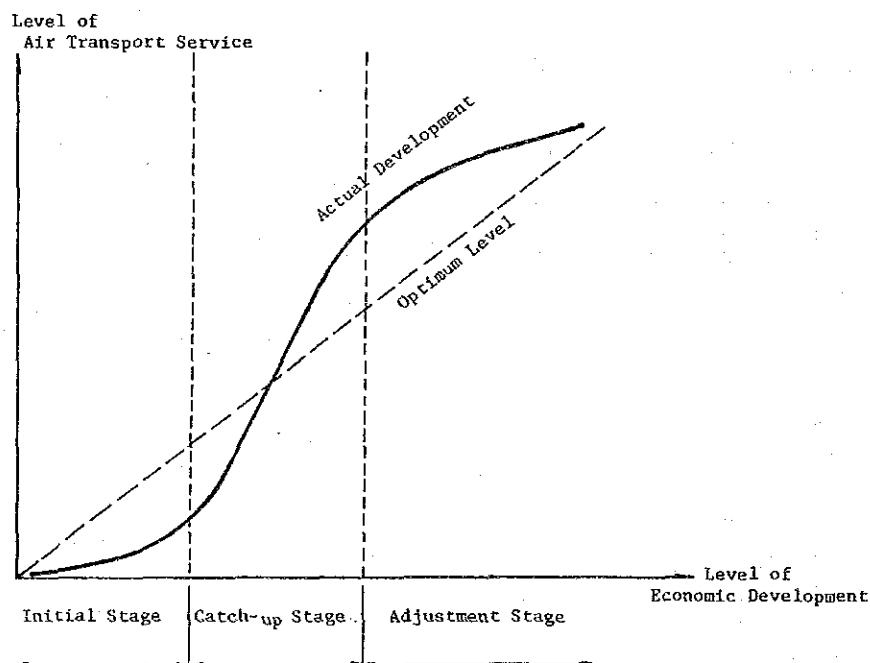


Fig. 3.4.2 Air Transportation and Economic Development

The above steps can be verified by comparing air transport development of various countries at different stages of economic development against the economic development indicators. In the following section, domestic passengers carried per 1000 population are compared against per capita GDP (see Fig. 3.4.3).

The countries listed in Fig. 3.4.3 are at different stages of economic and air transport development. In these countries, India is at an early stage of development for both economy and air transport activities, while the United States represents the final stage of development within the economic and technological framework which will prevail in the next few decades. Although the volume of air transport activities in different countries is determined by each country's geographical characteristics and the level of development of other means of transportation, it can be seen from Fig. 3.4.3 that the countries with a high population density tend to have more active air transport activities. In this sense, on a high side forecast, domestic passengers in Egypt (population density 40 per km<sup>2</sup>) are estimated to increase to reach the level of Malaysia (39 per km<sup>2</sup>) as its economy develops, and then continue to grow toward the level of the United States.

However, domestic passenger demand is forecast as a medium projection in this Study on the assumption that air transport in Egypt would develop along the line of regression equation (Equation 2 in the figure) based on the data for 16 countries listed in Fig. 3.4.3.

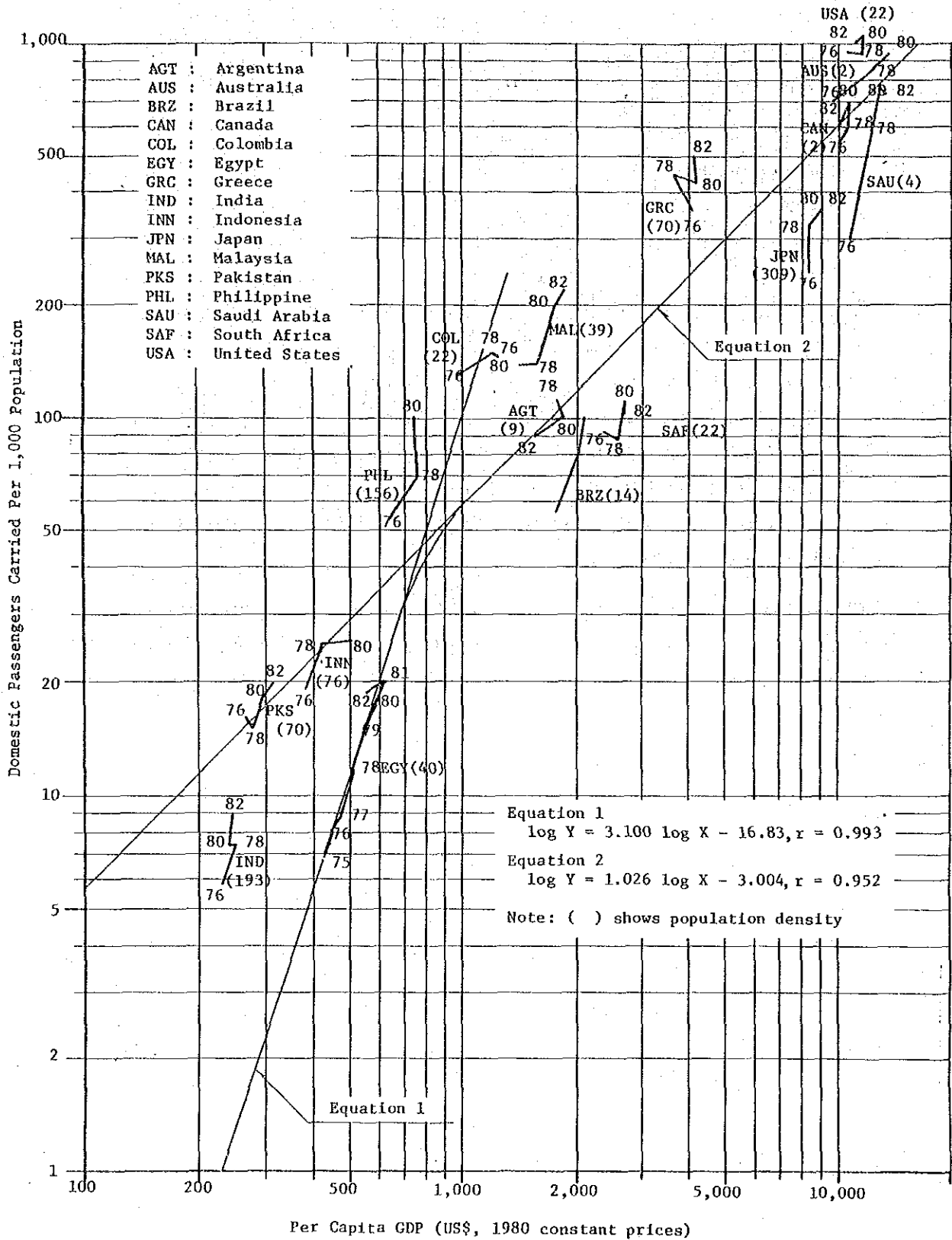


Fig. 3.4.3 Domestic Passengers per 1,000 population and per capita GDP



### 3.4.2 Domestic Passengers in Egypt

Domestic passengers carried in Egypt are forecast from the estimated regression line in Fig. 3.4.3 based on the future per capita GDP in Section 3.3.

Table 3.4.1 shows total domestic embarked and disembarked passengers in Egypt which are forecast based on the same growth rate as that of passengers carried.

**Table 3.4.1 Projected Domestic Passengers in Egypt**

Year	GDP/Capita (US\$)	Pax. Carried per 1,000 population	Population (x 1,000)	Pax. Carried (x 1,000)	Annual Growth Rate(%)	Embarked/ Disembarked pax. in Egypt (x 1,000)
1983	(603)	20	43,900	880		2,205
1990	826	44.8	50,800	2,280	14.6	5,720
1995	969	56.2	56,300	3,160	6.7	7,920
2000	1,140	67.8	62,500	4,240	6.1	10,600
2005	1,330	79.7	69,400	5,530	5.5	13,900
2010	1,560	93.8	77,000	7,220	5.5	18,200

Note: ( ) Estimated Value

### 3.4.3 Domestic Passengers at Alexandria International Airport

The average load factor of Alexandria-Cairo route for 1982 and 1983 is compared with that of all domestic routes in Egypt and Abu Simbel-Aswan route with the highest load factor as shown in Table 3.4.2.

**Table 3.4.2 Load Factor of Domestic Flights**

Route \ Year	1982	1983
Alexandria - Cairo	64%	78%
All Domestic Routes in Egypt	70%	73%
Abu Simbel - Aswan	86%	79%

From the above table, it is judged that Alexandria is not suffering undersupply of air transport service against the demand, but is receiving average air transport service for Egypt.

Therefore, the future domestic passengers at Alexandria international airport are estimated as indicated in Table 3.4.3 and Fig. 3.4.4 based on an assumption that the share of Alexandria in total embarked and disembarked passengers in Egypt remains at the same level as that in 1983 i.e. approximately 4%.

**Table 3.4.3 Projected Domestic Passengers at Alexandria International Airport**

Item \ Year	Dom. Embarked /Disembarked Pax. in Egypt (x 1,000)	Dom. Embarked /Disembarked Pax. in Alexandria (x 1,000)	Remarks
1983	2,205	81	Actual
1990	5,720	230	
1995	7,920	320	
2000	10,600	420	
2005	13,900	560	
2010	18,200	730	

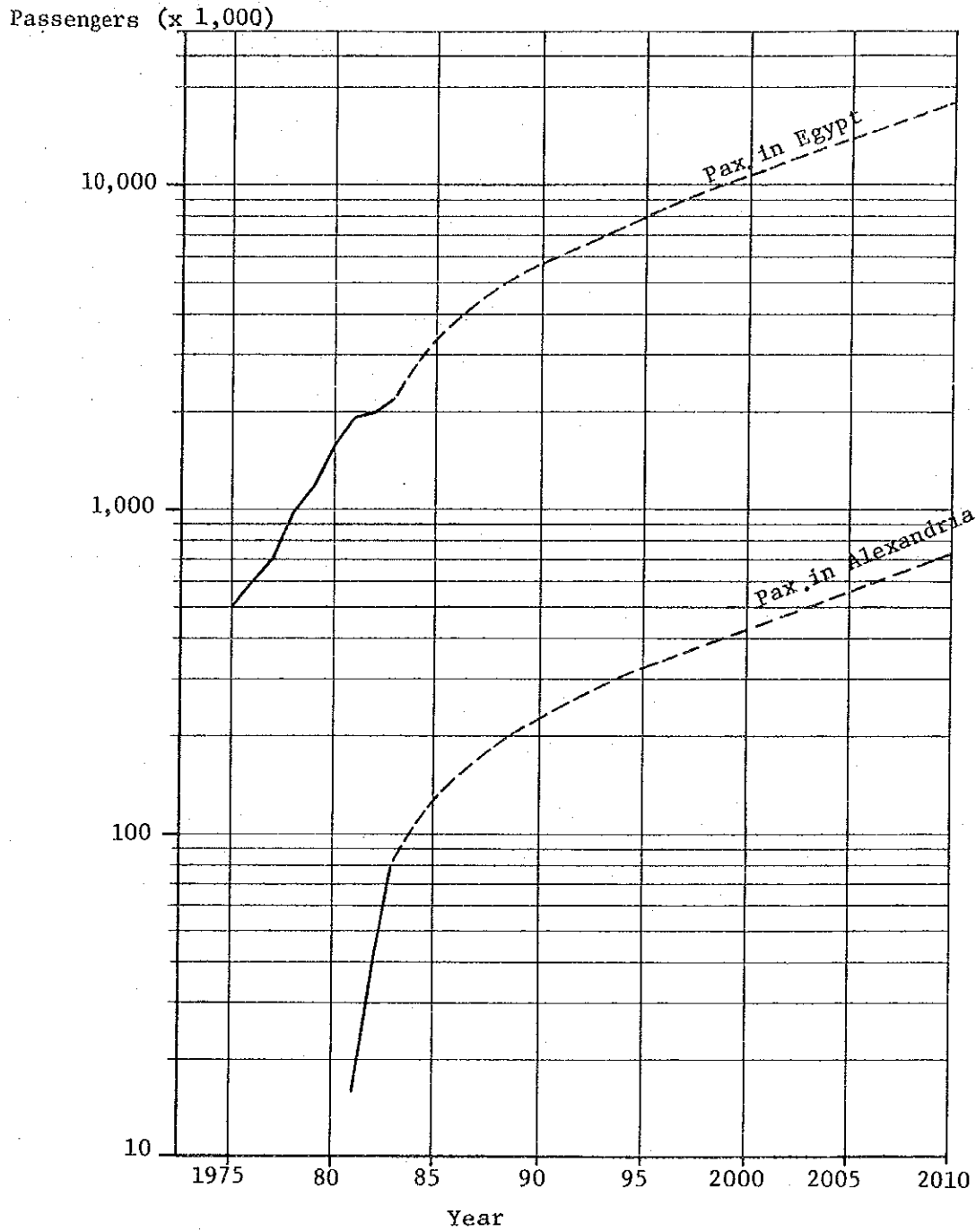
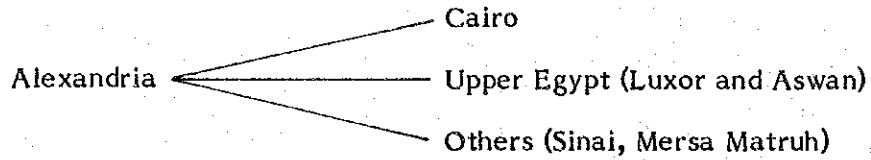


Fig. 3.4.4 Projected Domestic Passengers in Egypt and at Alexandria International Airport

#### 3.4.4 Domestic Passengers by Air Route

Domestic routes from/to Alexandria International Airport in the future are estimated as shown below and in Fig. 3.4.5 which include Alexandria-Upper Egypt and other routes in addition to the present route connecting Alexandria and Cairo.



Total domestic passengers from/to Alexandria are divided into the above air routes based on an assumption that the share of each of these air routes will be proportional to the gravity index, which is the product of the urban population of the origin and the destination.

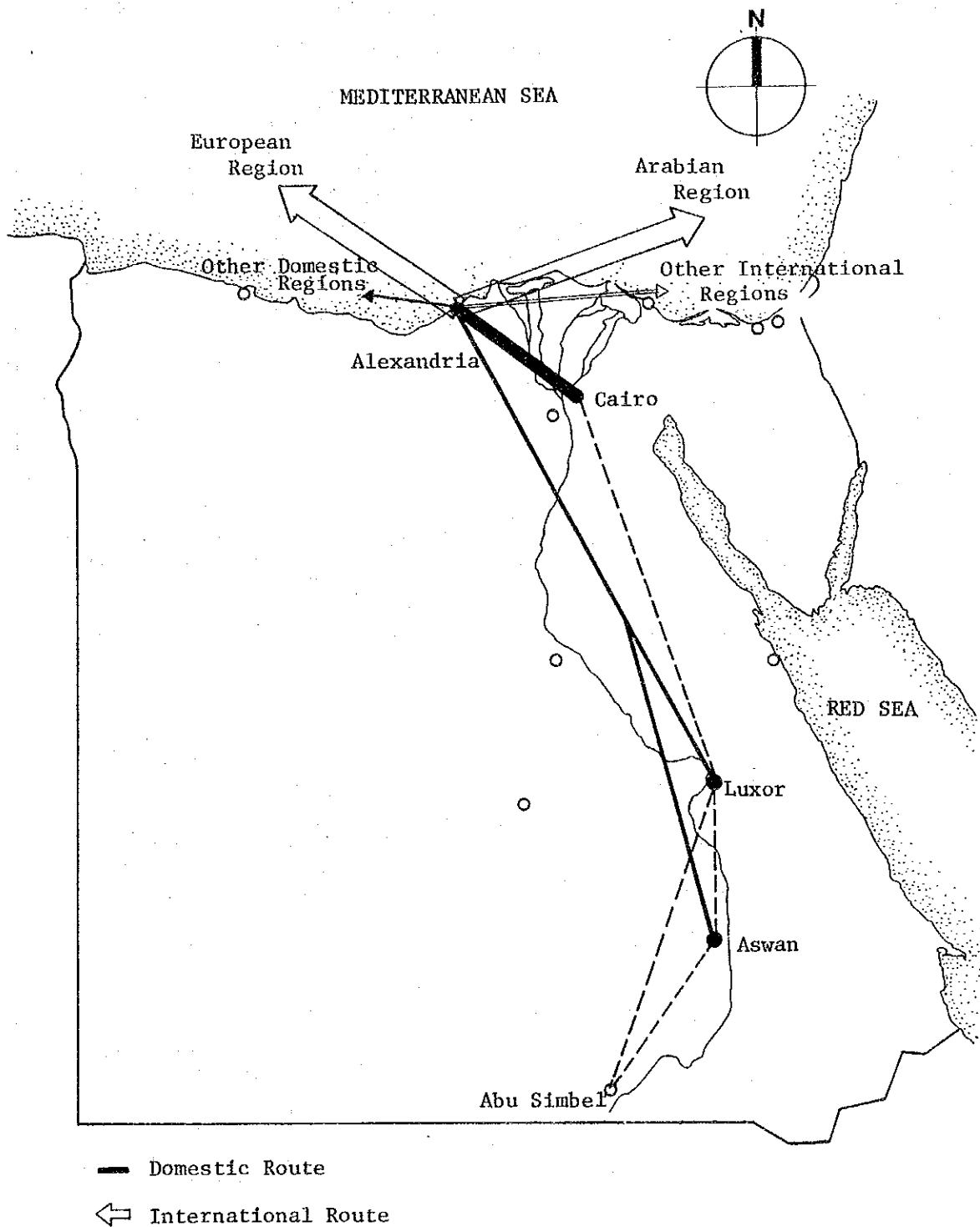


Fig. 3.4.5 Future Air Routes from/to Alexandria

Tables 3.4.4 through 3.4.6 show the urban population of airport service area, the gravity index, the share, and projected domestic passenger demand by air route.

**Table 3.4.4 Urban Population of Airport Service Area**

Airport	Possible Areas *1 (Governorates) Served by the Airport	Urban Population *2 of the Service Area (x 1,000)	Share (%)
Alexandria	Alexandria	2,318	23
Cairo	Cairo, Suez, Ismailia	5,442	54
Upper Egypt	Menia, Asyut, Suhag, Qena, Aswan, New Valley	1,972	19
Other	Port Said, Red Sea, Matruh, Sinai	373	4
Total		10,105	100

Note: \*1 The possible areas (governorates) are selected to estimate the proportion of the potential of domestic passenger by route.

Source: \*2 Population of Governorates by Urban/Rural Residence, 1976 Population and Housing Census.  
Statistical Yearbook, 1952-1982, Aug. 1983  
Central Agency for Public Mobilisation and Statistics, Egypt

**Table 3.4.5 Share of Domestic Passengers by Route**

Route	Gravity Index (x 10 <sup>12</sup> )	Share (%)
Alexandria - Cairo	12.61	70
Alexandria - Upper Egypt	4.57	25
Alexandria - Others	0.86	5
Total	18.04	100

**Table 3.4.6 Domestic Passengers by Market**

Market	Alexandria - Cairo	Alexandria - Upper Egypt	Alexandria - Others	Total
Share	70%	25%	5%	100%
1983 *1	81	-	-	81
1990	161	58	11	230
1995	224	80	16	320
2000	294	105	21	420
2005	392	140	28	560
2010	511	183	36	730

Note: \*1 Actual

### **3.5 Annual International Passengers**

#### **3.5.1 Methodology**

As stated in Section 3.2, Egypt's international passenger transport service is now in the growth stage, and when it approaches and enters the mature stage in the future the present high growth rate will gradually slow down.

In forecasting, "direction of change" is taken into consideration. In practice, the future demand is forecast by deriving some appropriate regression equations from correlation between economic indices and air traffic demand.

Now, it is probable that international passenger demand will be affected not only by economic development of Egypt, but also by the economic conditions and geographical location of other nations connected by air. Therefore, as for international passenger demand, a method that differs from the one used earlier in forecasting domestic passenger demand is employed.

#### **3.5.2 International Passengers in Egypt**

International air passengers can be divided broadly into Egyptians and foreigners.

These two groups show significantly different rates of growth, and in order to strive for greater precision, it is more appropriate to develop forecasts separately for each group, rather than to do so for all air passengers.

Below, the forecasting of Egyptian international passengers, foreign international passengers and international transit passengers are discussed.

##### **(1) Egyptian International Passengers**

With respect to Egyptian international passengers, the following two cases are hypothesized, and the future demand is forecast by regression analyses.

##### **Case A**

Egypt's foreign exchange income depends to a significant extent on remittances of workers working abroad, as well as on petroleum exports, transit fees from the Suez Canal, and revenue from tourism. The Egyptian government has also adopted policies to encourage its workers to work overseas. From these circumstances, one case is postulated, in which Egyptian international passenger demand can be

explained not so much on the level of economic activities in Egypt, but more on those of overseas.

In this case, therefore, per capita GDP for Middle East region and Europe/USA region (with each region weighted at 50%) is adopted as the explanatory variable in the regression analysis.

#### Case B

In this case, it is assumed that international travel by Egyptians depends on the economic conditions in both Egypt and destination countries; the income level of the Egyptian people is also taken into account as an explanatory variable for air traffic demand. Therefore, per capita GDP in Egypt, Middle East region and Europe/USA region are given weightings of 50%, 25% and 25% respectively.

It is considered reasonable to select a regression equation which has the characteristic that the elasticity of Egyptian international passenger demand against per capita GDP will gradually decline in accordance with the development of air transport toward the mature stage.

As a result of regression by the past data covering the period between 1975 and 1981, high correlation was observed for both Case A and Case B as shown in Table 3.5.1. Therefore, these equations are employed for the forecast of future demand.

The passengers for the future key years are estimated based on the actual traffic in 1982 and by the growth rate of the passengers calculated by the regression equation because the actual traffic volume in 1982 as the starting year does not match the figure obtained from the regression equation.



**Table 3.5.1 Correlation between Weighted per capita GDP and Egyptian International Passengers in Egypt**

Item CASE	Correlation Equation	Correlation Coefficient
CASE A	$P_E = 1.5258 \frac{GDP}{N} - 6139$	0.959
CASE B	$P_E = 0.8366 \frac{GDP}{N} - 6490$	0.953

$P_E$  : Egyptian International Passengers (x1,000)

$\frac{GDP}{N}$ : Weighted per capita GDP

(US\$, 1980 constant market prices)

Table 3.5.2 shows forecast of Egyptian international passenger demand based on the regression correlation equations for Case A and Case B.

**Table 3.5.2 Forecast of Egyptian International Passengers by Case**

Year	Case A		Case B		Remarks
	Egyptian Int'l Pax. (x1,000)	Annual Growth Rate (%)	Egyptian Int'l Pax. (x1,000)	Annual Growth Rate (%)	
1982	3,535	-	3,535	-	Actual
1990	5,760	6.3	5,900	6.6	
1995	7,530	5.5	7,710	5.5	
2000	9,570	4.9	9,750	4.8	
2005	11,700	4.1	11,900	4.1	
2010	14,100	3.8	14,300	3.8	

Table 3.5.2 show that both equations give approximately the same values. Egyptian international passenger demand is projected as shown in Table 3.5.3 based on the above result.

**Table 3.5.3 Projected Egyptian International Passengers in Egypt**

Year	Egyptian Int'l Pax. (x1,000)	Annual Growth Rate (%)	Remarks
1982	3,535	-	Actual
1990	5,810	6.4	
1995	7,590	5.5	
2000	9,590	4.8	
2005	11,700	4.1	
2010	14,100	3.8	

(2) Foreign International Passengers

With respect to foreign international air passengers, the following two cases are hypothesized, and future demand is forecast by regression analyses.

Case A

Most of foreigners who visit Egypt by air are tourists, and the size of demand is considered to be explained by income level of foreigners. Based on the share of past foreign visitors to Egypt by nationality, an explanatory variable was established to be an average per capita GDP of different areas weighted by the following weights: 51% for Europe/USA region, 42% for Middle East region, and 7% for other regions.

Case B

As a component of the explanatory variable for air transport, the level of economic activities of Egypt is taken into account. The following weights were given to the per capita GDP of the different regions: 50% for Egypt, 25% for the Europe/USA region, 21% for Middle East region and 4% for other regions. This weighted per capita GDP is adopted as an explanatory variable.

As for the type of regression equation the same one is used as selected in the forecast of Egyptian international passengers.

The regression equations for these two cases, based on the data from 1975 to 1981, are shown in Table 3.5.4.

**Table 3.5.4 Correlation between Weighted per capita GDP and Foreign International Passengers in Egypt**

Case \ Item	Correlation Equation	Correlation Coefficient
CASE A	$P_F = 0.4341 \frac{GDP}{N} - 2494$	0.919
CASE B	$P_F = 0.7845 \frac{GDP}{N} - 2288$	0.928

$P_F$ : Foreign International Passengers (x1,000)

$\frac{GDP}{N}$ : Weighted per capita GDP  
(US\$, 1980 constant market prices)

Table 3.5.5 shows forecast of foreign international passenger demand based on the regression equations for Case A and Case B in Table 3.5.4.

**Table 3.5.5 Forecast of Foreign International Passengers by Case**

Year	Case A		Case B		Remarks
	Foreign Int'l Pax. (x1,000)	Annual Growth Rate (%)	Foreign Int'l Pax. (x1,000)	Annual Growth Rate (%)	
1982	2,058	-	2,058	-	Actual
1990	2,820	4.0	2,860	4.2	
1995	3,410	3.9	3,450	3.8	
2000	4,050	3.5	4,090	3.5	
2005	4,740	3.2	4,810	3.3	
2010	5,520	3.1	5,610	3.1	

As a result of the regressions of foreign international passenger demand as calculated in Table 3.5.5, foreign international passenger demand in Egypt for the key years are set as shown in Table 3.5.6.

Table 3.5.6 Projected Foreign International Passengers in Egypt

Year	Foreign Int'l Pax. (x1,000)	Annual Growth Rate (%)	Remarks
1982	2,058	-	Actual
1990	2,840	4.1	
1995	3,420	3.8	
2000	4,060	3.5	
2005	4,750	3.2	
2010	5,540	3.1	

(3) International Transit Passengers

International transit passenger volume is estimated on the basis of transit passenger ratio, which is the number of transit passengers divided by the number of embarked and disembarked passengers excluding transit passengers.

At Cairo international airport, the transit passenger ratio is going down steadily each year, and was 3.3% in 1982. However, considering the role of Egypt as a transit point in this region and the past records at several airports in neighboring countries (see Table 3.5.7), it is assumed that the transit ratio will remain fairly stable at around 3.5% in the coming years.

Table 3.5.7 Transit Ratio at Cairo and Other Airports

Airport \ Year	1978	1980	1982
Cairo	4.8	4.1	3.3
Rome	6.4	4.9	5.6
Athens	16.7	-	7.7
Tunis	2.5	2.2	1.4
Istanbul	-	2.0	1.1
Dhahran	-	-	5.1
Jeddah	-	-	2.2
Kuwait	9.1	9.7	5.8
Bahrain	29.6	41.7	48.4
Karachi	12.7	11.1	12.1

Table 3.5.8 summarizes total international passenger demand in Egypt as a results of the studies in Section 3.5.2.

**Table 3.5.8 Projected International Passengers in Egypt**

Year	Egyptian (x1,000)	Annual Growth Rate (%)	Foreigners (x1,000)	Annual Growth Rate (%)	Embarked/ Disembarked (x1,000)	Annual Growth Rate (%)	Transit (x1,000)	Re- marks
1982	3,535	-	2,058	-	5,590	-	185	Actual
1990	5,810	6.4	2,840	4.1	8,650	5.6	300	
1995	7,590	5.5	3,420	3.8	11,000	4.9	390	
2000	9,590	4.8	4,060	3.5	13,700	4.5	480	
2005	11,700	4.1	4,750	3.2	16,500	3.8	580	
2010	14,100	3.8	5,540	3.1	19,600	3.5	690	

### 3.5.3 International Passengers at Alexandria International Airport

As stated in Section 3.2, international service at Nozha airport was only started in 1983. There are no reliable data available for indicating the relationship between supply and demand for international passengers. Hence, it is necessary to introduce some indices to distribute total demand of Egypt to Alexandria international airport.

As the purposes of travel of Egyptian international passengers and foreign international passengers are considered to be different from each other, they are distributed separately with different indices.

#### (1) Distribution of Egyptian International Passengers

In general, the demand for passenger transport is considered to be related to the size of the urban population. However, considering the fact that a large percentage of Egyptian air travelers are overseas workers, Egyptian international passenger demand is distributed to Alexandria international airport based on the ratio of the population of the service area of Alexandria international airport (which includes both urban and local population) to the total population of Egypt. The service area of Alexandria international airport includes the three states of Alexandria, Behera and Matruh, with a combined population accounting for about 13% of the total national population. Table 3.5.9 shows the populations of the service areas of major airports in Egypt, and then respective shares in the total population of Egypt.

**Table 3.5.9 Population Distribution by Service Area of International Airports in Egypt**

Airport	Possible Areas (Governorates) Served by the Airport	Population of the Service Area (x1,000)	Share (%)
Alexandria	Alexandria, Matruh, Behera	5,707	13
Cairo	Cairo, Port Said, Suez, Damietta, Sharkia, Kalyubia, Kafr-El-Sheikh, Gharbia, Munufia, Ismailia, Giza, Beni-Suef, Fayum, Menia, Asyut, Red Sea, Sinai, Dakahlia	32,228	75
Luxor	Suhag, Qena, New Valley	4,350	10
Aswan	Aswan	721	2
Total		43,006	100

Source: Mid-Year Population Estimates by Governorate & Sex 1982, Statistical Yearbook 1952-1982, Aug. 1983, Central Agency for Public Mobilization and Statistics, Egypt

(2) Distribution of Foreign International Passengers

As most foreign international passengers are tourists, it is considered reasonable to distribute international passenger demand to Alexandria international airport on the basis of the capacity of hotel accommodations. Therefore, the number of beds in deluxe hotels within the airport's service area is used as an index, and it is assumed that the current ratio (8%) of the number of beds in deluxe hotels within the service area of Alexandria international airport to that of whole Egypt remains unchanged. Table 3.5.10 shows the number of beds in deluxe hotels in the airport service areas, and their respective shares in the national total.

**Table 3.5.10 Number of Beds of Deluxe Hotels by Service Areas of International Airport in Egypt**

Airport Service Area	Bed Number of Deluxe hotels	Share (%)
Alexandria	944	8
Cairo	9,536	82
Luxor	520	5
Aswan	554	5
Total	11,554	100

Source: Egypt Tourist Statistics Information 1975-1982, Egyptian General Authority for the Promotion of Tourism

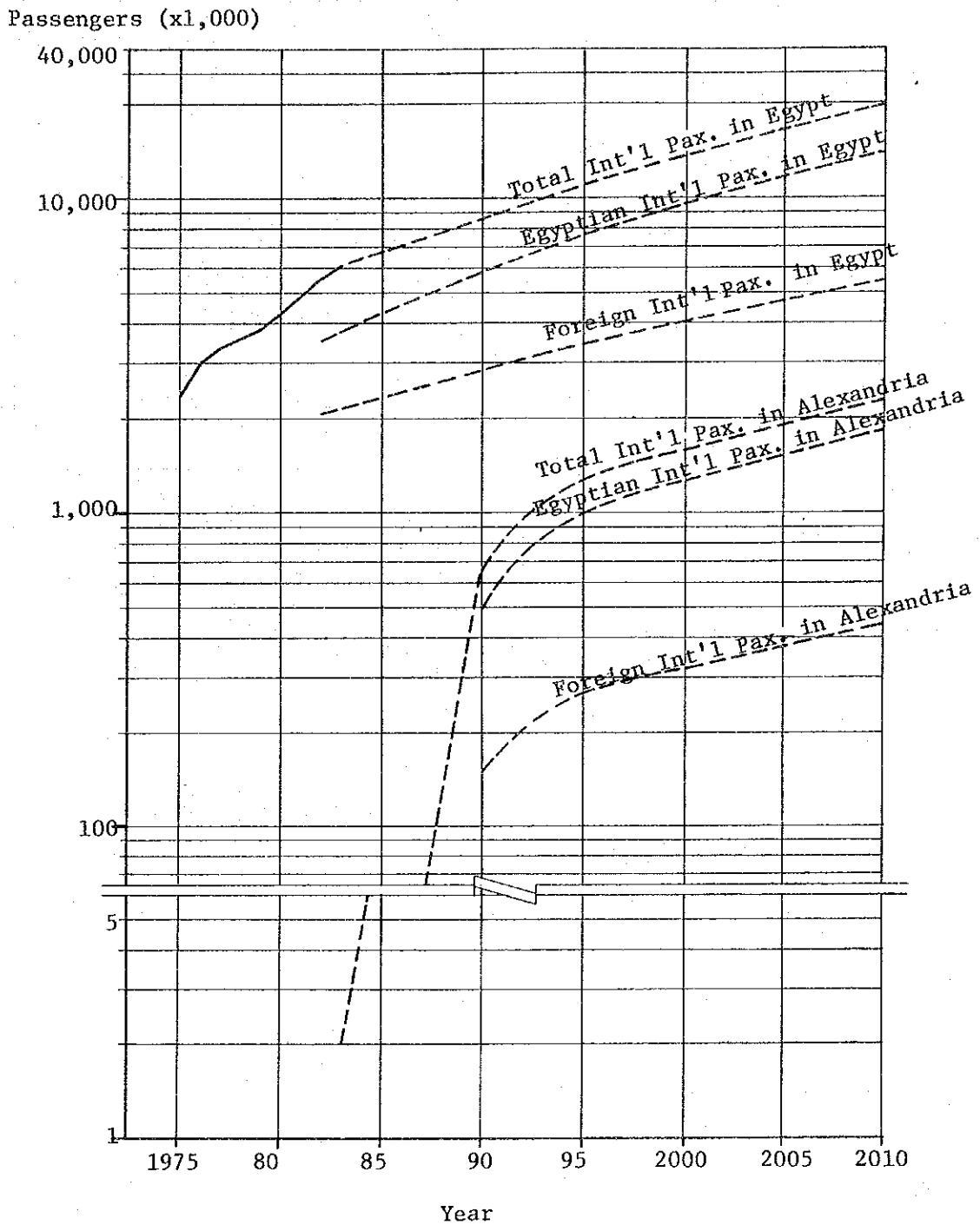


Fig. 3.5.1 Projected International Passengers in Egypt and at Alexandria International Airport

The future demand of Egyptian and foreign international passengers at Alexandria international airport is estimated based on the above distribution rates as shown in Table 3.5.11 and Fig. 3.5.1.

**Table 3.5.11 Projected International Passengers at Alexandria International Airport**

Year	Egyptian (x1,000)	Annual Growth Rate (%)	For- eigner (x1,000)	Annual Growth Rate (%)	Embarked/ Disem- barked Pax. (x1,000)	Annual Growth Rate (%)	Transit (x1,000)	Remarks
1983	-	-	-	-	2*1	-	-	Actual
1990	490	-	150	-	640	-	25	
1995	990	15.1	270	12.5	1,260	14.5	45	
2000	1,250	4.8	320	3.5	1,570	4.5	55	
2005	1,520	4.1	380	3.2	1,900	3.9	65	
2010	1,830	3.8	440	3.1	2,270	3.6	80	

Note: \*1 Operation started in Nov. 1983



(3) International Passengers by Air Route

At present, international routes connecting Alexandria international airport serve only Jeddah with five flights weekly. However, as the demand increases, the number of international routes served at this airport are expected to be expanded to the same level as Cairo international airport.

Furthermore, as shown in Table 3.5.12, the market shares of international passengers at Cairo airport have been fairly stable over the past five years (from 1979 to 1983). Therefore, assuming that these market shares will be maintained in the coming years, the share of international passenger demand by route at Alexandria international airport is established as follows : 60% for the Middle East, 30% for Europe and the United States, and 10% for others.

Table 3.5.13 shows the projected international passenger demand by route.

**Table 3.5.12 Past Trend and Adopted Market Share of International Passengers**

Market \ Year	1979	1980	1981	1982	1983	Adopted Share
Middle East	55.2	55.7	58.0	60.6	58.1	60%
Europe/USA	33.7	33.3	33.5	31.3	31.4	30%
Other Countries	11.1	11.1	8.5	8.1	10.5	10%

Source: Annual Statistical Report, ECAA

**Table 3.5.13 Projected International Passengers by Route at Alexandria International Airport**

Year	Middle East (x 1,000)	Europe/USA (x 1,000)	Others (x1,000)	Total Int'l Pax. (x 1,000)
1990	380	190	70	640
1995	750	380	130	1,260
2000	940	470	160	1,570
2005	1,140	570	190	1,900
2010	1,360	680	230	2,270

Note: Excluding transit passengers

### 3.6 Domestic Cargo

#### 3.6.1 Methodology

Forecast of domestic cargo demand at Alexandria international airport is made by a method similar to that for domestic passengers. Firstly, domestic cargo demand in Egypt is forecast by the correlation between per capita GDP and domestic cargo carried per 1,000 population in numbers of countries. Secondly, total domestic cargo demand in Egypt is distributed to the Alexandria international airport by an appropriate index.

#### 3.6.2 Domestic cargo in Egypt

Fig. 3.6.1 shows the relationship between per capita GDP and domestic cargo carried per 1,000 population in Egypt and various countries at different stage of economic development. It is considered in comparison with other countries in Fig. 3.6.1 that the domestic cargo transport in Egypt is underdeveloped as compared with the level of economic development of Egypt and is in the initial phase of the growth stage. This situation is considered to result from the industrial structure of Egypt and the geographical characteristics that the two largest cities in Egypt, Cairo and Alexandria, are only 200 km apart from each other, and most of Cargo transport in-between depends on roads and railway. However, as the industrial and economic structures undergo further changes and development, and as the value of "time" changes, the development of air cargo toward world-wide levels can be anticipated. Fig. 3.6.1 shows a scenario for the development of domestic cargo demand from present situation to the global level.

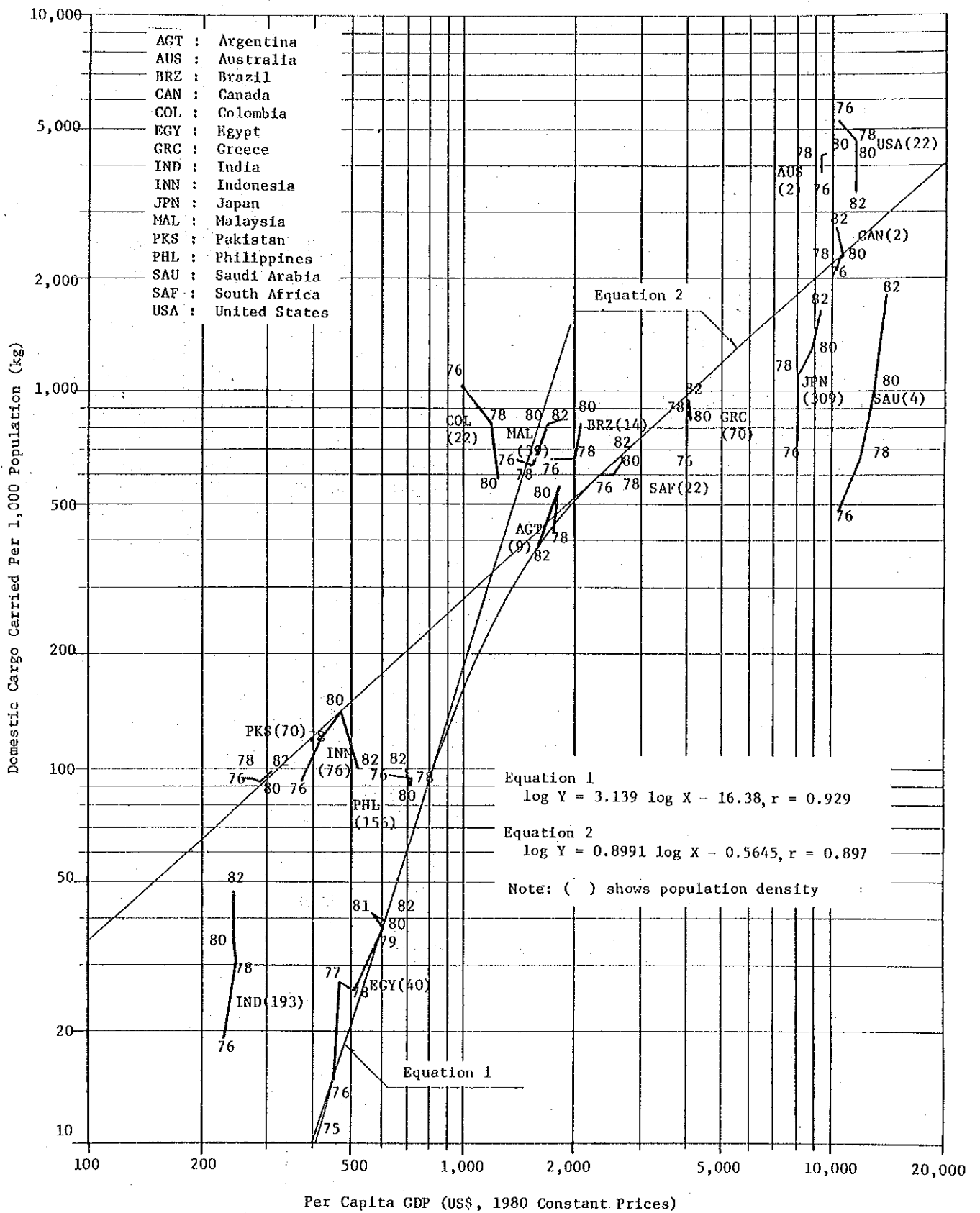


Fig. 3.6.1 Domestic Cargo per 1,000 population and per capita GDP

From Fig. 3.6.1, domestic cargo demand in Egypt is projected as shown in Table 3.6.1 below.

Table 3.6.1 Projected Domestic Cargo in Egypt

Year	GDP/Capita (US\$)	Cargo carried /1,000 population (kg)	Population (x1,000)	Cargo Carried (ton)	Annual Growth Rate (%)	Loaded/unloaded Cargo (ton)
1983	(603)	38.6	43,900	1,693	-	4,275
1990	826	94	50,800	4,780	16.0	12,100
1995	969	146	56,300	8,220	11.5	20,800
2000	1,140	211	62,500	13,200	9.9	33,400
2005	1,330	287	69,400	19,900	8.6	50,400
2010	1,560	371	77,000	28,600	7.5	72,400

### 3.6.3 Domestic cargo at Alexandria International Airport

In 1983, domestic cargo at Nozha airport was approximately 2% of total Egypt\*1. It is assumed that this share in the total will not change in the coming years. Domestic cargo demand at Alexandria international airport is projected as shown in Table 3.6.2 and Fig. 3.6.2.

Note : \*1 
$$\frac{\text{Domestic cargo at Nozha airport}}{\text{Total domestic cargo of Egypt}} = \frac{68 \text{ ton}}{4,275 \text{ ton}} = 1.6\%$$

Table 3.6.2 Projected Cargo at Alexandria International Airport

Year	Domestic Cargo (ton)	Annual Growth Rate (%)	Remarks
1983	68	-	Actual
1990	240	19.7	
1995	420	11.5	
2000	670	1.9	
2005	1,010	8.6	
2010	1,400	7.5	

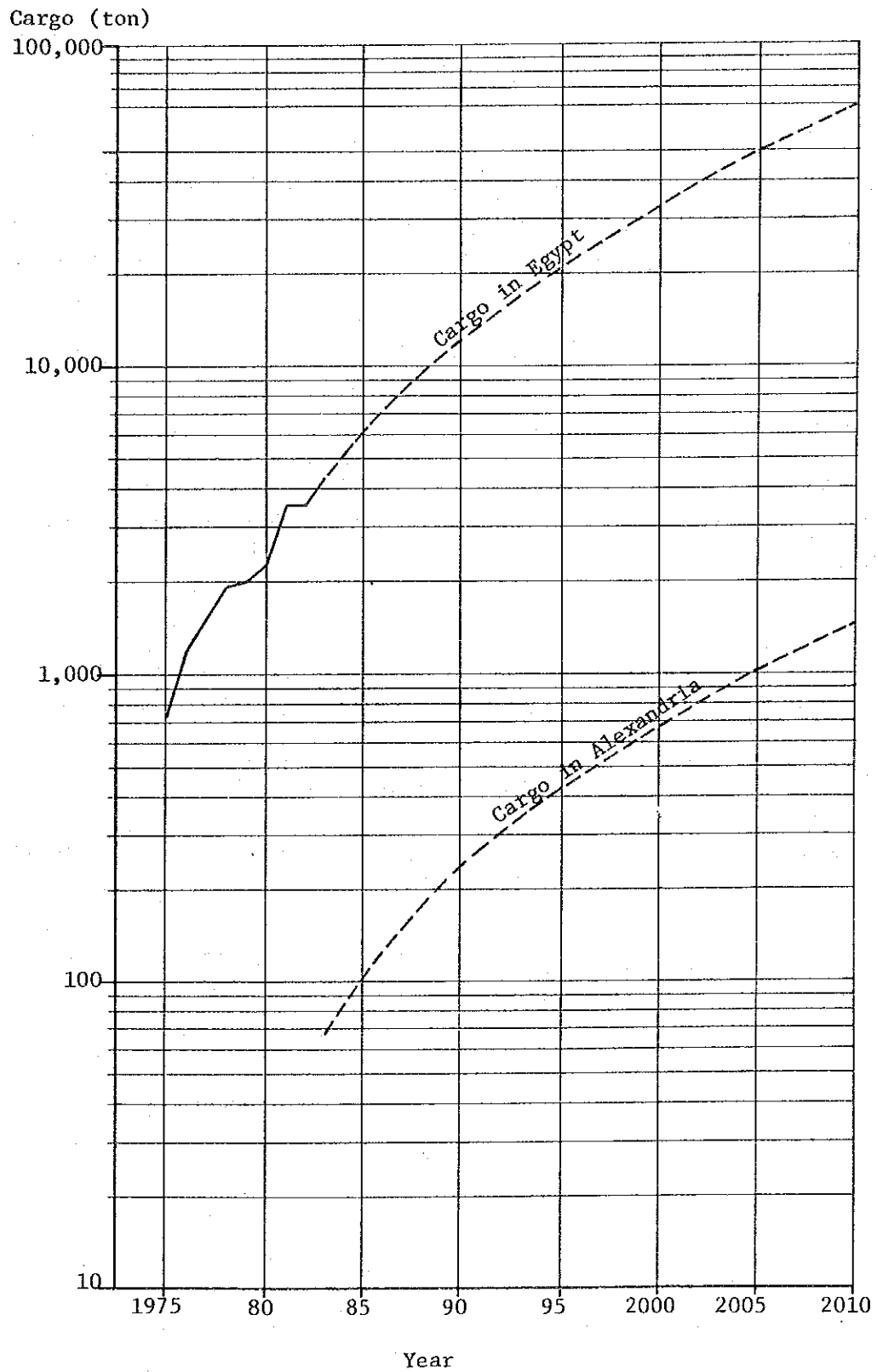


Fig. 3.6.2 Projected Domestic Cargo in Egypt and at Alexandria International Airport

### 3.7 International Cargo

#### 3.7.1 Methodology

It is reasonable to assume that international cargo demand in Egypt can be explained by the level of economic activities in Egypt. Therefore, regression analysis between international air cargo demand and GDP of Egypt is performed in order to forecast the future demand of international cargo in Egypt. Then, total demand in Egypt is distributed to Alexandria international airport with an adequate index.

#### 3.7.2 International Cargo in Egypt

By examining international cargo demand in Egypt and GDP of Egypt for the period between 1975 and 1981, the following regression equation is obtained and verified by a high degree of correlation.

$$C = 2,707 \text{ GDP} - 14,350 \quad r = 0.933$$

Where ; C= Annual cargo volume (ton)

GDP= GDP of Egypt

(in US\$, 1980 constant market prices)

Based on the equation above, international cargo demand in Egypt is projected as shown in Table 3.7.1.

Table 3.7.1 Projected International Cargo in Egypt

Year	International Cargo (ton)	Annual Growth Rate (%)	Remarks
1983	123,228	-	Actual
1990	213,000	8.1	
1995	286,000	6.1	
2000	381,000	5.9	
2005	505,000	5.8	
2010	666,000	5.7	

### 3.7.3 International Cargo at Alexandria International Airport

There is not enough data available about international cargo at Nozha airport because its service was just started in 1983. Therefore, it is required to introduce an adequate index to distribute total demand of Egypt to Alexandria international airport.

The ratio of the population of the service area of Alexandria international airport to the total population in Egypt, which is shown in Table 3.5.9, is adopted as the distribution index. Then international cargo demand at Alexandria international airport is estimated as shown in Table 3.7.2 and Fig. 3.7.1.

Table 3.7.2 Projected International Cargo at Alexandria International Airport

Year	International Cargo Volume (ton)	Annual Growth Rate (%)	Remarks
1983	13 *1	-	Actual
1990	18,000	-	
1995	37,200	15.6	
2000	49,500	5.9	
2005	65,700	5.8	
2010	86,600	5.7	

Note: \*1 Operation started in Nov, 1983.

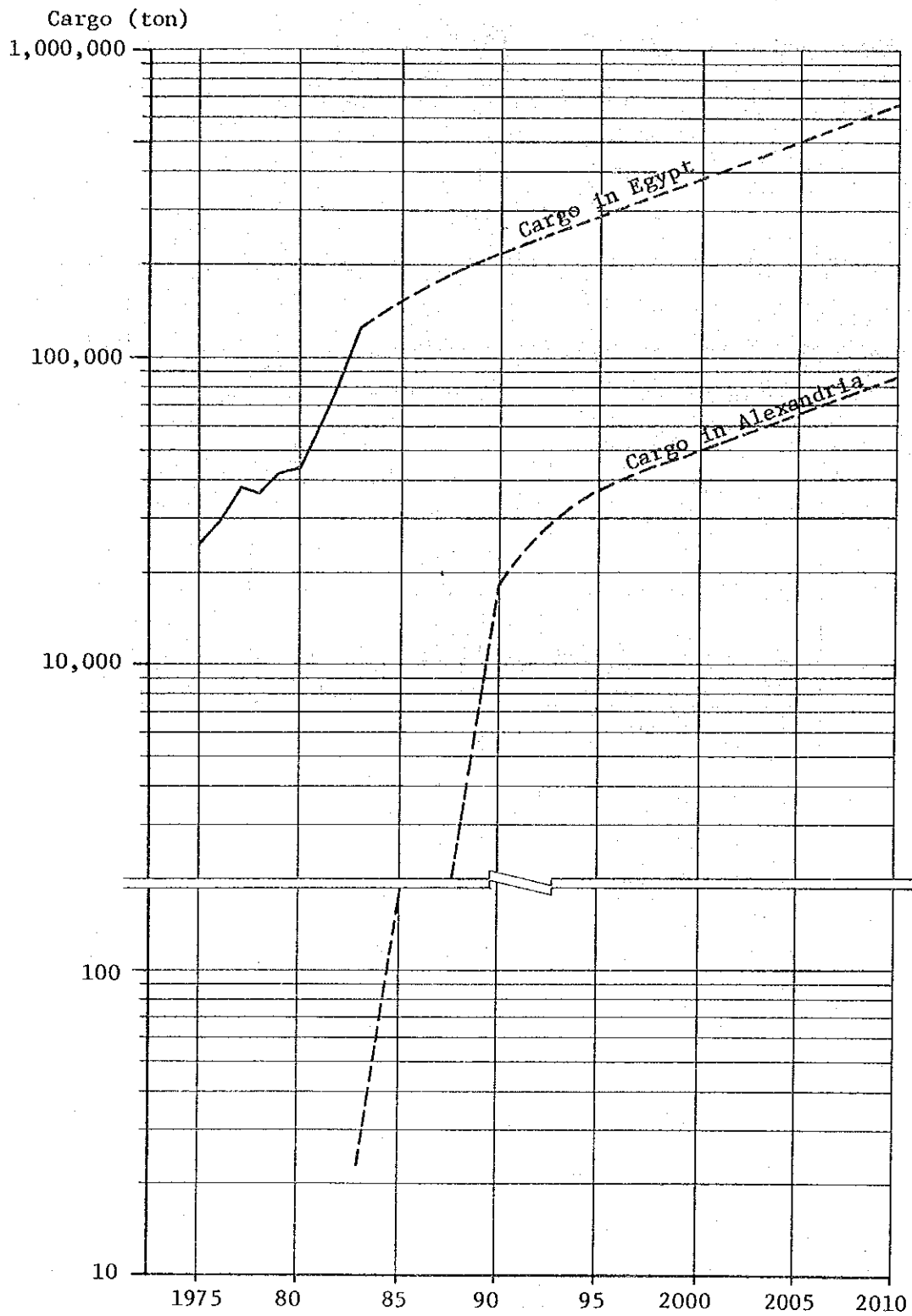


Fig. 3.7.1 Projected International Cargo in Egypt and at Alexandria International Airport



### 3.8 Air Traffic Demand for Alternative Development Concept

In this study, the following three alternatives are proposed as the airport development concept in Alexandria and air traffic demand for each alternative is projected in this section. Detailed discussions of the development plans are presented in Chapters 6 and 7.

#### Alternative Development Concepts

- Alt-A : Redevelopment plan of Nozha airport
- Alt-B : Development plan of a new airport as the replacement of Nozha airport
- Alt-C : Development plan of both Nozha airport and a new airport

Projected domestic passengers in Alexandria for the years 2000 and 2010 are 420,000 and 730,000 respectively, and existing Nozha airport is expected to be able to accommodate up to about 600,000 - 700,000 passengers annually with small improvement and investment as discussed in Chapter 5.

Therefore, in Alt-C domestic demand is served at Nozha airport and a new airport is planned for all international services and limited domestic services.

In case of Alt-A and Alt-B, air traffic demand equals to what is projected in Section 3.4 through 3.7 because both domestic and international demand is served at one airport, However, in Alt-C the above air traffic demand are divided into Nozha and the new airport.

#### (1) Annual Passenger Volume

All international passengers are accommodated at the new airport, but some domestic flights are planned between the new airport and Cairo airport for the following two reasons:

- a) To meet the demand for the development plan of New Ameriyah city and Northwest coast.
- b) The sector between Cairo and Alexandria of Cairo-Alexandria-Jeddah route is presently operated as a domestic route.

Annual domestic passengers volume is distributed to the new airport and to Nozha airport by 10% and 90% respectively based on the future population ratio of New Ameriyah city and Alexandria city in the Northwest Coast Development Plan\*1. Projected domestic passenger demand for Alt-C is shown in Table 3.8.1.

Note : \*1 Terms of Reference for North West Coast Development, North West Coast Development Authority, Ministry of Development and New Communities, Egypt.

Table 3.8.1 Projected Passenger Demand for Alt-C

(x 1,000)

Airport \ Year		1990	1995	2000	2005	2010
		Nozha Airport	Dom.	210	290	380
New Airport	Dom.	20	30	40	60	70
	Int'l	640	1,300	1,600	1,900	2,300
	Total	660	1,330	1,640	1,960	2,370
	Transit	25	45	55	65	80

(2) Cargo Demand

All international cargo is handled at the new airport and domestic cargo is distributed to the new airport and Nozha airport by the same ratio adopted in domestic passengers. Table 3.8.2 shows projected cargo demand for Alt-C.

Table 3.8.2 Projected Cargo Demand for Alt-C

(ton)

Airport \ Year		1990	1995	2000	2005	2010
		Nozha Airport	Dom.	220	380	600
New Airport	Dom.	20	40	70	100	140
	Int'l	18,000	37,000	50,000	66,000	87,000
	Total	18,020	37,040	50,070	66,100	87,140

### 3.9 Aircraft Size and Mix

#### 3.9.1 Aircraft Classification

Aircraft owned by Egypt Air are classified by type and size in relation to other classification systems as shown in Table 3.9.1. Among them, B-737 and F-27 are operated at Nozha airport. For the planning of the airport in Alexandria, the aircraft is classified by size as indicated in Table 3.9.2 based on the following assumptions:

- (1) B-707 of Egypt Air for medium and long haul services will gradually be retired and replaced by B-747 and B-767 as is practiced by many other airlines in the world.
- (2) Economical and efficient services coping with demand will require the use of wide body jets with 300 seats and small jet of 150 seater class.

**Table 3.9.1 Comparison of Aircraft Classification**

No. of Seat	Present Egypt Air Fleet (as of Aug. 1984)	FAA	NACO	Japanese C.A.B Design Basis for 1990
500				JUMBO (525) B-747
	B-747 (440)	Special B-747 (421 - 500)		
400		B-747 (341 - 420)		AIRBUS (370)
		Special DC-10 (281 - 340)	JUMBO (300)	DC-10/L-1011
300	A-300 (255 - 260)	DC-10/L-1011/A-300 (211 - 280)	DC-10/L1011/B-747	
	B-767 (206 - 222)	DC-8-61/NSA (161 - 210)		MEDIUM JET (230) B-767/A-300
200		DC-8/B-707/B-727/DC-9 (111 - 160)	LARGE (150) VC-10/DC-8/B-707	SMALL JET (165) DC-9
	B-707 (156 - 184)	B-737/B-727/DC-9 (81 - 110)		
100	B-737 (99 - 121)	DC-9/BAC-111 (61-80)	MEDIUM (90) BAC-111/B-727/B-737	PROPELLER (64)
	F-27 (57)	CV-580/YS-11 (40 - 60)	SMALL (60) F-27/F-28	YS-11 STOL (19)
0				DHC-6

Table 3.9.2 Aircraft Classification and Seat Capacity

Category	Year		Up to 1990	Up to 2000	Up to 2010	REMARKS
	Type of Aircraft					
JUMBO	B-747 Class		500	500	500	B-747-300 to be introduced in 1985 by Egypt Air, is assumed to have 500 seats based on the present B-747-200 with 440 seats of Egypt Air.
LJ	A-300, L-1011, DC-10, class		260	290	320	A-300 class aircraft is assumed to be enlarged in future.
MJ	A-310, B-767 class		220	260	280	B-767 will be stretched after 2000.
NJ	A-320, MD 80, B-757 class		160	190	220	Seating capacity is assumed to increase B-757 class from A320 class at the present.
SJ	B-737-200, DC-9-40 class		110	135	160	Present B-737-200 will be gradually replaced by the larger class including B-737-300.
P	F-27 YS-11		57	60	60	Seating capacity will remain the same for Turbo prop.

### 3.9.2 Aircraft Mix in Alexandria

Aircraft mix expected in Alexandria is projected based on the present utilization of Egypt Air's fleet by routes and the present aircraft mix at Cairo International Airport.

(1) Domestic Routes

a) Route Structure

The present route structure is formed from north to south along the Nile River as shown in Fig. 3.4.5. The route connecting Alexandria with Abu Simbel via Cairo, Luxor and Aswan is the present trunk line of Egypt. This structure will basically be maintained in the future. Therefore, the future domestic routes from/to Alexandria are assumed to be changed as shown in Fig. 3.4.5 according to the growth of traffic.

b) Aircraft mix by route

i) The present aircraft mix for the domestic services by Egypt Air is as shown in Table 3.9.3.

Table 3.9.3 Present Aircraft Mix for Domestic Services

Year	Aircraft	Aircraft Mix (%)		
		A300	B-737	F-27
1983 Winter (Peak season of Luxor and Aswan)		12	78	10
1984 Summer (Peak season of Alexandria)		0	77	23

Passenger demand by routes and aircraft mix is shown below.

	Annual <sup>1)</sup> Passengers (x1,000)	Aircraft Mix by Egypt Air
Cairo-Luxor	249	A-300 (28%), B-737 (72%)
Cairo-Aswan	136	A-737 (100%)
Cairo-Alexandria	62	B-737 (19%), F-27 (81%)
Cairo-Hurghada	43	B-737 (100%)

Source : 1) Egypt Air, scheduled flights only.

Note : Winter season timetable in 1984 for Cairo-Luxor, and summer season timetable in 1983 for others.

Aircraft mix by route from/to Alexandria is estimated taking into account the above data.

ii) The Cairo-Alexandria route will become the largest domestic market in Egypt and the seating capacity for this route will be increased rapidly as compared with other routes. Annual route passenger demand is estimated in Table 3.4.6 as follows.

Year	Passengers (x1000)
1990	161
1995	224
2000	294
2010	511

Aircraft mix for 1990 and 1995 is estimated as follows taking into account the data in i) above.

1990	SJ class (100%)
1995	LJ/MJ class (25%), SJ class (75%)

Ratio of LJ/MJ is expected to become higher as passenger demand increases, and ratio of LJ/MJ is estimated as 50% in 2000 and 100% in 2010 as shown in Fig. 3.9.1.

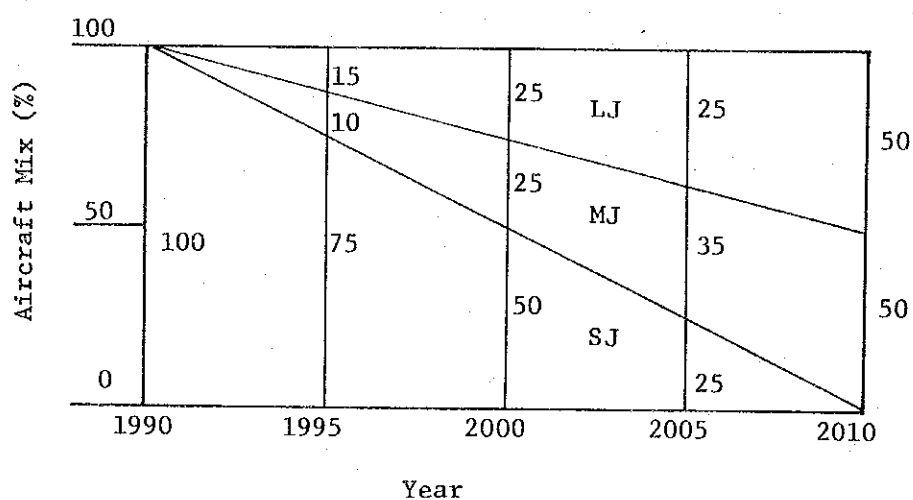


Fig. 3.9.1 Aircraft Mix for Alexandria -- Cairo Route

c) Passenger demand for Alexandria - Upper Egypt is projected as 58,000 in 1990 and 83,000 in 2010 in Table 3.4.6. From this demand, routes connecting Luxor and Aswan, are expected to be established in the future. At present, Cairo - Upper Egypt routes are mainly operated with B-737.

In 1983 passengers carried on the Cairo - Luxor route were 249,000 and on the Cairo - Aswan route 136,000. (Annual Report of Working Activity, Egypt Air). Therefore, air transport between Alexandria and Upper Egypt will be made with small jet (SJ).

d) As for other routes, passenger demand is estimated to be 11,000 to 36,000 annually, and several routes connecting Mersa Matruh and Sinai Peninsular, etc. are expected to be established in the future, F27 class is considered to be operated.

e) Other aircraft movements (excluding military aircraft movements)

The past record indicates considerable number of small aircraft operations other than commercial movements at Alexandria and Cairo airports. Other aircraft movements are projected based on the actual record at Cairo airport because there are no recent data available at Nozha airport. According to Annual Statistical Report (ECAA), the ratio of other aircraft movements at Cairo airport averaged 9% of commercial aircraft movements during the period from 1975 to 1979. Therefore, it is assumed that there will be the same rate of other aircraft movements in Alexandria airport.

## (2) International Routes

### a) Route Structure

Although there is at present no international service other than the Jeddah route, other international routes to Europe including Athens, Rome, etc. and Middle East including Amman, Kuwait, Baghdad, etc. are assumed to be established according to the increase in demand.

### b) Aircraft Mix

The aircraft mix for international flights was investigated at Cairo airport in July 1984 and is summarized as shown in Table 3.9.4.

**Table 3.9.4 Present Aircraft Mix for International Services at Cairo**

Aircraft Type	JUMBO B-747	LJ A-300 L1011 DC-10	MJ A-310 B-767	NJ B-757 DC-9 B-727	SJ B-737	P F-27
Share (%)	10	36	3	34	16	1

The above share will be used as the basis for the projection of the aircraft mix in Alexandria international airport.

Weekly number of B-747 flights in 1984 at Cairo airport is follows.

Route	Flights/Week	Annual Passengers (x1000)
Cairo - Jeddah	14	746
Cairo - Riyadh	11	294
Cairo - Kuwait	7	478
Cairo - Baghdad	4	255
Cairo - New York	3	101
Cairo - Bangkok	2	64
Cairo - Paris	1	197

At Cairo airport, operation of B-747 on Middle East routes is 86% of the total operation of B-747's. This tendency is assumed to be applicable to Alexandria international airport in the future. From the above weekly number of B-747 flights, excluding the New York and Bangkok long distance routes, it is considered that an annual passenger demand level of 200,000 is needed to introduce B-747 flights.

It is expected that international passenger demand in Alexandria international airport will not reach the demand level which requires an introduction of large aircraft such as B-747 in the beginning of the 1990's. However, it is estimated that B-747 will be introduced into Alexandria - Jeddah route in 1995 for the following reasons :



i) On the assumption that route passenger shares of total international passengers at Alexandria international airport in the future will be the same as that at Cairo airport, Alexandria-Jeddah route will have the largest share with 14% of total annual passengers.

ii) Passenger demand on the Jeddah - Alexandria route is expected to reach 200,000 annually in 1995. B-747 is expected to be introduced in 1995.

Based on the assumptions above, aircraft mix at Cairo airport is modified and the future aircraft mix at Alexandria international airport is estimated as indicated in Fig. 3.9.2.

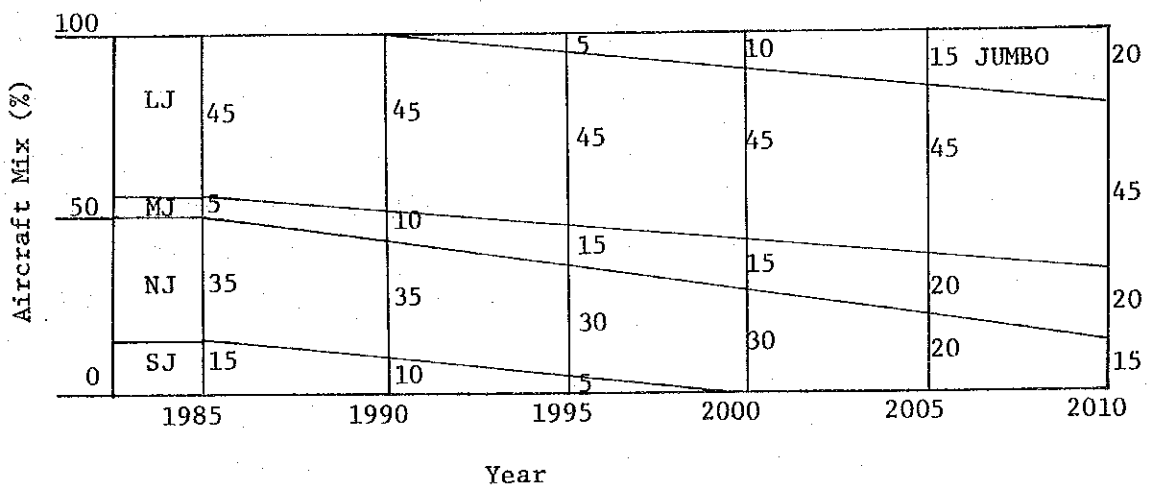


Fig. 3.9.2 Aircraft Mix for International Routes

c) Other Aircraft Movements excluding military aircraft movements

Other international aircraft movements at Alexandria airport are projected based on the actual data at Cairo airport for the same reason described in other domestic aircraft movements in paragraph (1),e) above.

At Cairo airport, international aircraft movements without passengers embarked and disembarked averaged 8.5% of the total for the period from 1975 to 1983. (Annual Statistical Report, ECAA). Hence, 9% is adopted based on the above.