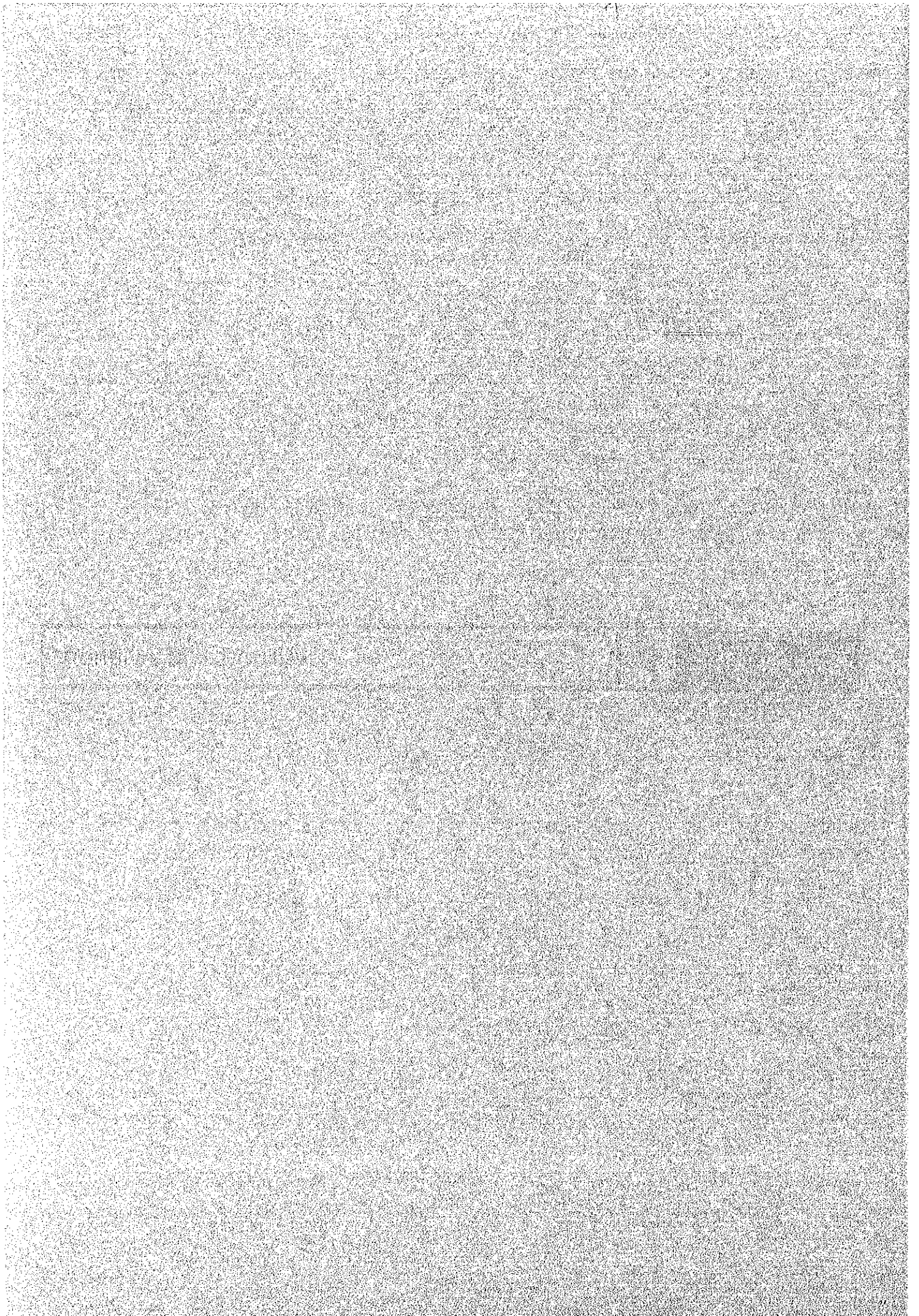


CHAPTER

9

Airport and Aviation



CHAPTER 9 AIRPORT AND AVIATION

9.1 Present Condition and Problems	9-1
9.1.1 General.....	9-1
9.1.2 Present Status.....	9-1
9.1.3 Review of the Seventh Five Year Plan.....	9-24
9.1.4 Capacity Analysis for the Present Condition.....	9-30
9.1.5 Present Problems.....	9-36
9.2 Master Plan	9-38
9.2.1 General.....	9-38
9.2.2 Future Traffic Demand for Planning.....	9-38
9.2.3 Breakdown of Air Traffic Volume.....	9-41
9.2.4 Facility Requirements.....	9-44
9.2.5 Fleet Plan.....	9-52
9.2.6 Basic Concept for Master Plan.....	9-52
9.2.7 Development Plan.....	9-54
9.3 The Eighth Five Year Plan	9-56
9.3.1 Basic Policies/Strategies for the Eighth Five Year Plan.....	9-56
9.3.2 Candidate Projects.....	9-56
9.3.3 Project Cost Estimation.....	9-58
9.3.4 Preliminary Economic Evaluation of the Projects.....	9-63
9.3.5 Viable Financial Plan and Arrangement.....	9-67
9.4 Policy Option	9-70
9.4.1 Airport Management.....	9-70
9.4.2 Non-Aeronautical Revenue.....	9-72
9.4.3 Non-Profitable Airport.....	9-74
9.4.4 Role of Private Airlines.....	9-74
9.4.5 Financial Arrangement.....	9-74

List of Tables

Table 9.1.2.1	Airport Classification.....	9-1
Table 9.1.2.2	Airports in Pakistan.....	9-4
Table 9.1.2.3	Income and Expenditure of CAA as of June.....	9-5
Table 9.1.2.4	Balance Sheet of CAA.....	9-5
Table 9.1.2.5	Private Airlines.....	9-6
Table 9.1.2.6	Share of Private Airlines in Domestic, 1993-94.....	9-7
Table 9.1.2.7	Top Five Airlines in Pakistan by International Aircraft Movements & Number of Passengers, 1992-93.....	9-7
Table 9.1.2.8	The Busiest Route in Pakistan by Domestic Aircraft Movements & Number of Passengers, in 1992-93.....	9-8
Table 9.1.2.11	Fleet Possession (As of May, 1994).....	9-11
Table 9.1.2.9	Profit and Loss Account of PIA.....	9-12
Table 9.1.2.10	Balance Sheet of PIA.....	9-12
Table 9.1.2.12	Existing Condition of Radio Navigation Aids in Pakistan.....	9-21
Table 9.1.2.13	Existing Condition of Ground Visual Aids in Pakistan.....	9-22
Table 9.1.3.1	Budget Allocation and Utilization for CAA.....	9-24
Table 9.1.3.2	Civil Aviation Authority (Pakistan) Summary of Seventh Five Year Plan 1988-93.....	9-25
Table 9.1.3.3	Traffic Projection and Achievement in the Seventh Five Year Plan.....	9-26
Table 9.1.3.4	Budget Allocation and Utilization for PIA.....	9-27
Table 9.1.4.1	Aircraft Movements.....	9-30
Table 9.1.4.2	Runway Length and Operating Aircraft.....	9-31
Table 9.1.4.3	Number of Aircraft Stands.....	9-31
Table 9.1.4.4	Floor of Terminal Building.....	9-32
Table 9.1.4.5	Car Park Area.....	9-33
Table 9.1.4.6	ICAO Recommendation for Rescue and Fire Fighting.....	9-34
Table 9.1.4.7	Evaluation of Air Navigation Systems and Rescue & Fire Fighting.....	9-35
Table 9.2.2.1	Forecast of Annual International Passengers.....	9-39
Table 9.2.2.2	Forecast of Annual Domestic Passengers.....	9-39
Table 9.2.2.3	Forecast of Annual Cargo Volume.....	9-39
Table 9.2.3.1	Aircraft Classification.....	9-41
Table 9.2.3.2	Operating Aircraft Assignment for Domestic Flight Operation.....	9-41
Table 9.2.3.3	Aircraft Mix for International Flights in 1992-93.....	9-43
Table 9.2.3.4	Aircraft Mix for International Flight in 2005-06.....	9-43
Table 9.2.3.5	Design Day Coefficient.....	9-43
Table 9.2.3.6	Load Factor.....	9-44
Table 9.2.4.1	Aerodrome Reference Code.....	9-45

Table 9.2.4.2	Required Runway Length and Width.....	9-45
Table 9.2.4.3	Required Width of the Runway Strip.....	9-46
Table 9.2.4.4	Required Taxiway Width	9-46
Table 9.2.4.5	Gate Occupancy Time.....	9-47
Table 9.2.4.6	Parking Space Requirement	9-47
Table 9.2.4.7	Required Airfield Lighting System	9-50
Table 9.2.4.8	Requirements of Rescue and Fire Fighting Services.....	9-51
Table 9.2.5.1	Fleet Plan.....	9-52
Table 9.2.7.1	Project and Cost Estimation for Airport Development.....	9-54
Table 9.3.3.1	Airport Project Cost for Eighth Five Year Plan.....	9-58
Table 9.3.3.2	Cost of Aviation Project in the Eighth Five Year Plan	9-60
Table 9.3.3.3	Priority and Investment Schedule for the Airport Projects	9-61
Table 9.3.3.4	Priority and Investment Schedule for Aviation	9-62
Table 9.3.4.1	Financial Cost of Proposed Air Transport Projects.....	9-65
Table 9.3.4.2	Economic Evaluation of Proposed Air Transport Projects upto the Year 2005-06	9-65
Table 9.3.4.3	Economic Evaluation of Proposed Air Transport Projects for the 8th FYP Period	9-66
Table 9.3.5.1	The Project Cost(Rs. Million).....	9-67
Table 9.3.5.2	Calculation of Viability of Self Financing by CAA (Rs. Million)	9-69

List of Figures

Figure 9.1.2.1	Airports in Pakistan	9-3
Figure 9.1.2.2	International Air Routes from/to Pakistan	9-9
Figure 9.1.2.3	Domestic Air Routes	9-10
Figure 9.1.2.4	Air Passenger Traffic Trend	9-15
Figure 9.1.2.5	International Passengers by Airport.....	9-16
Figure 9.1.2.6	International Passengers by Route (PIA).....	9-16
Figure 9.1.2.7	Domestic Passengers by Airport.....	9-16
Figure 9.1.2.8	Air Cargo Traffic Trend.....	9-17
Figure 9.1.2.9	Aircraft Movements.....	9-18
Figure 9.1.2.10	Type of Aircraft Flight in 1992-93	9-18
Figure 9.1.2.11	Air Traffic Control System in Pakistan.....	9-23
Figure 9.1.3.1	Passenger Traffic Trend (PIA).....	9-28
Figure 9.1.3.2	Transition of Fleet Possession.....	9-29
Figure 9.2.2.1	Air Traffic Projections	9-40
Figure 9.2.3.1	Flow Chart for Air Traffic Analysis.....	9-42
Figure 9.4.1.1	The Entities Responsible for Establishing and Administering Airports in Japan.....	9-73

CHAPTER 9 AIRPORT AND AVIATION

9.1 Present Condition and Problems

9.1.1 General

Air transportation has played an important role in the public national integration and socioeconomic development of the nation. The main cities such as Karachi, Islamabad, Peshawar, Lahore, Multan and Quetta are spread all over the nation with an area of approximately 800,000 sq.kms. The Pakistan International Airlines network was developed to connect 47 cities in the world and major domestic cities.

In Pakistan, although the share of air transport is relatively small compared with other modes of transport, such as roads and railways, growth rate is considerably high. Therefore air transport today has become a primary mode of transport between the main cities. It not only ensures faster movement of passengers and cargo, but it also promotes internal and foreign trade, and foreign relations. Accordingly, air transport is expected to play a more important role in the future in line with social and economic growth.

This chapter describes the present condition and problems of the air transportation system in Pakistan.

9.1.2 Present Status

(1) Airports in Pakistan

1) Airports

There are 41 airports which are commercially operating as of 1994 in Pakistan as shown in Table 9.1.2.1 and Figure 9.1.2.1. The airports are classified into two categories as follows:

There are six airports (Karachi, Islamabad, Lahore, Peshawar, Gwadar and Quetta) which belong to the international airport. Domestic airports are divided into the following three categories; regular, feeder service and other.

Table 9.1.2.1 Airport Classification

International Airports	6
Domestic Airports	
Regular Airports	18
Feeder Service Airports	16
Other Airports (Private)	1
Sub Total	35
Total	41

There are 35 airports belong to the domestic airport: 18 regular airports, 16 feeder service airports and one other airport.

Feeder service airports are located in the remote areas of the country to improve transportation to/from these areas. The areas are generally with denser population and higher level of economic activities of the region. Most of airports are capable to accommodate Fokker F-27 and Twin Otter type aircraft. However, some airports such as Sibi, Talhar, Bhagtanwala, Mianwali, Mangla and Kohat which are not utilized due to lack of

traffic.

Air services in Pakistan are heavily concentrated at Karachi, Islamabad and Lahore International Airports. Karachi Airport has played an important role in Pakistan air transportation as the gateway and the stopover point for East West air traffic and the main hub of the domestic network. Islamabad and Lahore Airports are secondary major international airports next to Karachi Airport, and they are the hub airports in the northern part of Pakistan.

Table 9.1.2.2 summarizes the present status of airports in Pakistan.

2) Administration

All of these airports are operated by Civil Aviation Authority (CAA), of which 15 airports are under joint operation between CAA and Pakistan Air Force (PAF). At seven airports out of the 15 airports, PAF is only responsible for air traffic control. Sui airport is exceptionally managed by the Pakistan Petroleum Ltd.

CAA is organized under the Ministry of Defense (MOD) and was established in 1982 to promote safe operations and to develop air transportation to meet the air traffic increase. CAA is responsible for planning, construction/improvement and maintenance of airport facilities such as runways, aprons, terminal buildings, cargo buildings and air navigational systems, for provision of air safety facilities, of fire fighting and rescue facilities. It also acts as the aeronautical authority to enforce aviation rules and regulations including aircraft and air crew licensing and concludes bilateral air agreements between Pakistan and other countries. Pakistan International Airlines (PIA), Airport Security Force (ASF) and Pakistan Meteorological Department (PMD) are organized under MOD. PIA is the national carrier, ASF is the authority for security all the airport and PMD is the authority for the meteorological services, respectively.

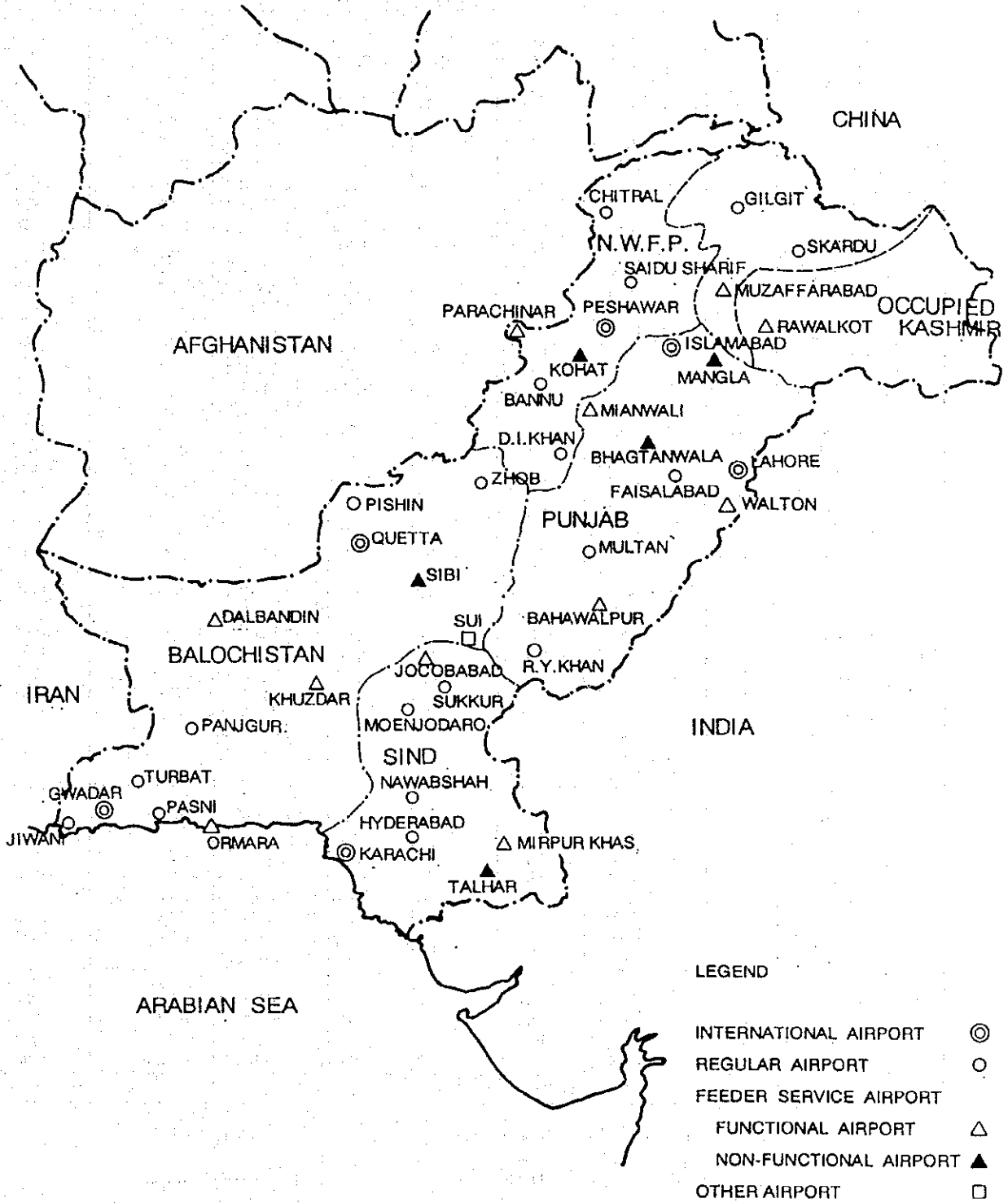
3) Income and Expenditure of CAA

Income and expenditure and balance sheet of CAA are summarized in Table 9.1.2.3 and Table 9.1.2.4. The income increased from Rs. 671 million in 1984-85 to Rs.2,431 million in 1992-93. The income mainly consists of aeronautical revenue such as landing and rents for space occupied, enroute navigation charges, embarkation charges and other non-aeronautical revenue (i.e., commercial income).

At present, the ratio between aeronautical and non-aeronautical revenues is 85:15, hence, CAA has to make a great effort to increase the non-aeronautical revenue.

On the other hand, the expenditure was Rs. 271 million in 1984-85 and Rs. 2,181 million in 1992-93. The expenditures mainly consist of expenditures of administrative, repairs and maintenance, financial charges and others. The accumulated surplus in June,1993, (unappropriated income carried over to the next year) reached Rs. 3,179 million as shown in Table 9.1.2.3. Karachi International Airport accounts for about 76% of CAA's overall revenue as shown in Appendix 9.1.12.

Figure 9.1.2.1 Airports in Pakistan



Tabel 9.1.2.2 Airports in Pakistan

(As of Mar, 1994)

	Airport	Administrative Authority	Airport Category	Traffic in 1992-93			Runway Length & Wide (m)	Maximum Operated Aircraft	Commencement Year of Civil Air Service	
				Passengers	Cargo (ton)	Aircraft Movements				
Balochistan	Quetta	JF	I	INT'L	11,581	142	130	3,658 X 46	A-300	1956
				DOM	276,443	1,722	2,980			
	Gwadar	C	I	INT'L	11,700	29	403	1,524 X 23	F-27	1966
				DOM	57,023	82	2,271			
	Jiwani	C	R	DOM	3,352	7	202	1,783 X 46	F-27	1966
	Khuzdar	C	F	DOM	5,558	41	307	1,829 X 31	F-27	1987
	Panjgur	C	R	DOM	34,296	92	1,908	1,524 X 23	F-27	1966
	Pasni	JC	R	DOM	31,435	138	1,598	2,743 X 46	B-737	1966
	Sui	P	O	DOM	7,272	11	194	1,524 X 46	F-27	1966
	Turbat	C	R	DOM	95,835	331	3,838	1,829 X 31	F-27	1978
	Zhob	C	R	DOM	19,237	25	1,300	1,829 X 31	F-27	1979
Dalbandin	JC	F	DOM	3,638	2	388	1,524 X 25	C-130	1986	
Ormara	C	F	DOM	6,157	9	418	1,524 X 23	F-27	1990	
Sibi			N	DOM			1,829 x 23		1986	
Sindh	Karachi	C	I	INT'L	2,766,449	106,662	23,458	3,200 X 46	B-747	1935
				DOM	2,570,827	37,734	24,227	2,286 X 46	F-27	
	Hyderabad	C	R	DOM	11,888	31	1,312	2,133 X 31	F-27	1966
	Moenjodaro	C	R	DOM	37,470	117	1,560	1,981 X 31	F-27	1966
	Nawabshah	JC	R	DOM	7,042	6	1,348	2,743 X 46	B-737	1966
	Sukkur	JC	R	DOM	101,626	271	3,310	2,743 X 31	B-737	1966
	Jacobabad	JF	F	DOM	7,314	16	308	3,048 X 31	F-27	1985
	Mirpur Khas	JF	F	DOM	1,728	1	356	3,048 X 46	F-27	1987
Talhar			N	DOM			2,743 X 23			
Punjab	Islamabad	JF	I	INT'L	508,685	10,742	2,809	2,743 X 46	B-747	1947
				DOM	1,553,885	13,631	18,493			
	Lahore	JC	I	INT'L	363,017	8,402	3,205	3,360 X 46	B-747	1947
				DOM	1,684,338	21,597	17,348	2,743 X 46	A-300	
	Faisalabad	JC	R	DOM	201,792	1,110	2,868	2,826 X 46	A-300	1961
	Multan	JC	R	DOM	302,216	932	4,042	2,743 X 30	B-707	1960
	Mianwali	JF	F	DOM	238	0	70	3,048 X 46	F-27	1985
	Bahawalpur	C	F	DOM	31,090	14	908	1,524 X 23	F-27	1986
	R.Y.Khan	C	R	DOM	33,565	52	720	2,743 X 30	B-737	1990
	Bhagtanwala			N	DOM			1,920 X 46		
Mangla			N	DOM			1,524 X 31		1985	
Walton			N	DOM						
N.W.F.P	Peshawar	JF	I	INT'L	129,679	1,215	930	2,743 X 46	A-300	1947
				DOM	397,552	2,929	8,032			
	Chitral	C	R	DOM	40,096	44	1,120	1,768 X 31	F-27	1961
	D.I.Khan	C	R	DOM	38,745	96	2,002	1,524 X 23	F-27	1960
	Saidu Sharif	C	R	DOM	23,895	66	1,236	1,829 X 46	F-27	1985
	Bannu	C	R	DOM	11,672	9	494	1,829 X 30	F-27	1986
	Kohat	JF	F	DOM	203	0	82	2,352 X 46	F-27	1990
Parchinar			N	DOM			1,219 X 23		1990	
Northern Area	Gilgit	C	R	DOM	40,777	43	1,146	1,658 X 31	F-27	1962
	Skardu	JC	R	DOM	64,268	258	632	1,981 X 31	B-737	1962
	Muzaffarabad	C	F	DOM	10,058	1	716	914 X 23	DHC-6	1988
	Rawalakot	C	F	DOM	10,387	3	1,052	914 X 23	DHC-6	1988
Total	41			11,514,029	208,613	139,721				

Note : 1) C : Civil Aircraft Operation only Controlled by CAA
 JC : Joint User Airports Controlled by CAA
 JF : Joint User Airports Controlled by PAF
 P : Private

2) I : International Airport
 R : Regular Airport
 F : Feeder Service Airport
 O : Other Airport
 N : Not Utilized Airport

Source : AIP Pakistan
 Civil Aviation Statistics

Table 9.1.2.3 Income and Expenditure of CAA as of June

	(Rs. in thousand)	
	1993	1992
INCOME		
Operational	2,057,655	1,804,610
Non-operational	373,063	368,815
	2,430,718	2,173,425
EXPENDITURE		
Administrative	879,003	724,631
Repairs and maintenance	166,281	152,202
Financial charges	490,213	477,450
Depreciation	645,307	387,987
	2,180,804	1,742,270
Prior period and exceptional items	249,914	431,155
	300,243	(29,794)
Provision for taxation	550,157	401,361
	(178,655)	(4,052)
SURPLUS FOR THE YEAR AFTER TAXATION	371,502	397,309
ACCUMULATED SURPLUS BROUGHT FORWARD	2,807,173	2,409,864
ACCUMULATED SURPLUS CARRIED FORWARD	3,178,675	2,807,173

source : CAA Annual Report 1992-93

Table 9.1.2.4 Balance Sheet of CAA

	(Rs. in thousand)	
	1992-93	1991-92
GOVERNMENT EQUITY		
ACCUMULATED SURPLUS	2,457,854	3,854,208
	3,178,675	2,807,173
	5,636,529	6,661,381
REPRESENTED BY :		
ASSETS AND LIABILITIES.		
Tangible fixed assets	10,030,700	11,177,538
Long-term investments	123,901	117,384
Long-term deposits	97,807	110,542
Deferred expenditure	35,013	31,237
Current assets	1,980,102	1,553,281
Less : Current liabilities	1,591,836	1,663,570
Net current assets/(current liabilities)	388,266	(110,289)
Total assets less current liabilities	10,675,687	11,326,412
Less : Long-term loans and advances	2,396,859	2,266,985
Redeemable bonds	892,530	892,530
Deferred liabilities	1,749,769	1,505,516
Contingencies and Commitments	5,039,158	4,665,031
Net assets	5,636,529	6,661,381

Source : CAA Annual Report 1992-93

(2) Airlines

1) Airlines

There are four main airlines in Pakistan: Pakistan International Airlines (PIA), Aero Asia, Shaheen Air International and Bhoja Airline. PIA has solely managed the international and domestic services as the national flag carrier in Pakistan for a long time. However, the Government directed CAA in August, 1992 to encourage establishment of airlines in the private sector so that healthy competition could generate benefits for air passengers and cargoes. The network of PIA's flights developed covers almost all of the world and currently it is spread to connect with 47 international and 36 domestic airports.

Appendix 9.1.6 shows the trend of passenger traffic by PIA.

As mentioned above, Aero Asia, Shaheen Air International and Bhoja Airline are private companies, which have provided air services only for domestic services since 1993. These private airlines are operated only on the main routes with small jet aircraft. The outline of these private airlines and share of private airlines are summarized Table 9.1.2.5 and Table 9.1.2.6 respectively.

As in June 1993, CAA issued the license to Raji Airlines, Aero Asia, Shaheen Air International, Bhoja Airline, Schon Air and Air Shuttle. Hajvairy Airlines, which was the first private airline in Pakistan following to Raji Air, went out of business due to financial problems.

Air safety circulars were provided to comply with all air worthiness requirements. Wet lease of aircraft is permitted. The safety and staff training regulations obligate all private airlines to vouch for wet leasing aircraft and entering into cooperation or copartnership agreements with foreign airlines. Site inspections of aircraft and training facilities for cockpit and cabin crew have been done to ensure safety standards to meet the ICAO requirements.

Although the share of the private airlines in domestic is 21% as shown in Table 9.1.2.6 however, it will be expected to increase this in the future a Government policy.

Table 9.1.2.5 Private Airlines

Airlines Nam	Aero Asia	Shaheen Air Int'l	Bhoja Airline
Started Operation	May 1993	Nov 1993	Nov 1993
Aircraft	BAC 1-11 5 Aircraft	B737-200 2 Aircraft	B-727, B737-200 6 Aircraft
Lease	Wet Lease	Dry Lease	Dry Lease
Flight Schedule	KHI-Peshavar-KHI 1/Daily	KHI-ISB-KHI 2/Daily	KHI-Lahore-Quetta- 2/Weekly *
	KHI-ISB-KHI 2/Daily	KHI-Lahore-KHI 2/Daily	KHI-lahore-KHI 1/Weekly
	KHI-Faisalabad-KHI 1/Daily	ISB-Lahore-ISB 1/Daily	KHI-ISB-Skardu-ISB- 1/Weekly
	KHI-Lahore-KHI 4/Daily		Lahore-KHI
	KHI-Multan-KHI 1/Daily		
	KHI-Pasni-KHI 3/Weekly		
Employee	569	263	475

Note: KHI : Karachi Airport
 ISB: Islamabad Airport
 *: Except Saturday

Table 9.1.2.6 Share of Private Airlines in Domestic, 1993-94

Airline	Passenger	Share (%)	Cargo (ton)	Share (%)
	Embarked + Dis Embarked		Loaded + Un Loaded	
PIA	6,667,336	79.0	69,796	94.3
Aero Asia	849,018	10.1	-	-
Shaheen Air	142,462	1.7	134	0.2
Bhoja Airline	96,662	1.1	232	0.3
Hajvairy Airlines	461,896	5.5	1,496	2.0
Raji Airlines	219,270	2.6	2,344	3.2
Total	8,436,644	100.0	74,002	100.0

Source : Civil Aviation Statistics

In 1992-93, the scheduled international flights were provided by 29 foreign airlines. Table 9.1.2.7 presents the top five airlines in terms of number of international aircraft movements and passengers. Pakistan International Airlines (PIA) shared at 47.3 % of the total international aircraft movements and 59.5 % of the total international passengers in 1992-93.

Table 9.1.2.7 Top Five Airlines in Pakistan by International Aircraft Movements & Number of Passengers, 1992-93

Airline	Movements	Share (%)	Passengers	Share (%)
PIA	14,639	47.3	2,256,965	59.5
Saudia	2,597	8.4	507,135	13.4
Gulf Air	2,078	6.7	193,218	5.1
Emirates	1,528	4.9	172,946	4.6
Lufthansa	1,322	4.3	62,792	1.7
Sub Total	22,164	71.6	3,193,056	84.3
Others	8,777	28.4	598,055	15.7
Grand Total	30,941	100.0	3,791,111	100.0

Source : Civil Aviation Statistics

2) Air Routes

International air services are provided by PIA and 28 foreign carriers. The current international air routes directly connecting Pakistan and with other countries by scheduled flights are shown in Figure 9.1.2.2. The International air routes extend to the North America, the Western Europe, the North and East Africa, and all of the Asian countries, with flights to 47 major cities of the world. The busiest international route is that of to/from the Middle East.

The domestic air services are provided by PIA and three private airlines i.e., Aero Asia,

Shaheen Air and Bhoja Airline. The PIA's domestic air network as of 1994 extends to 36 domestic airports as shown in Figure 9.1.2.3.

Table 9.1.2.8 presents the busiest route in terms of the number of domestic aircraft movements and passengers. The busiest route is that of Karachi-Lahore with 7 daily flights on the average, using the B-747, A-300, A-310, and B-737. The second is that of Karachi-Islamabad 4 daily flights on the average using the same aircraft mix as the Lahore route. The Islamabad-Lahore route uses mainly B-737 and F-27 with 6 daily flights on average, supplemented by 1 or 2 runs of A300 and A310. The above flights are all direct flights and roundabout flights are not included.

Peshawar, Multan, Quetta, and several other airports to/from Karachi, Lahore and Islamabad airports are operated by A-300, B-737, and other types of aircraft. From the other airports, there are additional flights as required. There are also other flights connected with one or two of 3 main airports depending on the demand for which F-27 or DHC-6 is used and this makes up part of the network of air flights in Pakistan.

Table 9.1.2.8 The Busiest Route in Pakistan by Domestic Aircraft Movements & Number of Passengers, in 1992-93

Route	Movements	Share (%)	Passengers	Share (%)
Lahore - Karachi	3,723	6.8	460,674	11.9
Karachi - Lahore	3,777	6.9	459,293	11.9
Karachi - Islamabad	3,147	5.8	359,382	9.3
Islamabad - Karachi	3,176	5.8	351,004	9.1
Islamabad - Lahore	3,140	5.8	239,659	6.2
Lahore - Islamabad	3,163	5.8	234,687	6.1
Sub Total	20,126	36.9	2,104,699	54.5
Others	34,267	63.1	1,756,760	45.5
Grand Total	54,393	100.0	3,861,459	100.0

Source : Civil Aviation Statistics

Figure 9.1.2.2 International Air Routes from/to Pakistan

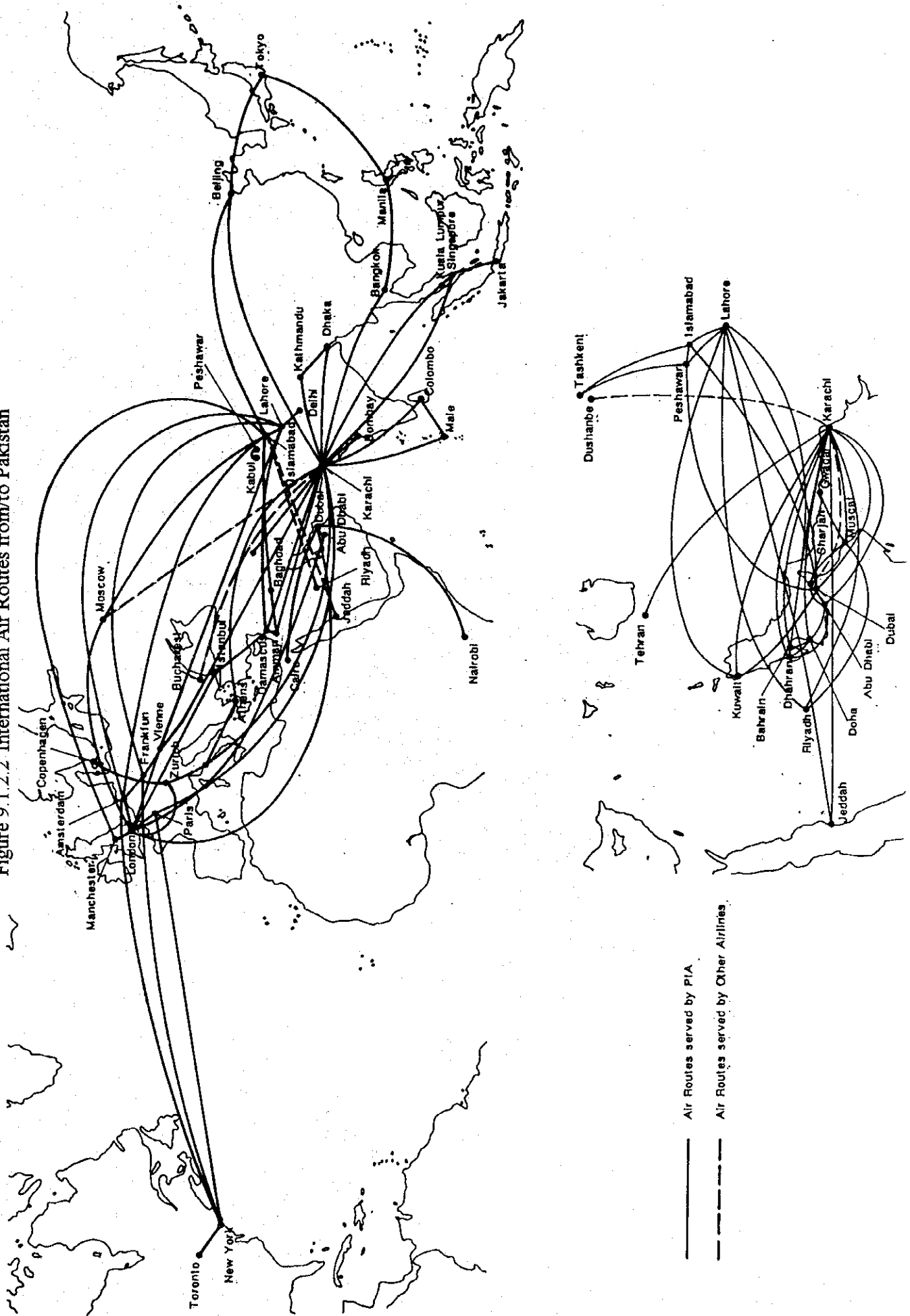
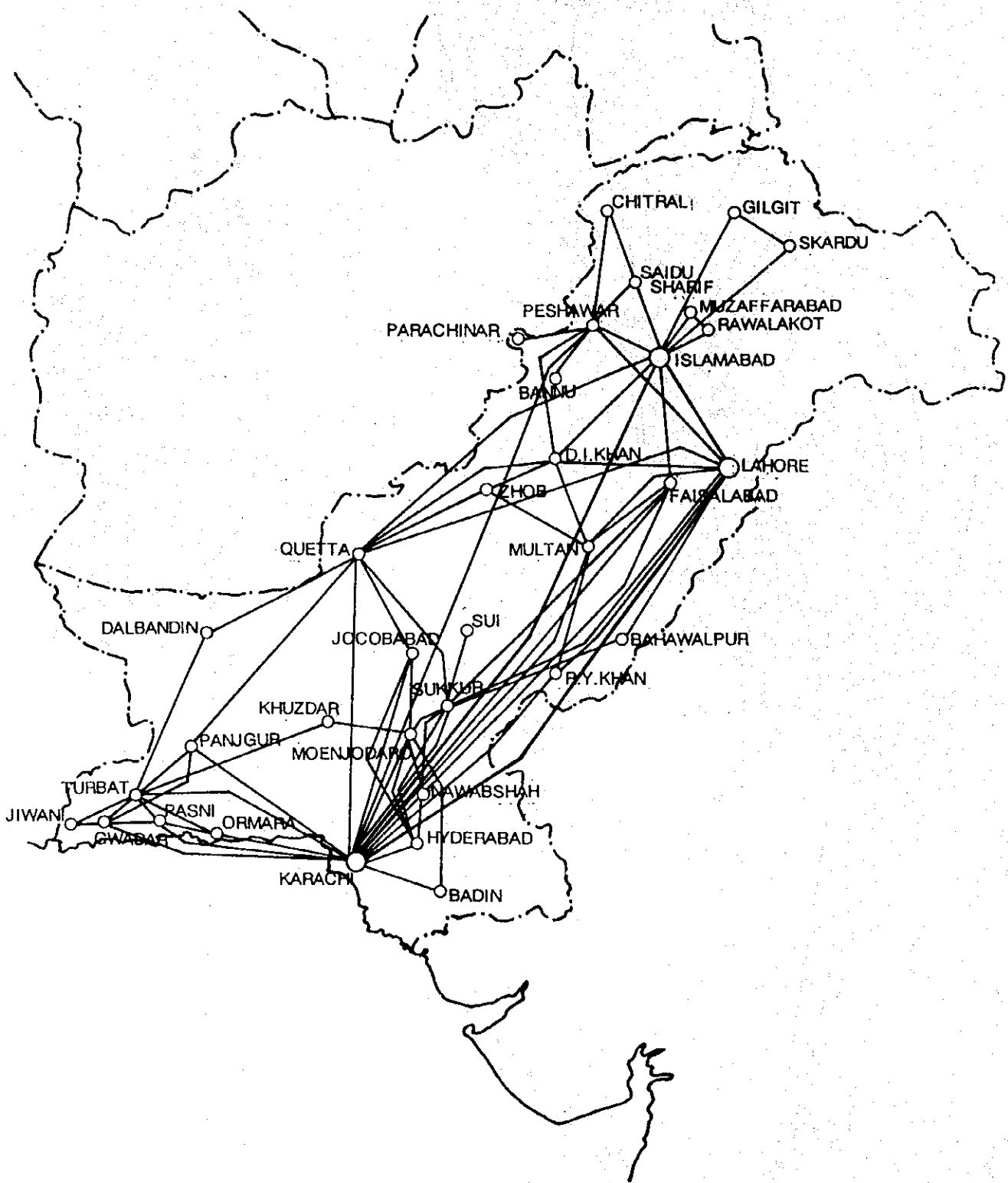


Figure 9.1.2.3 Domestic Air Routes



3) Administration of PIA

PIA was established under the Ministry of Defense (MOD) in 1954 by the Government of Pakistan as a Government enterprise with 90% stock hold by the Government, and the remaining portion is shared by private companies. Total number of regular employees was about 20,200 in 1992.

4) Revenue and Expenditure of PIA

Profit and loss account and balance sheet of PIA are shown in Table 9.1.2.9 and Table 9.1.2.10, respectively. Revenue increased to Rs. 21,970 million in 1992-93 from Rs. 10,621 million in 1985-86. Expenditures also increased to Rs. 21,347 million in 1992-93 from Rs. 10,038 million in 1985-86 and operating income increased to Rs. 623 million from 583 million in 1985-86.

5) Aircraft Fleet Owned by PIA

Table 9.1.2.11 shows the aircraft fleet of PIA as of 1994. PIA owns 47 aircraft consisting of 23 wide bodied aircraft, 22 small jet aircrafts and 2 small aircrafts.

Table 9.1.2.11 Fleet Possession (As of May, 1994)

Aircraft Type	Number of Aircraft
B747-200	8
A300-B4	7 +2*
A310-300	6
B737-300	6
B707	2
F-27	14
Twin Otter	2
Total	45 +2*

Note : * shows aircraft on lease to other airlines
Source : Role and Performance of PIA

Table 9.1.2.9

Profit and Loss Account of PIA

Table 9.1.2.10

Balance Sheet of PIA

	(Unit: Rs. in thousand)	
	1993	1992
REVENUE		
Traffic and maintenance	21,194,895	19,845,794
Other revenue	774,759	594,760
EXPENDITURES		
Flying, maintenance and others	21,969,654	20,440,554
Depreciation	18,988,525	16,805,361
Bonus to employees	2,271,239	1,935,267
	87,000	120,000
OPERATING INCOME	21,346,744	18,860,628
	622,890	1,579,926
Financial charges	(807,312)	(772,138)
Interest income	329,862	165,379
Profit on disposal of fixed assets	662,459	9,137
PROFIT BEFORE TAXATION	807,899	982,304
PROVISION FOR TAXATION		
Current year	109,848	102,203
Prior year	109,848	20,703
	109,848	122,906
PROFIT AFTER TAXATION	698,051	859,398
Unappropriated Profit/(loss) brought forward	178,287	(259,921)
APPROPRIATIONS		
Dividend-preference shares	876,338	599,477
Reserve for issue of bonus shares	25,547	78,250
	308,646	342,940
	334,193	421,190
UNAPPROPRIATED PROFIT CARRIED FORWARD	542,145	178,287

source : PIA Annual Report 1992-93

	(Unit: Rs. in thousand)	
	1993	1992
SHARE CAPITAL AND RESERVES		
Share Capital		
Authorized	5,000,000	5,000,000
Issued, subscribed and paid-up	3,336,461	2,943,521
Reserves	4,439,358	4,473,652
Unappropriated profit	542,145	178,287
	8,217,964	7,595,460
SURPLUS ON REVALUATION OF FIXED ASSETS	22,330	22,330
REDEEMABLE CAPITAL	400,000	400,000
LONG-TERM LOANS	1,925,643	1,792,638
OBLIGATIONS UNDER FINANCE LEASE		
	1,136	1,136
OBLIGATIONS UNDER HIRE PURCHASE		
	6,437,711	4,741,456
LONG-TERM DEPOSITS	36,831	29,000
CURRENT LIABILITIES		
Current maturity - redeemable capital		100,000
- long-term loans	761,971	693,356
- obligations under finance lease	1,227	2,859
- obligations under hire purchase	534,373	358,575
Obligation for redemption of preference shares	50,000	50,000
Bank overdraft	390,698	251,928
Creditors, accrued expenses and other liabilities	4,395,415	3,556,852
Taxation	212,053	123,705
Advance against transportation	1,251,777	1,417,693
Dividend - preference shares	25,547	78,250
	7,623,061	6,583,218
CONTINGENT LIABILITIES AND COMMITMENTS		
	24,663,540	21,165,238
	24,663,540	21,165,238

source : PIA Annual Report 1992-93

(3) Air Traffics

1) Passengers

According to the records of CAA in 1992-93, the total number of air passengers in Pakistan was 12.080 million which consisted of domestic passengers of 7.952 million and international passengers of 4.128 million. The average annual growth rates of domestic and international passenger traffic were 4.90 % and 1.93 % respectively during the last five years (1987-88 ~ 1992-93). Appendix 9.1.1 through Appendix 9.1.3 show the air traffic and Figure 9.1.2.4 through Figure 9.1.2.7 show the trend of air passengers.

International passengers are heavily concentrated at Karachi, Islamabad and Lahore international airports. These three airports handled 95.4 % of the total passengers as shown in Appendix 9.1.3 and Figure 9.1.2.5, where it is found especially the share of Karachi International Airport was 71.5 %. Passengers from/to the Middle East countries were 54.5% of the total international passengers in 1992-93 as shown in Appendix 9.1.6 and Figure 9.1.2.6. These data demonstrate Karachi International Airport has developed as the major international gateway airport of Pakistan as well as the hub of the domestic network.

Domestic passengers are also heavily concentrated at Karachi, Islamabad and Lahore international airports, with combined share of 74.5 % of total passengers as shown in Appendix 9.1.2 and Figure 9.1.2.7. These airports play a role of the hub airports on the domestic air route network in Pakistan.

The actual trends of international and domestic passengers, the forecast for the Seventh Five Year Plan (1988-1993) and the balances are shown in Figure 9.1.2.4. The Seventh Five Year Plan target for international, domestic and total passengers has envisaged an average annual growth rate of 8.73%, 5.03% and 6.63%, respectively. Against these targets the achievements were 1.93%, 4.90% and 3.83% respectively. The lower side deviation might be explained due to unprecedented socio-economic and political environment in the country, world economic recession and the Gulf War happened during the period.

2) Cargo

The actual trends of international and domestic cargo for these ten years, 1983-84-1992-93, are shown in Appendix 9.1.4 and Figure 9.1.2.8 respectively. The total cargo volumes increased to 211,094 tonnes in 1992-93 from 150,295 tonnes in 1983-84 at an average annual growth rate of 3.85%, however, in the last five years (1987-88~1992-93), the average annual growth rate was 3.02%.

International cargo volume reached 129,672 tonnes in 1992-93, at the average growth rate of 1.46% for the recent five years. The annual growth rates are less than the forecasted cargo volumes in the Seventh Five Year Plan. The domestic cargo reached 81,422 tonnes in 1992-93, at the average annual growth rate of 5.84% for the last five years (1987-88 ~ 2005-06).

The international and domestic mails handled during the same period have a decreasing tendency as shown in Appendix 9.1.5. The international mail had decreased from 3,194 tonnes in 1983-84 to 2,538 tonnes in 1992-93, similarly the domestic from 3,352 to 2,319 tonnes, and the total from 6,546 to 4,857 tonnes.

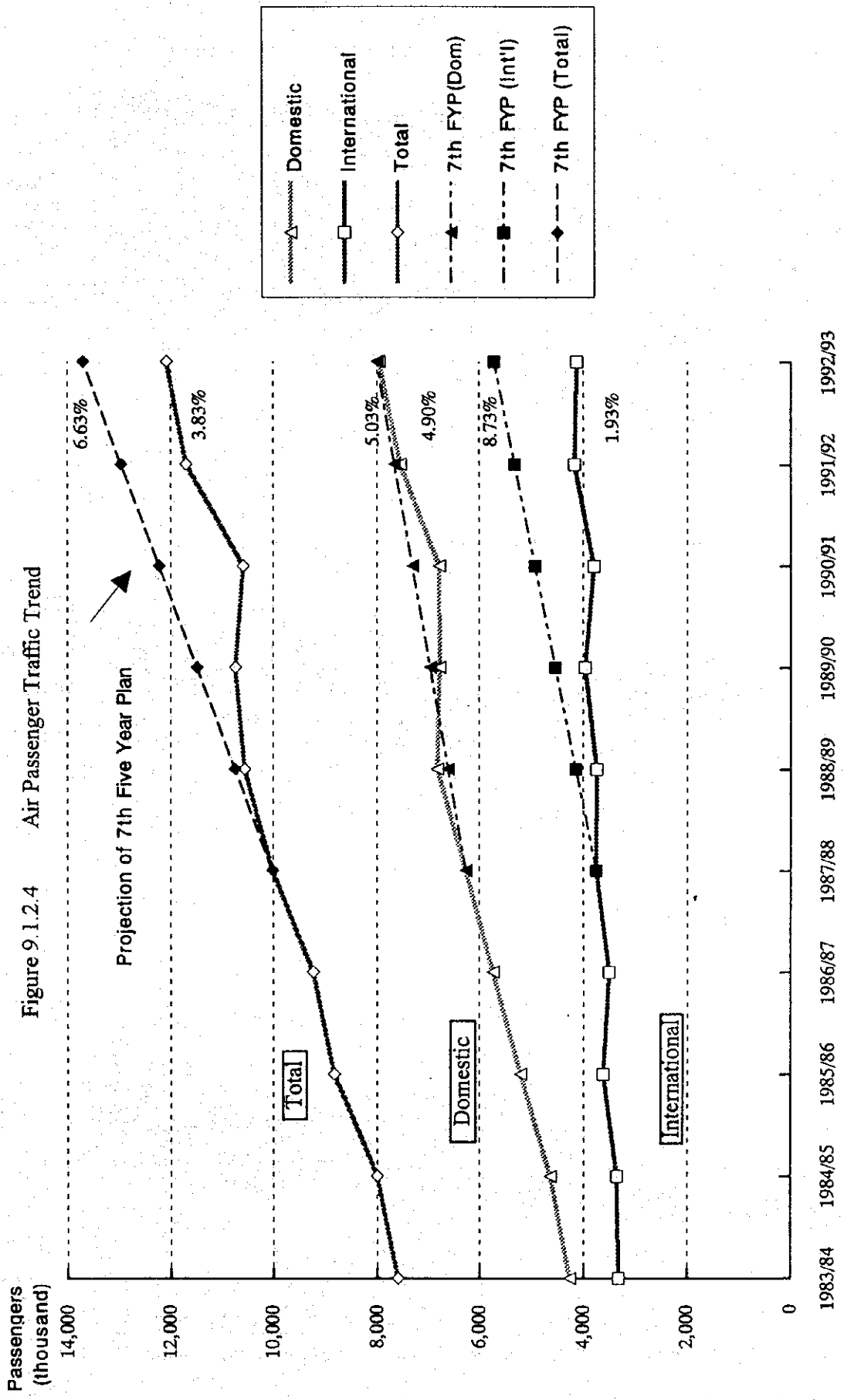
3) Aircraft Movements

The actual trend of aircraft movements for these ten years has increased at the average annual growth rate of 5.32%, and reached 216,348 movements in 1992-93 as shown in Appendix 9.1.7 and Figure 9.1.2.9. Domestic, international, general aviation and local aircraft movements shared at 50.3%, 14.3%, 7.5% and 27.9% respectively in 1992-93, as shown in Figure 9.1.2.10.

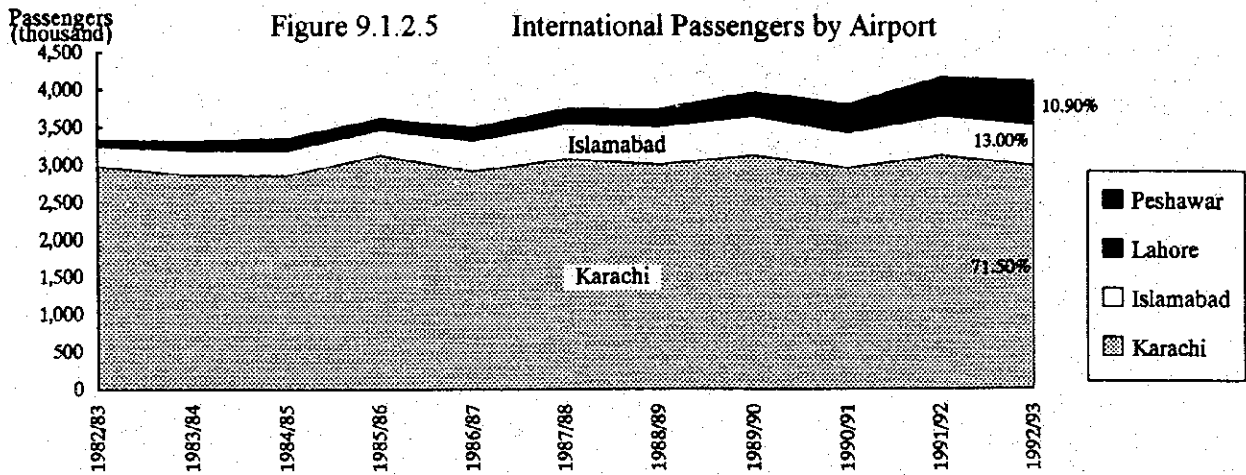
The international and domestic aircraft movements have increased to 30,941, and 108,786 movements in 1992-93 at the average annual growth rate of 1.8% and 6.7% since 1983-84. Karachi International Airport has accommodated 75.8% of the total movements, and is followed by Lahore (10.4%) and Islamabad (9.1%). The domestic aircraft movements were handled mainly by Karachi Airport (22.3%), being followed by Islamabad Airport (17.0%) and Lahore Airport (15.9%) in 1992-93. These three airports share reached 55.2%.

Appendix 9.1.8 shows the domestic aircraft movements by aircraft type in 1992-93. F-27 and B-737 were predominantly utilized high, at the share of 74.1% in total. Wide bodied aircraft such as B-747, A-300 and A-310 were utilized for only international flights except at Gwadar International Airport.

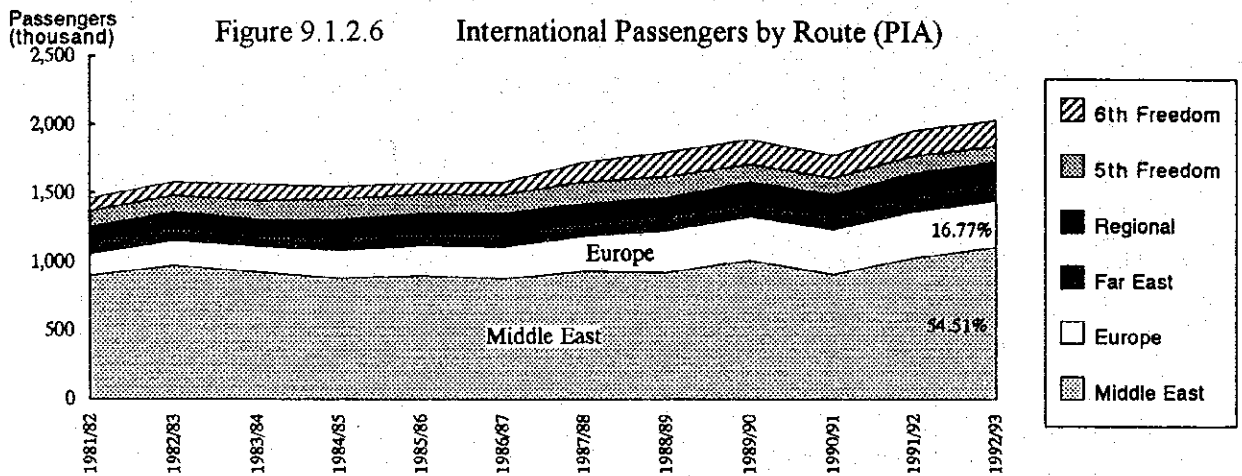
Figure 9.1.2.4 Air Passenger Traffic Trend



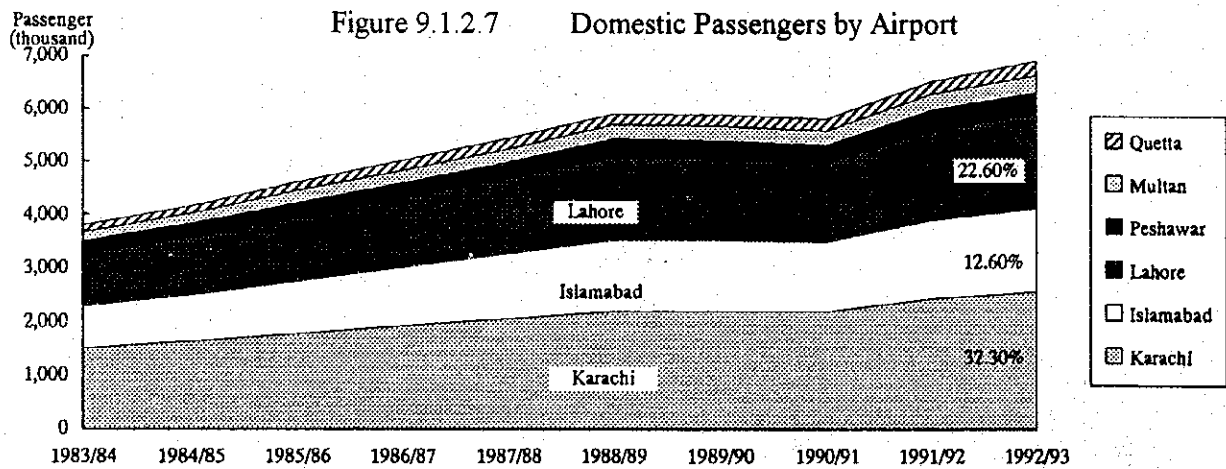
From Appendix 9.1.1



From Appendix 9.1.3



From Appendix 9.1.3



From Appendix 9.1.2

Figure 9.1.2.8 Air Cargo Traffic Trend

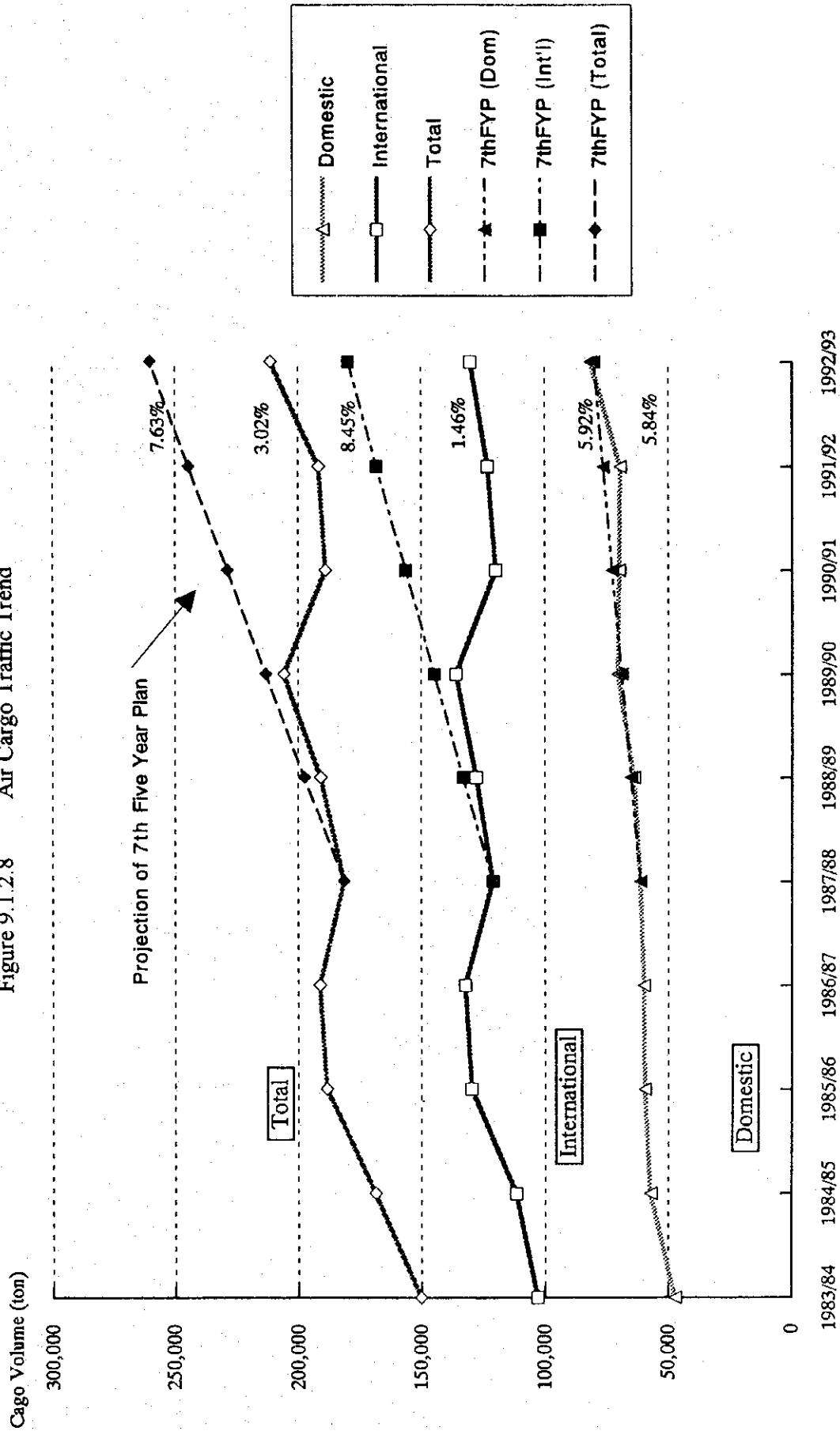
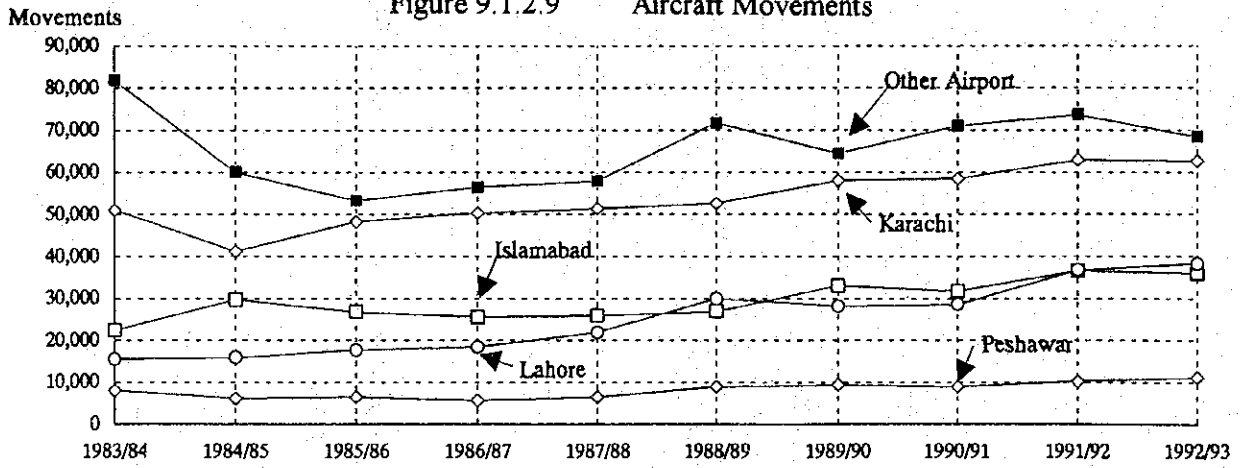
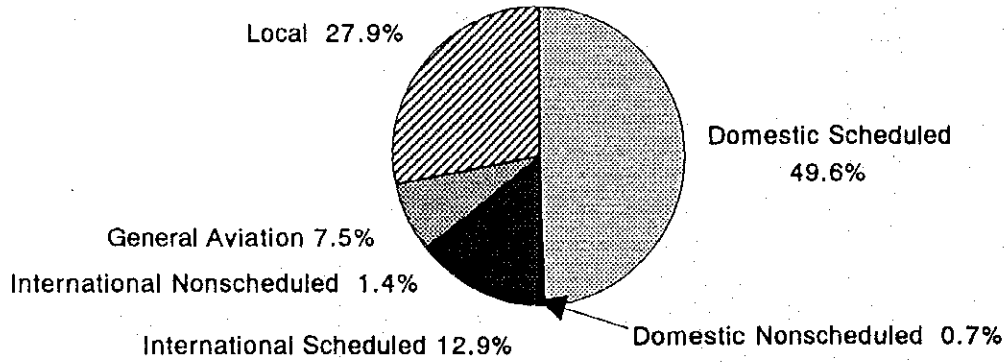


Figure 9.1.2.9 Aircraft Movements



From Appendix 9.1.7

Figure 9.1.2.10 Type of Aircraft Flight in 1992-93



From Appendix 9.1.7

(4) Air Navigation Systems

1) Flight Information Service

The air space of Pakistan is divided into two Flight Information Regions (FIR) boundaries on latitude 30° 00' N i.e., the Karachi FIR (Southern area) and Lahore FIR (Northern area) as shown in Appendix Figure 9.1.1.

2) Radio Navigation Aids & Aeronautical Ground Lights

Table 9.1.2.12 and Table 9.1.2.13 summarize the present status of radio navigation aids and ground visual aids in Pakistan. The navigation aids are located at the airports or in their immediate vicinity managed by CAA. Before the establishment of CAA, simple radio navigational aids such as Non Directional Radio Beacon (NDB) were only available at almost all of the airports. A short term plan was, therefore, drawn up to rectify immediate critical deficiencies. Old navigational aids were replaced and a large number of modern and sophisticated aids were added to ensure safe aircraft operation.

In the numerous mountainous region, Doppler VHF Omnidirectional Radio Range (DVOR) has been set up to counter spurious reflections due to obstructions of the terrain. CAT II ILSs are now being operated at Karachi, Islamabad, Lahore, Faisalabad and Multan airports. Small sized airports have been installed with NDBs and PAPI (except for a few small airports). Simple landing lights for night operations are available at smaller airports for minimum requirement.

3) Air Traffic Control System & Aeronautical Telecommunication System

Air traffic services are managed by the Air Traffic System (ATS) division of CAA.

Figure 9.1.2.11 shows the Air Traffic Control System in Pakistan after completion of the AC&C project. The project is under going as follows:

The Aeronautical Communication and Control Systems (AC&C) comprise of four main elements, i.e., Primary Surveillance Radars (PSR), Secondary Surveillance Radars (SSR), Aeronautical Fixed Telecommunication network (AFTN) and an Automatic Message Switching System (AMSS), and VHF communication facilities.

Radar Approach Control Facilities have been installed at Karachi, Lahore and Islamabad airports by installing PSR in airport premises. The enroute Air Traffic Control of SSR system, throughout the Pakistan Air Space, is being operated at R.Y Khan (Rojhan), Quetta (Lakpass), Pasni, Karachi, Islamabad and Lahore. Lakpass and Pasni have not been installed yet with SSRs. At Karachi, Lahore and Islamabad, the SSRs have been integrated with PSRs. Data from all these radars are fed into and processed at the Area Control Centers (ACC) located at Karachi and Lahore. A total picture of the air traffic in the skies of Pakistan would, thus, be available at the two Area Control Centers.

The VHF Communication throughout the Pakistan Air Space is being established through a number of stations located at Karachi, Quetta, Pasni, Rojhan, Hyderabad, Faisalabad and Laram Killa. An Automatic Message Switching System (AMSS) has been replaced with the manual AFTN. This system receives aviation information, including weather reports and flight plans from neighboring Flight Information Regions and distributes the same to airports throughout Pakistan.

When this project is completed, the entire airspace of Pakistan will have radar coverage and the communication range would be extended beyond the national boundaries. The completion of the project is foreseen by the end of 1994.

(5) Others

1) Training System

a. Civil Aviation Training Institute (CATI)

In view of the rapid expansion and modernization of civil aviation infrastructure in

Pakistan, and to operate and maintain the increased modern facilities effectively, skilled and well-trained manpower is required. For this purpose, the Civil Aviation Training Institute (CATI) was established in Hyderabad by the CAA under the aegis of ICAO and the United Nations Development Program (UNDP) in 1985. The CATI provides training of multifarious disciplines of aviation, which include air traffic services, electronic and electrical-mechanical engineering, airport management and rescue & fire fighting.

b. PIA Training Center

PIA has trained pilots, electrical mechanical, technicians, traffic/sales staff and cabin crew since 1956. Courses are conducted according to the requirements of the industry and the standards laid down by the Civil Aviation Authority of the United Kingdom, FAA and ICAO. All courses are also approved and certified by CAA.

Table 9.1.2.12 Existing Condition of Raiddo Navigation Aids in Pakistan

Location	AIRPORT	RADAR	NDB	C-VOR	D-VOR	DME	T-DME	ILS (CAT II)	LOC/BCN	Commencement Year of Civil Air Service
Balochistan	Quetta		Dec,1982		Jan,1984	Jan,1984				1,956
	Gwadar		Apr,1983							1,966
	Khuzdar		Nov,1986							1,987
	Jiwani		Oct,1985	Nov,1983		Nov,1983				1,966
	Panjgur		Dec,1982	Apr,1987		Nov,1989				1,966
	Pasni		Apr,1983							1,966
	Sui									1,966
	Turbat		Apr,1983							1,978
	Zhob		Dec,1982		Dec,1986	Dec,1986				1,979
	Dalbandin		Jan,1986							1,986
Sindh	Ormara		Mar,1990							1,990
	Sibi		Nov,1985							1,986
	Karachi	May,1988	Dec,1982	Jan,1983		Jan,1983	Available	Dec,1983	Nov,1984	1,937
	Hyderabad		Aug,1987							1,966
	Moenjodaro		Available							1,966
	Nawabshah		Dec,1982	Aug,1983		Dec,1989				1,966
	Sukkur		May,1983							1,966
Jacobabad		Available							1,985	
Mirpur Khas		Available							1,987	
Talhar										
Punjab	Talhar									
	Islamabad	May,1993	Dec,1982		Jun,1983	Jun,1983	Mar,1989	Dec,1983		1,947
	Lahore	1993	Dec,1982	Sep,1991	Sep,1991	Jul,1983	Apr,1989	Apr,1989		1,947
	Faisalabad		Aug,1990				Aug,1985	Aug,1985		1,961
	Multan		Dec,1982	Dec,1982			Oct,1984	Oct,1984		1,960
	Mianwali		Available							1,985
	Bahawalpur		Apr,1986			Apr,1986				1,986
	R.Y.Khan		Dec,1982	Dec,1982						1,990
	Bhagtanwala									
Mangla									1,985	
Walton										
N.W.F.P	Peshawar		Available		Feb,1984	Nov,1984				1,947
	Chitral		Available							1,962
	D.I.Khan		Available							1,968
	Saidu Sharif		Jun,1983							1,980
	Bannu		Aug,1983							1,983
	Kohat									1,985
Northern Area	Prachinar									1,990
	Gilgit		Sep,1989							1,962
	Skardu		Jul,1989							1,962
	Muzaffarabad		Jan,1988							1,988
Rawalakot		Jan,1988							1,988	

Source : AIP Pakistan
Civil Aviation Authority

Table 9.1.2.13 Existing Condition of Ground Visual Aids in Pakistan

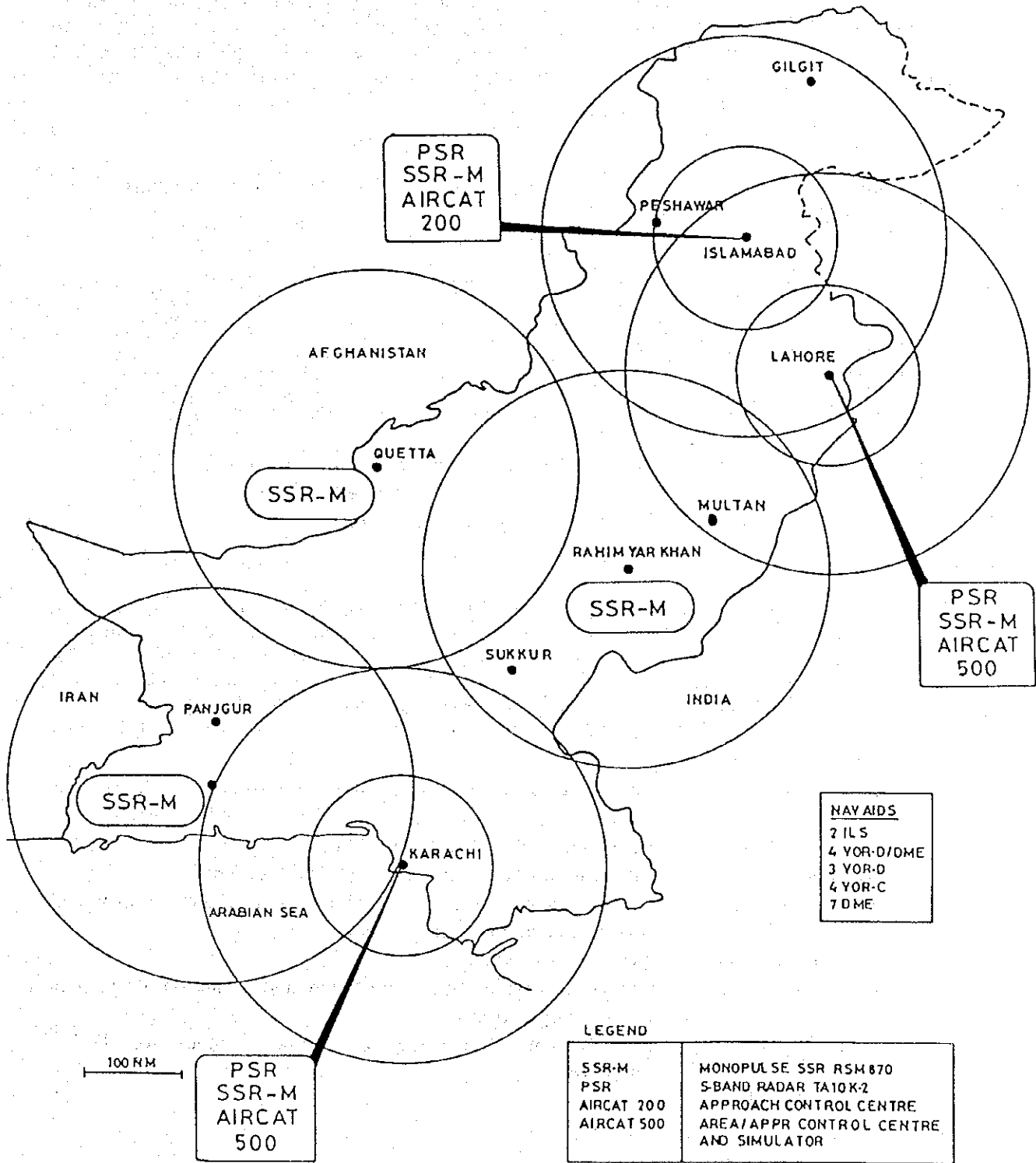
Location	AIRPORT	RUNWAY			TAXIWAY		Approach Lights	PAPI / VASIS	Sequence Flashing Lights	Strobe Lights	Apron Lights
		Center Line Lights	Edge Lights	Threshold Lights	Edge Lights	Center Line Lights					
Balochistan	Quetta		x	x	x		x	x		x	x
	Gwadar										
	Khuzdar										
	Jiwani										
	Panjugur										
	Pasni		x	x	x		x	x			x
	Sui										
	Turbat		x	x	x		x	x			x
	Zhob										
	Daibandin										
Sindh	Ormara										
	Sibi										
	Karachi		x	x	x	x	x	x	x	x	x
	Hyderabad		x	x	x		x	x			x
	Moenjodaro		x	x	x		x	x			x
	Nawabshah		x	x				x			x
	Sukkur		x	x	x			x			x
Punjab	Jacobabad										
	Mirpur Khas										
	Talhar										
	Islamabad	x	x	x	x	x	x	x	x	x	x
	Lahore	x	x	x	x	x	x	x	x	x	x
	Faisalabad		x	x	x		x	x			x
	Multan		x	x	x			x			x
	Mianwali										
	Bahawalpur										
R.Y.Khan		x	x	x		x	x			x	
N.W.F.P	Bhagtanwala										
	Mangla										
	Walton										
	Peshawar		x	x	x		x	x			x
	Chitral										
	D.I.Khan										x
Northern Area	Saidu Sharif										
	Bannu										
	Kohat										
	Prachinar										
	Gilgit										
Northern Area	Skardu										
	Muzaffarabad										
	Rawalakot										

Source : AIP Pakistan
Civil Aviation Authority

Figure 9.1.2.11

Air Traffic Control System in Pakistan

PAKISTAN ATC SYSTEM



9.1.3 Review of the Seventh Five Year Plan

(1) Civil Aviation Authority

The Seventh Five Year Plan proposed the development of airport terminals and facilities, the improvement of air navigation systems, and the construction of feeder service airports.

Capital outlays of Rs. 4,243 million were approved for the development projects of CAA in the Seventh Five Year Plan. After that the ceiling was raised to Rs. 7,500 million after the mid plan review to ensure timely completion of Jinnah Terminal Complex, AC&C and other important projects of the CAA. Budget allocation and utilization in the Seventh Five Year Plan for CAA is as shown in Table 9.1.3.1. Finally, the total budget of Rs. 6,729 million was allocated.

Table 9.1.3.1 Budget Allocation and Utilization for CAA (Unit : Rs. Million)

	Public Sector	Corporate Sector	Total
Seventh Plan Allocation			4,243 (7,500)*
Utilization until 1988-92	8	5,582	5,590
1992 to 1993 (Draft)	51	1,088	1,139
Total Utilization	59	6,670	6,729

Note : * Revised in Mid-Plan Review of the 7th Five Year Plan

Source: 1) Mid-Plan Review of the 7th Five Year Plan
2) 8th Five Year Plan Civil Aviation

Table 9.1.3.2 summarizes the major projects in the Seventh Five Year Plan for CAA, showing the budget allocation and utilization for the projects. As shown in the table, the following major development projects of CAA were completed during the Seventh Five Year Plan. (In addition, two major projects i.e., Jinnah Terminal Complex and Aeronautical Communication & Controls (AC&C) Project were completed. These projects would contribute to increase the passenger and cargo handling capacity at Karachi and to make aircraft operations much safer and more economical.)

1. Lahore Airport: Improvement of new runway and re-construction of old runway. Expansion and renovation of the existing terminal building.
2. Islamabad Airport: Renovation of existing terminal building.
3. Karachi Airport: Construction of new terminal (Jinnah Terminal)
4. AC&C Project: Establishment of radar network for air traffic control and surveillance in Pakistan's air space.
5. Nawabshah Airport: New terminal building.
6. Faisalabad Airport: Overlay and widening of the runway and expansion of facilities for A300 operation.
7. Gilgit Airport: Improvement of existing aerodrome facilities for B-737 operation.
8. Muzaffarabad, Rawalakot, Ormara: New airport

Table 9.1.3.2 Civil Aviation Authority (Pakistan)
Summary of Seventh Five Year Plan 1988-93

(unit : Rs. Million)

	Total Cost	FEX	1988-89		1989-90		1990-91		1991-92		1992-93		Remarks
			ADP Allocation	Expenditure	ADP Allocation	Expenditure	ADP Allocation	Expenditure	ADP Allocation	Expenditure	ADP Allocation	Expenditure	
Public Sector Development Programme													
Global Trainer	9.00	9.00	4.33	0.00	4.00	0.00	4.00	0.00	5.00	5.00	4.00	4.00	
Civil Aviation Development Programme	59.00	54.00	0.00	0.00	9.00	0.00	14.89	0.00	30.15	0.00	39.00	39.00	
Upgrading CAA airports Engrs. capability	20.00	18.00	0.00	0.00	0.00	0.00	11.26	0.00	3.88	3.00	11.06	8.00	
Sub-Total Public Sector	88.00	81.00	4.33	0.00	13.00	0.00	30.15	0.00	39.03	8.00	54.06	51.00	
Corporate Sector Development Programme													
Major Projects													
Aeronautical Communications & Control	2,412.00	1,435.00	686.82	558.00	670.00	220.00	290.00	291.00	304.02	58.00	107.00	93.00	
New Jinnah Terminal Complex--Karachi	5,058.00	1,863.00	444.00	430.00	1,604.20	545.00	1,351.20	1,360.00	1,567.27	1,724.00	430.00	757.00	completed
New Islamabad int'l Airport	6,000.00	4,000.00	85.00	85.00	35.00	0.00	0.00	85.00	68.00	8.00	96.00	68.00	Design finished
New Lahore Air Terminal Complex	3,200.00	1,200.00	37.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	do
Other Development Projects													
New Lahore Runway	384.00	52.00	50.00	50.00	0.00	1.00	12.60	33.00	30.14	1.00	50.00	9.00	completed
Reactivation of old runway at Lahore	21.00						0.00	0.00	0.00	10.00	0.00	3.00	
Addition/Alteration in T/Bldg. at Islamabad	19.00		0.83	1.00			0.00	0.00	7.77		17.85	6.00	completed
Proc. of Eqt & Material for repair of R/W at ISB	21.00	10.00					0.00	0.00	0.00		21.00	9.00	do
Shopping Plaza & Officer Club at Karachi	46.00		7.00	7.00			2.65	2.65	0.00		0.00	0.00	do
Airline ramp vehicles maint facilities--Karachi	18.00						17.50	5.00	2.00	10.00	2.75	3.00	do
New Runway at Faisalabad	127.00		21.00	21.00	37.50	9.00	5.22	26.00	10.45	4.00	6.19	3.00	do
Re-construction of Runway at Gwadar	7.00				15.00		0.00	0.00	0.00		6.58	3.00	do
Strengthening of Runway at Moenjodaro	20.00		0.10		0.00	13.00	0.00	0.00	1.20		1.82		do
Extension of VIP lounge at Peshawar	3.00				15.00		0.00	0.00	0.00	2.00	1.00		do
Const. of T/Bldg. at R.Y. Khan	55.00	24.00			0.00		1.00	20.00	10.00		0.00		do
Const. of Royal Lounge at R.Y. Khan	11.00				0.00		0.00	0.00	0.00		7.67	3.00	
Re-carpeting of Runway at Sukkur	42.00				0.00	1.00	0.00	0.00	35.00		20.00	20.00	completed
Procurement of FF suits & eqpt.	16.00	5.00			0.00		0.00	0.00	0.00		2.51	3.00	
Sub-Total	17,460.00	8,589.00	1,332.17	1,152.00	2,376.70	789.00	1,680.17	1,737.65	2,035.85	1,817.00	770.37	977.00	
Technical Support Equipment				6.00	1.00	1.00	11.00	11.00		17.00		14.00	
Misc. Works				5.00	4.00	4.00	13.35	13.35		29.00		97.00	
Sub-Total Corporate Sector				1,163.00	794.00	794.00	1,762.00	1,762.00	2,074.88	1,871.00	824.43	1,088.00	
GRAND TOTAL			1,336.49	1,163.00	2,389.70	794.00	1,710.32	1,762.00	2,074.88	1,871.00	824.43	1,139.00	

Note : FEX : Foreign Exchange
Source : Civil Aviation Statistics

The following projects could not be implemented during the Seventh Five Year Plan, therefore, these projects will be given the highest priority for implementation in the Eighth Five Year Plan.

1. Islamabad Airport: Rehabilitation and extension of the runway.
2. Karachi Airport: Repair of the main runway and re-building the secondary runway.
3. Sukkur, Turbat, Gwadar Airport: Upgrading of the runway for B737 operation.
4. Multan Airport: Strengthening of the runway for A300 operation.
5. Gwadar, Turbat: New terminal building for A300 operation.
6. Islamabad Airport : New airport.
7. Lahore airport : New terminal complex.

As for the new Islamabad airport and the new terminal complex at Lahore airport, which are originally intended to be built on BOT (Build-Operate-Transfer) basis, land acquisition and design works were already completed. However the construction works have not commenced due to delay of budget preparation.

(2) Pakistan International Airlines

The trend of the passenger traffic of PIA and the freight traffic are shown in Appendix 9.1.9 and Appendix 9.1.10, respectively.

PIA achieved the Seventh Five Year Plan targets of passenger service by introducing longer haul flights and improving their passenger uplift at foreign stations as shown in Table 9.1.3.3 and Fig. 9.1.3.1. Revenue Passengers Kilometers (RPKs) is 10,102 million in 1992-93 which is higher than what was estimated in the Seventh Five Year Plan. RPKs in 1990-91 declined over the last year due to the suspension of PIA flights to Gulf, Saudi Arabia and the Middle East during the Gulf war.

The Revenue Freight Tone Kilometers (RFTKs) is 400 million in 1992-93 which is below the estimation.

Table 9.1.3.3 Traffic Projection and Achievement in the Seventh Five Year Plan

	Bench Mark 1987-88	Projections		Actual 1992-93
		1988-89	1992-93	
Passenger RPKs (Million)	7,663	8,151	9,603	10,102
International	5,447	5,665	6,197	7,556
Domestic	2,216	2,486	3,406	2,546
Freight RFTKs (Million)	381	392	469	400
International	26	29	424	363
Domestic	355	363	45	37

Source: 8th Five Year Plan Civil Aviation

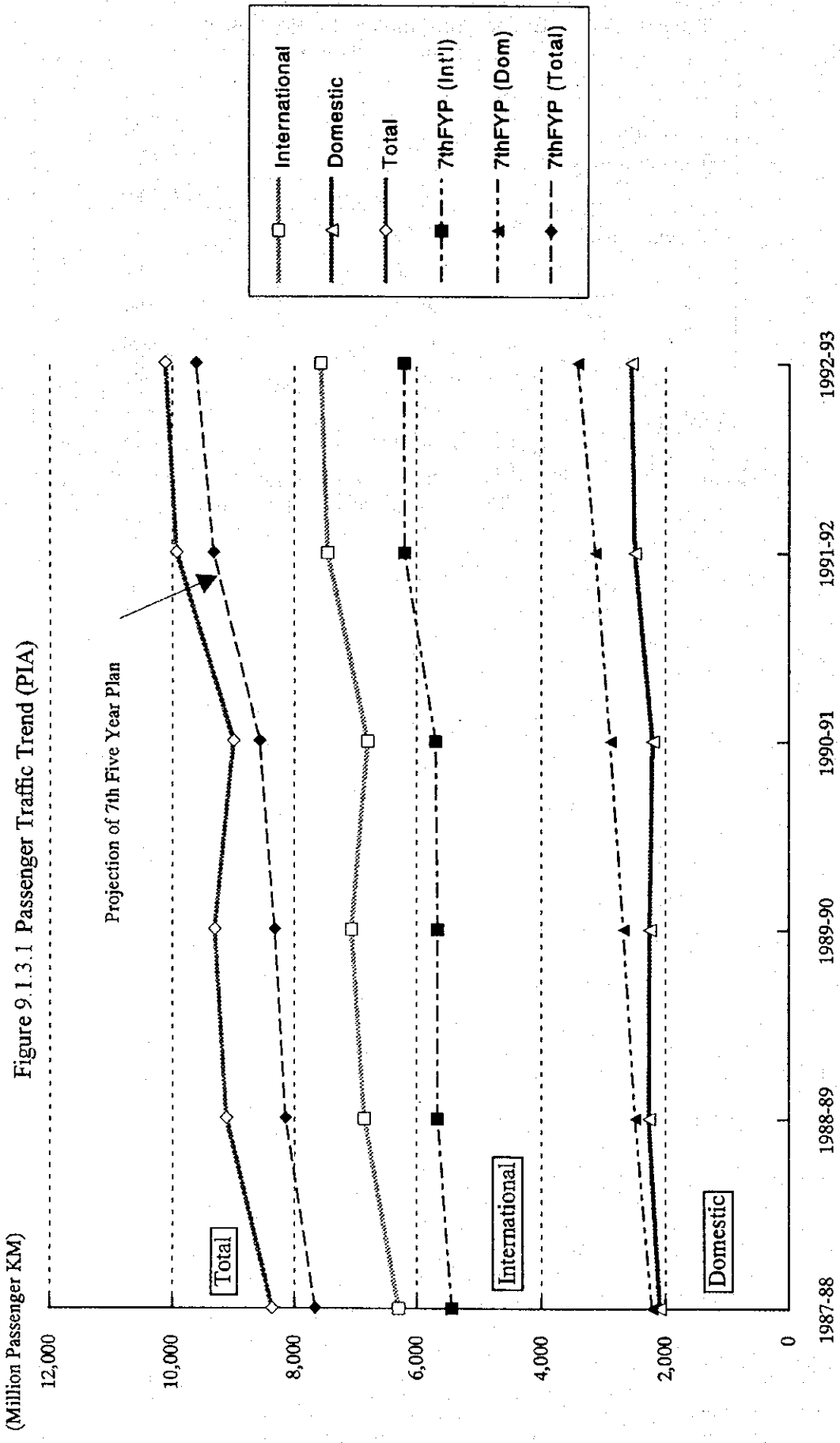
Budget allocation and utilization in the Seventh Five Year Plan for PIA is shown in Table 9.1.3.4. PIA was authorized to spend Rs. 17,684 million for aircraft and equipment/facilities. The total utilization remained to be Rs. 10,642 million.

The Seventh Five Year Plan envisaged to introduce one A300, one B707, six new wide body Twin Jets, two B737s, one F-27 and twelve Turbo Props. However, PIA acquired four A310-300s and four used F-27s. Thus, the transition of fleet possession resulted in as shown in Appendix 9.1.11.

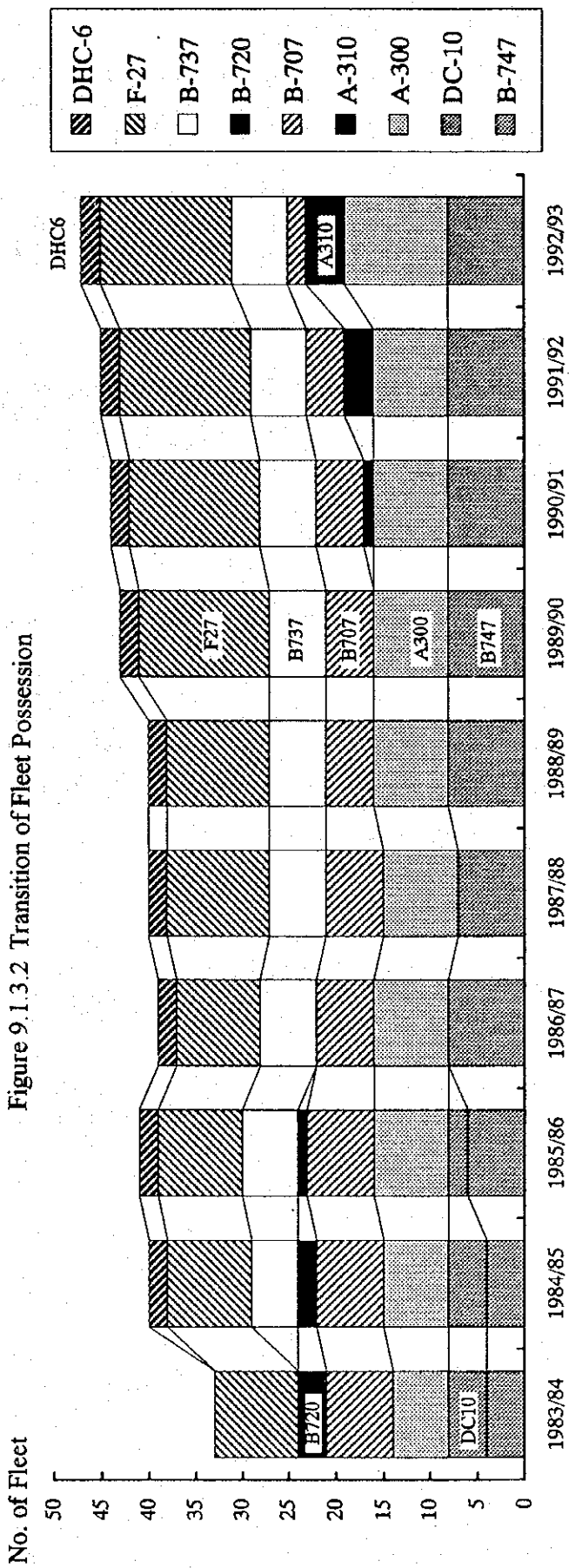
Table 9.1.3.4 Budget Allocation and Utilization for PIA
(Unit : Rs. Million)

		Total
Seventh Plan Allocation		952
		(17,684)*
Utilization until	1988-89	687
	1989-90	781
	1990-91	3,193
	1991-92	4,300
	1992-93	1,681
Total Utilization		10,642

Note : *Revised in Mid-Plan Review of the 7th Five Year Plan
Source : 1) Mid-Plan Review of the 7th Five Year Plan
2) 8th Five Year Plan Civil Aviation



From Appendix 9.1.9



From Appendix 9.1.11

9.1.4 Capacity Analysis for the Present Condition

In order to clarify the present condition, analyses are required on runway capacity, runway length, taxiway system, apron, passenger terminal buildings, car parking, air navigation system and rescue and fire fighting. The analyses are mainly focused on three main airports i.e., Karachi, Islamabad and Lahore.

Other airports are not examined due to less landing frequency and passenger volume which can be covered by the existing facilities for a certain period. The service may be not satisfactory, but in the tolerable range. They can be improved in stages to cope with the future demand increase.

(1) Runway

1) Runway Capacity

The required runway numbers and lengths at the existing airports are analyzed using the criteria of the Federal Aviation Administration of U.S.A (FAA). The annual aircraft movements at these three airports are currently far below the runway capacity and peak hour movements are also presumed to be below the capacity as shown in Table 9.1.4.1.

Table 9.1.4.1 Aircraft Movements

Airport	Movements in 1992-93	Runway Capacity 1)		Remarks
		Annual	Hourly	
Karachi	62,695	280,000	54	Close Parallel Runways
Islamabad	35,918	170,000	42	Single Runway
Lahore	38,271	280,000	54	Close Parallel Runways

Note : 1) From the Federal Aviation Administration, U.S.A.

2) Runway Length

The existing runway length of three airports are shown in Table 9.1.4.2. The Karachi airport have two close parallel runways of which the main runway has enough runway length for operations of all types of aircraft, however, the second runway length is not sufficient for B747 operation. The length of the secondary runway, is therefore inadequate as back-up for the main runway.

For the Islamabad airport, the runway extension work is under construction and is scheduled to be completed by the end of 1994. Therefore, after the completion, the runway will be capable to accommodate B747 operation.

The Lahore airport has a runway long enough for the current B747 operation.

Table 9.1.4.2 Runway Length and Operating Aircraft

Airport	Existing Runway Length (m)	Maximum Aircraft Operated	Required Runway Length (m)	Direction	Distance (Km)
Karachi	3,200	B747	2,500	Karachi-London	6,337
	2,290	F-27			
Islamabad	3,350	B747	3,000	Islamabad-London	6,057
Lahore	3,360	B747	3,100	Lahore-Amsterdam	5,944
	2,743	A300			

(3) Apron

The required number of aircraft stands for loading/unloading of passengers is calculated using the following formula:

$$S = \{Ti / 60 \times Ni / 2 \times a\} + b$$

Where,

S: Required number of aircraft stands

Ti: Apron occupancy time in minutes

Ni: Number of movements of aircrafts during the peak hour

a: Allowance for special occasions (= 1.2)

b: Extra stands for special occasions

One extra stand for the largest aircraft of the target year for unexpected peaking occasion (1 extra for every 10 stands)

Required number of aircraft stands under the present condition in comparison with the existing facilities are summarized as shown in Table 9.1.4.3.

Table 9.1.4.3 Number of Aircraft Stands

Airport	Existing		Required	
	Aircraft type	Number of Apron	Aircraft type	Number of Apron
Karachi	L	26	L	5
	WI	8	WI	7
			WII	4
	S	2	S	6
	F	9	F	5
	Total	45	Total	27
Islamabad	L	4	L	5
			WI	2
			WII	2
	S	7	S	3
	F		F	6
	Total	11	Total	18
Lahore	L	2	L	4
	WI	2	WI	2
			WII	2
	S	6	S	3
	F		F	4
	Total	10	Total	15

Note: L : B747 class WI : A300 class WII : A310 class S : B737 class F : F27 class

(3) Taxiway System

The Karachi and Lahore airports have full parallel taxiway systems. However, the Islamabad airport does not have a full parallel taxiway. According to the recommendation in Annex 14 of ICAO, a full parallel taxiway with right angle exits is economically justified where the number of instrument approaches exceeds four during a normal peak hour. Based on this criterion, the Islamabad airport is recommended to be provided with a full parallel taxiway.

(4) Passenger Terminal Building

Terminal building space requirements are calculated by multiplying the number of peak hour passengers by the unit floor area per peak hour passenger.

FAA stipulates the unit floor area is 14 sq.m per peak hour passengers for estimating gross terminal building space for domestic use. (FAA, Advisor Circular AC150/5360-7). In the case of terminal planning in Japan, unit floor area of 15 sq.m and 35 sq.m for domestic and international terminals is proposed, respectively. "Basic Planning Requirements for 6th Five Year Airport Development" (JCAB) is adopted for the area planning purpose.

The terminal building at Karachi Airport has unit floor area of nearly 14 sq.m and 25 sq.m for domestic and international respectively. The terminal is considered to be properly operated. Therefore, the existing terminal buildings are evaluated for future requirement based on these unit floor areas.

As shown in Table 9.1.4.4, terminal at Karachi airport has enough space, however, the Islamabad and Lahore airports have to be expanded.

Table 9.1.4.4 Floor of Terminal Building

Items	Karachi		Islamabad		Lahore	
	Dom.	Int'l.	Dom.	Int'l.	Dom.	Int'l.
(1) Actual Floor Area (m ²)	79,072		13,600		8,863	
(2) Peak Hour Passengers	1,160	1,620	710	400	810	330
(3) Required Unit Floor Area per one Passenger (m ²)	14	25	14	25	14	25
(4) Required Floor Area (m ²)	16,240	40,500	9,940	10,000	11,340	8,250
(1)-(4)	22, 332		-6, 340		-10, 727	

(5) Car Park

The following formula is used to calculate the required car parking spaces.

$$A = P \times C \times L$$

Where,

- A: Required car parking spaces
- P: Number of peak hour passengers
- C: Number of parking lots per peak hour passenger (0.8 by the Japanese and FAA standards)
- L: Unit space for one lot (25 m² for parking lot and circulation road only)

The required car parking space and the existing car parking space are summarized in Table 9.1.4.5. Islamabad and Lahore airports are recommended to be expanded, however, that of the Karachi airport is considered wide enough for the future requirement.

Table 9.1.4.5 Car Park Area

Items	Karachi	Islamabad	Lahore
Peak Hour Passengers	2,780	1,110	1,140
Number of Parking Spaces	2,224	888	912
Required Car Parking Spaces (m2) (1)	55,600	22,200	22,800
Actual Number of Parking Spaces	2,000	740	720
Actual Area (m2) (2)	115,000	19,000	9,900
(2) - (1)	59,400	-3,200	-12,900

(6) Air Navigation Systems

In accordance with the ICAO and JCAB standards, the basic planning criteria of major navigation systems are as follow :

1) Radar Approach Control

A radar approach control is justified when annual aircraft operation exceeds 10,000 movements under instrument flight rules (IFR). The unit shall be equipped with a terminal ASR/SSR and the associated control consoles.

2) ILS Category-I/Lighting Category-I

The Category-I operation is justified for an airport where turbo jet aircraft operate on scheduled civil transport basis.

Equipment necessary for the Cat.-I operations are as follows:

- ILS Category-I
- Approach Lighting System Category-I
- Precision Approach Path Indicator
- Runway Threshold Lights
- Runway End Lights
- Taxiway Edge Lights, etc.

Terminal DME allocated with ILS is applicable where an outer marker could not be justified for geographical and/or economic reasons.

3) VOR/DME, NDB

Installation of VOR/DME is justified for an airport where scheduled civil aircraft operates. NDB is also applicable instead of the VOR/DME under the condition that the annual aircraft movements do not exceed 3,000 operations and interception to the airport of destination could be made safely adjacent to VOR/DME or VORTAC located within 40 NM radius from the airport.

The results of analysis indicate that the indispensable equipment will be installed for safety operation, and are summarized as shown in Table 9.1.4.7.

(7) Rescue and Fire Fighting

The airport category is, in general, determined by the overall length of the longest airplane and their maximum fuselage normally using the airport, in compliance with the ICAO recommendation. However, these can be reduced to lower levels by taking infrequent aircraft operations into account. The required Category are analyzed as follows:

Table 9.1.4.6 ICAO Recommendation for Rescue and Fire Fighting

Aircraft	Length (m)	Required Category
B-747	70.51	Category 9
A-300	53.62	Category 8
B-707	44.42	Category 7
B-737	33.40	Category 6
F-27	23.85	Category 4
DHC-6	15.77	Category 3

Source : ICAO Annex 14

The existing status of rescue and fire fighting at each airport based on the Aeronautical Information Publication (AIP) are shown in Table 9.1.4.7. In the light of Table 9.1.4.6, several airports are recommended to be upgraded the category to meet the respective requirement.

Table 9.1.4.7 Evaluation of Air Navigation Systems and Rescue & Fire Fighting

X : Facility Available
R : Facility to be Required

Location	Airport	Maximum Operated Aircraft	Radio Aids					COM VHF UHF	Lighting Aids					MET RVR	Rescue & Fire Fighting	
			Radar	ILS	C-VOR D-VOR	DME	T-DME		NDB	ALS	RWL	VASIS PAPI	TWL		A/P	Existing Category
Balochistan	Quetta	A-300		R	X	X		X	X	X	X	X	X		PAF	8
	Gwadar	F-27						X	X						4	4
	Jiwani	F-27			X	X		X	X						4	4
	Khuzdar	F-27			X			X	X						RIV, water	4
	Panjugur	F-27			X	X		X	X						4	4
	Pasni	B-737						X	X	X	X	X	X		4	6
	Sui	F-27													Private	4
	Turbat	F-27			R	R		X	X	X	X	X	X		4	4
	Zhob	F-27			X	X		X	X						4	4
	Dalbandin	C-130						X	X						RIV, water	7
Ormara	F-27						X	X						RIV, water	4	
Sibi *							X	X								
Sindh	Karachi	B-747	X	X	X	X	X	X	X	X	X	X	X	X	9	9
	Hyderabad	F-27						X	X	X	X	X		4	4	
	Moenjodaro	F-27						X	X	X	X	X		4	4	
	Nawabshah	B-737			X	X		X	X	X	X	X		4	6	
	Sukkur	B-737		R	R	R		X	X	R	X	X	X	4	6	
	Jacobabad	F-27						X	X						4	
	Mirpur Khas	F-27						X	X						4	
	Talhar *	F-27														
Punjab	Islamabad	B-747	X	X	X	X	X	X	X	X	X	X	X	X	9	9
	Lahore	B-747	X	X	X	X	X	X	X	X	X	X	X	X	8	9
	Faisalabad	A-300		X	R		X	X	X	X	X	X	X		6	8
	Multan	B-707		X	X		X	X	X	R	X	X	X		7	7
	Mianwali	F-27						X	X							4
	Bahawalpur	F-27						X	X						RIV, water	4
	R.Y.Khan	B-737			X	X		X	X	X	X	X	X		RIV, water	6
	Bhagtanwala *															
	Mangla *															
Walton *																
N.W.F.P	Peshawar	A-300		R	X	X		X	X	X	X	X	X	X	7	8
	Chitral	F-27						R	X						4	4
	D.I.Khan	F-27						X	X				X		4	4
	Saidu Sharif	F-27						X	X						4	4
	Bannu	F-27						X	X						4	4
	Kohat	F-27						R	X						PAF	4
	Prachinar *							X	X							
Northern Area	Gilgit	F-27						X	X						4	4
	Skardu	B-737						X	X		R				4	6
	Muzaffarabad	F-27						X	X						RIV, water	4
	Rawalakot	DHC-6						X	X						RIV, water	3

Source : Aeronautical Information Publication (AIP)

Note : RIV, water : One Rapid Intervention Vehicle and One Water Bowser

PAF : Fire Services by PAF

* : Not Utilized Airport

(8) Conclusion

The analyses on the capacity of airport facility are summarized as follows :

- The existing runways at Karachi, Islamabad and Lahore airports are adequate for the current operation. The runway lengths are also long enough respectively, however, it is desirable that the second runway at Karachi airport be extended for B747 to ensure the safety operation.
- A parallel taxiway is necessary for the Islamabad airport.
- The number of aircraft parking stands were insufficient at the Islamabad and Lahore airports.
- The capacities of terminal buildings and car parks at the Islamabad and Lahore airports have already been saturated.
- The air navigation systems are requested to be installed at several airports in accordance with international standards.

The rescue and fire-fighting services are requested to be upgraded to meet the requirements at several airports.

9.1.5 Present Problems

Since CAA was established in 1982, the infrastructure facilities were not only improved but also modernized in line with international standards to handle the increasing demand. Bases on the analyses on airport facility capacity, the following problems are pointed out:

Passengers in Pakistan are too heavily concentrated to the three major international airports i.e., Karachi, Islamabad and Lahore. These three airports handle more than 97% of international passengers. Among them, Karachi airport has the largest share of 75% of the total.

These three airports are handling 74% of all domestic passengers, also. On the other hand, other airports play minor roles in the national air transportation. Therefore, from the viewpoint of the national air transportation development, the policy focus shall be on promotion of small-sized airports to increase the demand.

(1) Karachi Airport

The main runway has suffered from regular patterns of cracks and been densely covered with rubber, so that the improvement should be done with overlay. However, it is difficult to close aircraft operation because of the continuous traffic. Accordingly, the secondary runway shall be 3,400 m in length with the new exit taxiways. Although the reconstruction plan of the secondary runway was already authorized to be started in the Seventh Five Year Plan, the construction work has not started yet.

(2) Islamabad Airport

The extension of the runway to 3,353 m (11,000 ft) is under construction and is scheduled to be completed by the end of 1994. In order to reduce the waiting time at holding positions and to realize faster access to the runway, the full parallel taxiway systems is required to be directly connected with both ends of the runway.

The existing terminal building is old, and handling system is obsolete without any boarding bridges. It is congested with the present passengers. A new domestic departure lounge was constructed in February 1994; however the capacity is still inadequate.

The existing airport is located adjacent to the city of Rawalpindi, that it is difficult to expand the existing facilities. Hence a new airport 20 miles west from the existing airport is under study. About 3,000 acres for the new airport were acquired and the project implementation is intended on BOT basis, however due to the delay of the financial preparation, the construction works have not started yet.

(3) Lahore Airport

A new runway was constructed in 1989 to introduce A-300. Also the existing terminal building is old without any boarding bridges. The terminal buildings must be expanded to accommodate the overflowing passengers at present.

Lahore airport is jointly used by CAA and PAF. The terminal area is located far from the runway and the site is very limited for terminal expansion, therefore, a new terminal building with allied facilities will be built east of the new runway where 450 acres of land were acquired through exchange between the Army and the CAA. The new terminal complex project is intended to implement on BOT basis also, however due to the same reason as the new airport in Islamabad, the construction works have not been started yet.

(4) Other Airports

Several airports require extension, expansion, upgrading of facilities such as runways, terminal buildings and others to accommodate larger aircraft and to cope with increasing demands.

(5) Feeder airports

Feeder airports are planned in order to encourage and enhance the regional economy in remote areas, however, all of these airports are not feasible from the financial point of view due to such small demand of less than 10,000 passengers per year. It should be reminded these airports are not dispensable for the social welfare and the national integrity. The projects for airport improvement should be considered from the nationalistic view-point. If they are carried out by CAA's own budget, the losses incurred by these projects may not be recovered for a long time.

(6) Air Navigation Systems

Air navigational aids have been gradually improved and upgraded in order to ensure safer aircraft operation. However, several airports, on which scheduled turbo jet aircraft are being operated, have not installed ILS system. VOR/DMEs or NDBs have been installed at almost all of airports, however still there are some airports without VOR/DME or NDB even where scheduled flights are being operated.

9.2 MASTER PLAN

9.2.1 General

This chapter describes the Master Plan for airport/aviation in 2005-06, in consideration of mitigating the present problems which were mentioned in "9.1.5 Present Problems".

9.2.2 Future Traffic Demand for Planning

(1) Forecast of Air Traffic

The forecast of air traffic is shown in "Main Report - Volume I Chapter 3, 3.6 Projection of Air Traffic". Based on the present passenger OD table in 1992-93 which are shown in Appendix 9.2.1, the future passenger OD table in 1997-98 and 2005-06 were estimated as shown in Appendix 9.2.2 and Appendix 9.2.3.

The future OD tables between the airports have been created as follows:

- 1) In a zone where there is only one airport, the demand in the zone is equal to the demand of that airport.
- 2) In a zone where there are more than two airports, the demand in that zone is distributed to each airport according to the share of the past traffic demand. If a new airport is located in the zone which has no air traffic in the past, the total demand in that zone is distributed to each airport based on the ratio of the PIA passenger traffic forecast.

With regard to the forecast of international passenger, this forecast does not include the effect of Economic Cooperation Organization (ECO), however, ECO was set up in 1964. Pakistan, Iran and Turkey are the three founder members of the ECO. Now the Republics of Turkmenistan, Tajikistan, Uzbekistan, Kazakhstan, Kyrgyzstan, Azerbaijan and Afghanistan have also become the members of the ECO. The ECO, therefore, is spread on an area of more than six million m² and more than three hundred million population. Therefore, it can be expected that ECO is one of the factors to increase the traffic demand in future.

Summary of the International and Domestic annual forecasts are shown in Table 9.2.2.1 and 9.2.2.2. Table 9.2.2.3 shows the annual international and domestic cargo volume.

Table 9.2.2.1 Forecast of Annual International Passengers (Unit: thousand)

Airport	1992 -93		1997 -98		2005-06
Karachi	2,980	(4.3%)	3,686	(4.3%)	5,163
Islamabad	540	(4.6%)	677	(4.3%)	948
Lahore	454	(1.3%)	485	(4.3%)	679
Others	154	(5.5%)	201	(4.3%)	282
Total	4,128	(4.1%)	5,049	(4.3%)	7,072

Note: The figures in parentheses indicate the annual growth rate
 Source: JICA Study Team

Table 9.2.2.2 Forecast of Annual Domestic Passengers

(Unit: thousand)

	Airport	1992 -93		1997 -98		2005-06
Passenger-kms (million)	Total	2,545	(7.9%)	3,716	(6.6%)	6,176
Passengers (thousand)	Karachi	2,571	(7.4%)	3,672	(6.8%)	6,232
	Islamabad	1,554	(6.5%)	2,138	(6.7%)	3,595
	Lahore	1,684	(6.3%)	2,281	(6.5%)	3,771
	Others	1,914	(11.1%)	3,245	(7.3%)	5,701
	Total	7,723	(8.0%)	11,336	(6.9%)	19,299

Note: The figures in parentheses indicate the annual growth rate
 Source: JICA Study Team

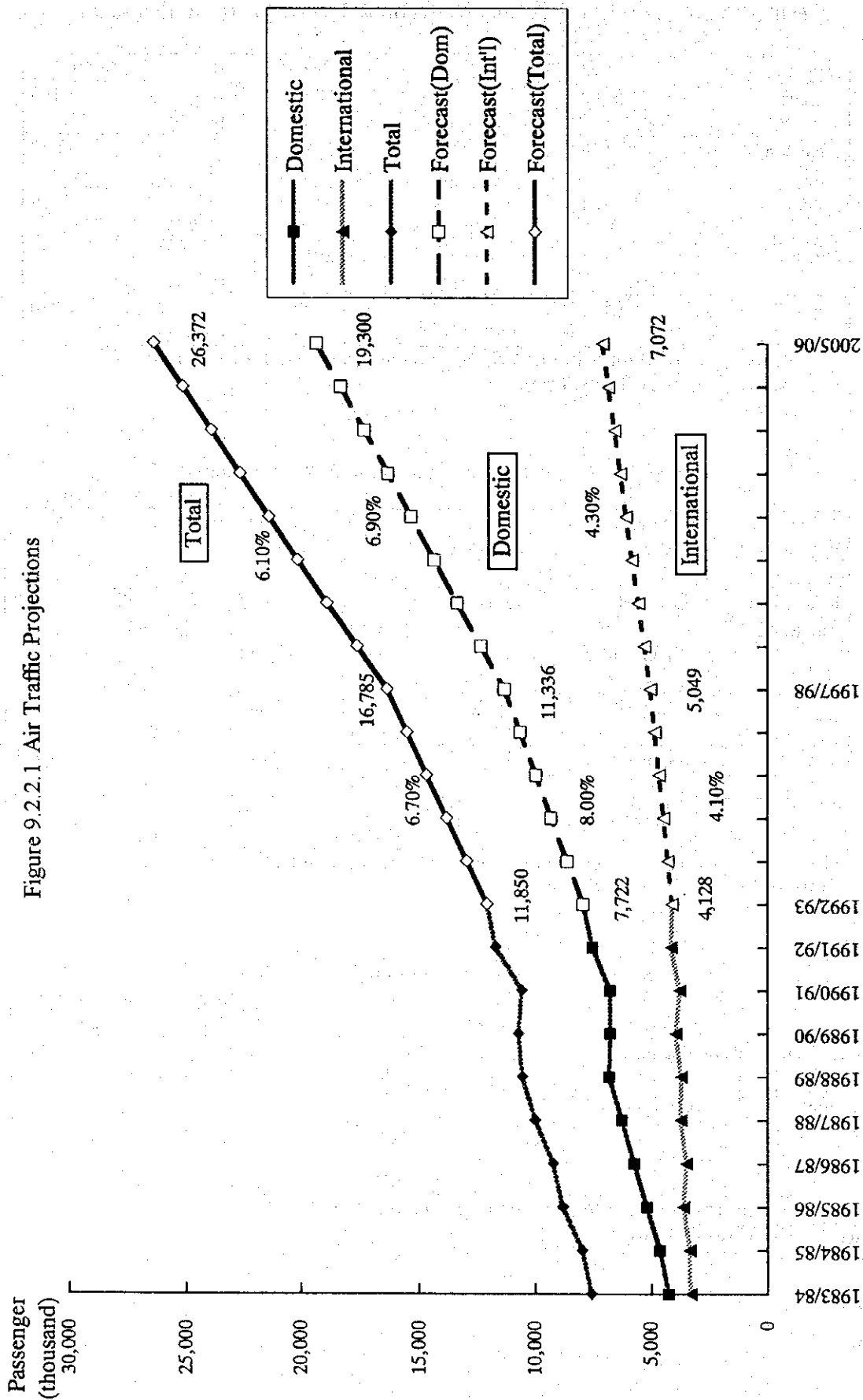
Table 9.2.2.3 Forecast of Annual Cargo Volume

(Unit: thousand tons)

		1992 -93		1997 -98		2005-06
International	(Thousand ton)	130	(4.8%)	164	(5.2%)	246
Domestic	(Million ton-kms)	37	(6.6%)	51	(6.6%)	85
	(Thousand ton)	81	(7.6%)	117	(7.0%)	201

Note: The figures in parentheses indicate the annual growth rate
 Source: JICA Study Team

Figure 9.2.2.1 Air Traffic Projections



From Table 9.2.2.1 and Table 9.2.2.2

9.2.3 Breakdown of Air Traffic Volume

The annual traffic demand is broken down into daily and hourly bases in order to establish the facility requirements as shown in Fig. 9.2.3.1. The parameters and the coefficients are determined by taking the actual conditions in Pakistan into account and referring to technical criteria of ICAO, FAA and JCAB.

(1) Aircraft Classification

Taking into account the aircraft fleet of PIA at present and in the future, the aircraft expected to be operated in Pakistan in 1997-98 and 2005-06 are classified by types and sizes as follows:

Table 9.2.3.1 Aircraft Classification

Class	Seating 1997-98	Capacity 2005-06	Aircraft Type
B747 Class	400	450	B747-200,300,400
Wide I	270	300	A300
Wide II	210	210	B767, A310
Narrow Body Jet Class	135	150	B737, B707
F27 Class*	40	50	F27
DHC-6 Class*	20	20	DHC-6

* Only for domestic route

Source: JICA Study Team

(2) Domestic Aircraft Mix

The selection of aircraft types by route was made mainly based on the above aircraft classification and the economic consideration. The criteria on aircraft assignment for domestic routes are assumed by annual passenger volume by route as shown below:

Table 9.2.3.2 Operating Aircraft Assignment for Domestic Flight Operation

Annual Passengers in One way	Aircraft	Seating	Capacity
		1997-98	2005-06
650 to 1,500	DHC-6 Class	20	20
1,500 to 80,000	F27 Class	40	50
80,000 to 150,000	Narrow Body Jet Class	135	150
150,000 to 400,000	Wide II	210	210
400,000 to 600,000	Wide I	270	300
Above 600,000	B747 Class	400	450

Source: JICA Study Team

(3) Operating Aircraft for International Routes

The assumptions of aircraft mix for international flight in 2005-06 was made as shown in Table 9.2.3.4 based on the present traffic pattern at Karachi Airport and the fleet requirements up to year 2006 by PIA. In the future, the size of aircraft tends to become large, particularly for Europe and Far East routes.

Besides, the aircraft mix in 1992-93 depending on the present pattern at Karachi is shown in Table 9.2.3.3.

Figure 9.2.3.1 Flow Chart for Air Traffic Analysis

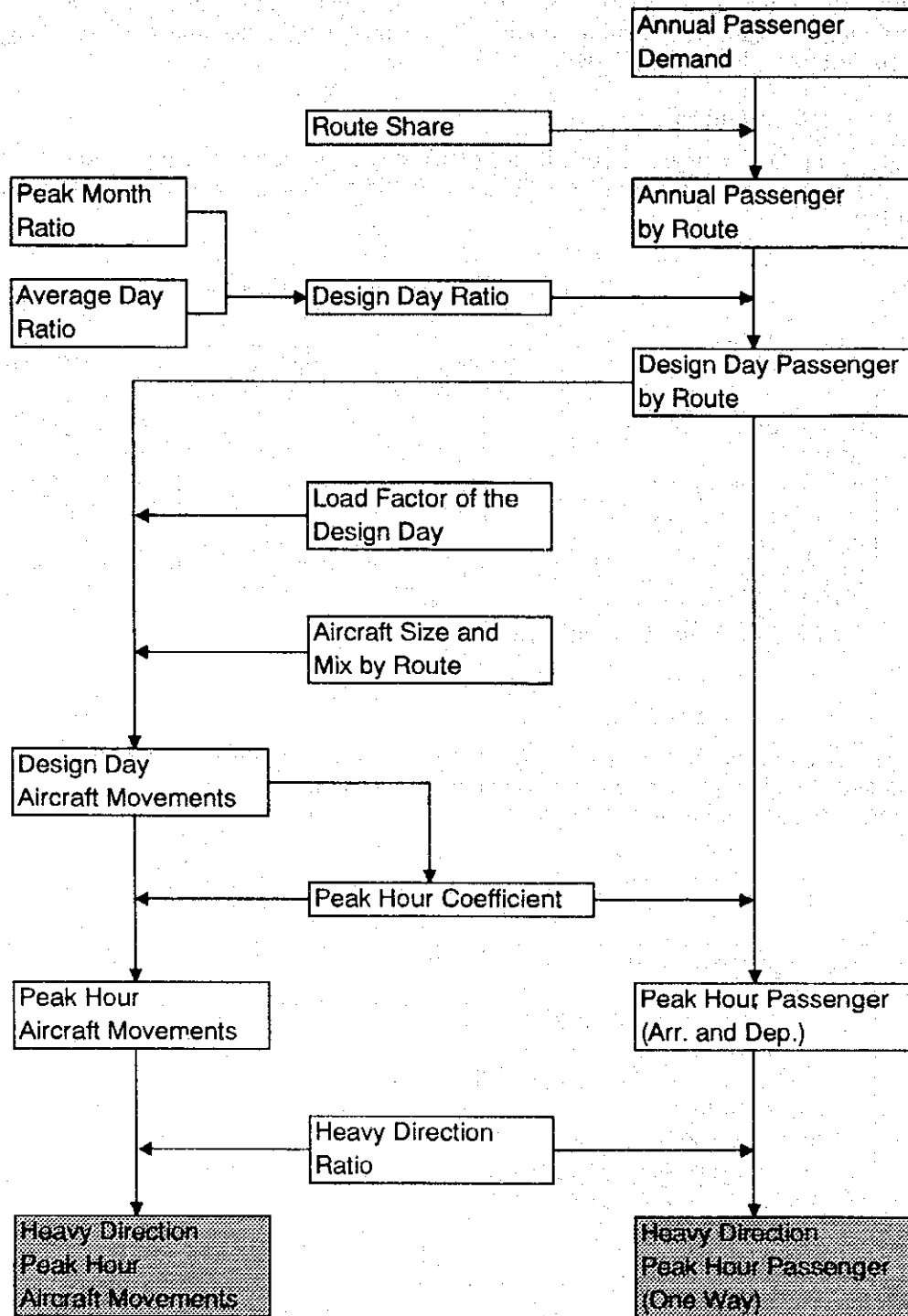


Table 9.2.3.3 Aircraft Mix for International Flights in 1992-93

Route	B747 Class	Wide I Class	Wide II Class	Narrow Body Jet Class
Middle East and Africa	25%	50%	20%	5%
Europe	65	10	20	5
Far East	30	30	40	-
Regional	5	60	15	20

Source: JICA Study Team

Table 9.2.3.4 Aircraft Mix for International Flight in 2005-06

Route	B747 Class	Wide I Class	Wide II Class	Narrow Body Jet Class
Middle East and Africa	30%	55%	10%	5%
Europe	65	15	20	-
Far East	35	35	30	-
Regional	10	65	20	10

Source: JICA Study Team

(4) Design Day Coefficient

The design day coefficient is established as shown in Table 9.2.3.5. This value is set up by the ratio of the average daily passengers in the second peak month to the annual air passengers traffic in Pakistan.

Table 9.2.3.5 Design Day Coefficient

Route	Domestic	International
Design Day Coefficient	1/320	1/300

Source: JICA Study Team

(5) Peak Hour Coefficient

The peak hour coefficient for planning is designated in ICAO and FAA standards as follows:

FAA: A graph is indicated to relate peak hour coefficient to annual enplaned passengers. (Advisory Circular AC 15/5360-7, FAA)

ICAO: Typical peak hour is defined as the 30th or 40th busy hour for the year. (Airport Planning Manual, Part 1)

The formula designated in the JCAB standard is a type similar to the formula in the FAA standard, using the peak day aircraft movements instead of annual passengers. The coefficient of the formula used the constant value based on the study on past records in Japan.

For this study, the peak hour coefficient is calculated based on the actual flight schedule in Pakistan, and summarized as follows:

Domestic: $P = 1.6372/A + 0.1257$

International: $P = 0.4908/A + 0.1538$

Where, P: Peak hour coefficient
 A: Peak day aircraft movements by airport.

(6) Load Factor on Design Day

Load factor on design day is assumed as shown in Table 9.2.3.6, considering general standard values used in airport planning and present situation in Pakistan.

Table 9.2.3.6 Load Factor

	Domestic	International
Load Factor	70%	70%

Source: JICA Study Team

(7) Design Day Aircraft Movement by Route

Design day aircraft movements by route is calculated by using the following formula:

Design day aircraft movements by route:

$$= \frac{\text{Annual passengers by route} \times \text{Design day coefficient}}{\text{Aircraft seating capacity} \times \text{Design load factor}}$$

(8) Peak Hour Aircraft Movement and Passengers

Peak hour aircraft movements and passengers are calculated using the following formula:

Peak hour aircraft movements

$$= \text{Design day aircraft movements} \times \text{peak hour coefficient}$$

Peak hour passengers

$$= \text{Annual passengers} \times \text{peak day coefficient} \\ \times \text{peak hour coefficient}$$

(9) Summary Forecast

Air traffic volume in 1997-98 and 2005-06 are calculated based on the procedure indicated in Fig.9.2.3.1. The passenger and cargo traffic volume and aircraft movements necessary to formulate facility requirements are summarized in Appendix 9.2.6 through 9.2.9.

9.2.4 Facility Requirements

The facility requirements are estimated basically in compliance with the relevant standards and the recommended practices of ICAO. Those of FAA, JCAB and IATA are also referred to where the ICAO criteria does not cover or more practical planning is possible.

(1) Runway

1) Aerodrome Reference Code

The aerodrome reference code, i.e., code number and letter is applied as shown in Table 9.2.4.1, in accordance with the largest aircraft anticipated to serve the airport.

Table 9.2.4.1 Aerodrome Reference Code

Code Number	Field Length (m)	Code Letter	Aircraft	Wing Span (m)
1	800	A		up to 15
2	800 to 1200	B	DHC-6	19.81
3	1200 to 1800	C	B-737, F-27	28.90, 29.00
4	1800 and over	D	A-300, A-310, B-707	44.84, 43.90, 44.42
		E	B-747	59.64

Source : ICAO Annex 14

2) Number of Runways

A single runway with proper exit taxiways under IFR conditions can handle 50 to 59 aircraft operations per hour according to the FAA.

3) Runway Length and Width

The runway length at each airport is estimated according to the requirement by maximum operating aircraft.

- The major airports which will handle B-747 and Airbus in the future are checked for the possibility of take-off and landing under the conditions of maximum pay load, airport altitude and temperature, utilizing the ICAO standard.
- An airport where B737 is expected to operate needs a runway length of 2,286 m (7,500 ft). Therefore, the runway is requested to be extended at the airports, where existing runway length is less than 2,286 m.
- The local airports where F-27 class aircraft will be introduced in the future, will require a runway of 1,829m (6,000 ft) according to the CAA criteria.

The required length and width of the runway are indicated in Table 9.2.4.2.

Table 9.2.4.2 Required Runway Length and Width

Aircraft		B-747	A-300,310	B-737	F-27	Twin Otter
Runway Length	(ft)	9,000~11,000	7,000~9,000	7,500	6,000	3,000
	(m)	2,743~3,353	2,133~2,743	2,286	1,829	914
Runway Width	(m)	46	46	30	30	23
Runway Shoulder	(m)	7.6	7.6	3.8	3.8	—

Source : Civil Aviation Authority

4) Runway Strip

A runway strip should be extended before the threshold and end of the runway for a distance of at least 60m where the aerodrome code number is 2, 3 and 4. The required widths of the runway strip are indicated in Table 9.2.4.3.

Table 9.2.4.3 Required Width of the Runway Strip

Code Number	Precision R/W	Non-precision R/W	Non-Instrument R/W
1	60 m	150 m	150 m
2	80 m	150 m	150 m
3	150 m	300 m	300 m
4	150 m	300 m	300 m

Source: ICAO Annex 14

(2) Taxiway and Apron

1) Taxiway System

A full parallel taxiway with right angle exits is economically justified where the number of instrument approaches exceeds four during the normal peak hour.

2) Taxiway Width

The width of the taxiway is indicated in Table 9.2.4.4.

Table 9.2.4.4 Required Taxiway Width

Code Letter	Aircraft	Taxiway Width
A		7.5 m
B	DHC-6	10.5 m
C	B-737, F-27	15.0 m
D	A-300, A-310, B-707	23.0 m
E	B-747	23.0 m

Source: ICAO Annex 14

(3) Aprons

1) Calculation Method for Required Number of Aircraft Stands

The following formula is used to obtain the required number of aircraft stands for the target year.

$$S = \{T_i / 60 \times N_i / 2 \times a\} + b$$

- Where,
- S: Required number of aircraft stands,
 - T_i: Gate occupancy time in minutes,
 - N_i: Number of movements of aircraft during the peak hour,
 - a: Allowance for special occasions (20%)
 - b: Extra stands for special occasions,
(1 extra for every 10 stands)

2) Gate Occupancy Time

The gate occupancy time for each category is assumed as tabulated in Table 9.2.4.5, with a margin for delay considering the current condition.

Table 9.2.4.5 Gate Occupancy Time

(Unit: minutes)

Flight or Airport		Occupancy Time	
		B-747 & Wide I	Others
Domestic	Primary airports	80	55
	Others	70	45
Int'l	PIA	130	70
	Foreign carrier		70

Notes: Primary airports; Karachi, Islamabad, Lahore, Peshawar, Quetta and Gwadar

3) Night Stay Apron

The number of night stay aircraft stands is calculated using the following formula:

$$N = A \times a$$

where ;
 N: Number of night stay stands
 A: Number of aircraft movements of the design day
 a: Night stay ratio (0.20)

Passenger loading spots will be used for the night stay purpose, and the combined use ratio of passenger loading and night stay spot is adopted as 1/2~2/3 based on JCAB standard.

4) Apron Space

The apron space is established according to the aircraft classification, and the added the required width of B747, Wide I, Wide II under self-maneuvering.

Table 9.2.4.6 Parking Space Requirement

	Width (m)	
	Nose-in / Push-out	Self - Maneuvering
B747-400 Class	75	-
B747 Class	70	-
Wide I, Wide II	60	95
Narrow Body Jet Class	45	60
F27 Class, DHC-6 Class	-	50

Note: Each figure includes the clearance between aircrafts.

(3) Passenger and Cargo Terminal Buildings

1) Passenger Terminal Building

The floor area required for the passenger terminal building is estimated by using the following formula:

$$RTA = UA \times PAX$$

where,
 RTA: Required floor area (sq.m)
 UA: Unit floor area required per peak hour passenger
 PAX: Number of peak hour passengers (2-ways)

The unit floor area per peak hour passenger of 10 to 15 sq.m was adopted for the domestic area and 20 to 35 sq.m for the international area in Japan and other countries. For the new terminal building of Karachi, the unit floor areas of 14 sq.m and 25 sq.m are adopted for the domestic and international terminals, respectively.

The unit floor area of 15 sq.m for major domestic airports and 10 sq.m for other small sized airports are adopted, respectively. And unit floor area of 25 sq.m is adopted for international terminals. In addition to the above space requirements, a space of 10 sq.m is required for international transit passengers at the Karachi airport, considering the number of transit passengers.

2) Cargo Terminal Building

The floor area required for the cargo terminal building is estimated based on the annual cargo volume and unit cargo handling capacity. For the calculation, the floor area of the cargo terminal building in Japan is applied, i.e., the unit capacity of 6 ton/sq.m for international and 15 ton/sq.m for domestic.

The required cargo handling space is calculated by multiplying annual cargo handling volume per unit floor area by the projected cargo volume.

(4) Car Park

The following formula is used to calculate the required car parking spaces:

$$\text{LOT} = \text{PAX} \times \text{PR}$$

Where, LOT: Required number of car parking spaces
 PAX: Number of peak hour passengers (2-way)
 PR: Number of parking lots per peak hour passenger
 (0.8 : Japanese and FAA standard)

The required total car park area is calculated by applying a unit space of 35sq.m for a parking lot which includes internal roads and a green zone in addition to net parking lots.

(5) Air Navigation Systems

Air navigation systems consisting of the following should be planned to satisfy the requirements of aircraft operation and air traffic control.

- Radio Navigation Aids
- Air Traffic Control System
- Aeronautical Telecommunication System
- Airfield Lighting System
- Meteorological Observation System

Air navigation systems have been planned in this study for air routes and airports in compliance with the international standards, i.e., Standards and Recommended Practices of ICAO. However, where detailed planning practices are not indicated in the ICAO Standards, the JCAB criteria will apply as for the supplement. The basic planning criteria for major navigation equipment are as follows:

1) Radio Navigation Aids

The following provision for radio navigation facilities is required:

- ILS or MLS
- VOR/DME
- NDB

Middle Marker and Outer Marker beacons should be provided for the ILS. In case where the provision of marker beacon is impracticable, alternative DME should be provided.

According to the report of ICAO Communications / Operations Divisional Meeting in 1985, MLS will be an ICAO primary system after 1998, and ILS services will be continued only on the basis of regional agreement to meet national requirements as an option.

MLS will be the sole ICAO standard approach and landing guidance system from 2000 onward. By the year 2000, the ILS will be withdrawn as an ICAO requirement. However, the ICAO transition plan states that the implementation schedule will be deferred due to a delay in the development of the operation program and airborne equipment.

a. ILS Category-I

The installation of navigational aids and lighting equipment enables Category-I Operation to be justified at an airport where turbo jet aircraft are operated on scheduled basis.

b. ILS Category-II

The installation of Category-II equipment is justified at a highly congested international airport because such installation could result in, to a great extent, the economic benefit and the contribution to higher safe aircraft operation.

c. VOR/DME

The installation of VOR/DME is justified at an airport where scheduled flights are intended to operate. NDB is also applicable instead of the VOR/DME under conditions that the annual aircraft movements would not exceed 3,000 operations and interception to the airport of destination could be safely made by an adjacent VOR/DME or VORTAC located within 40 NM radius from the airport.

2) Air Traffic Control System

The radar approach control is justified when annual aircraft operations exceed 10,000 movements under instrument flight rules (IFR). The system consists of terminal ASR/SSR and associated control consoles.

3) Aeronautical Telecommunication System

VHF radio having a range of more than 30 NM coverage should be provided to enable air-to-ground communication. VHF/UHF radio for surface movement control and ATIS (Automatic terminal information service) broadcast are also required. Direct speech communication circuits should be established between the control tower and rescue and emergency authority.

4) Airfield Lighting System

The airfield lighting system required for the non-precision and precision approach runways are shown in Table 9.2.4.7.

Table 9.2.4.7 Required Airfield Lighting System

Airfield Lighting System		Non-precision	Precision Category I	Precision Category II
Standard Approach Lighting System	(ALS)		ILS Cat-I	ILS Cat-II
Simple Approach Lighting System	(SALS)	X		
Precision Approach Path Indicator	(PAPI)	X	X	X
Runway Edge Lights	(REDL)	X	X	X
Runway Threshold Lights	(RTHL)	X	X	X
Runway End Lights	(RENL)		X	X
Runway Center Line Lights	(RCLL)			X
Runway Touch Down Zone Lights	(RTZL)			X
Taxiway Edge Lights	(TEDL)		X	X
Taxiway Center Line Lights	(TCLL)			X

Source : ICAO Annex 14

5) Meteorological Observation System

The automatic meteorological observation system which collects and indicates airport meteorological conditions automatically should be provided. Required terms of observation are as follows:

- Surface wind
- Horizontal visibility
- Runway visual range
- Cloud amount, type and height of base
- Air temperature and dew point temperature
- Atmospheric pressure values (QNH/QFE)
- Rain fall

The runway visual range should be provided for the precision approach runway.

(6) Rescue and Fire Fighting Service

The facility requirements for the rescue and fire fighting services are estimated in compliance with the ICAO recommendations. The requirements for the corresponding levels of protection are shown in Table 9.2.4.8.

Table 9.2.4.8 Requirements of Rescue and Fire Fighting Services

Item	F-27 class Category-4	B-737 class Category-6	B-707 class Category-7	A-300 class Category-8	B-747 class Category-9
Principal Extinguishing Agent					
- Performance level	B	B	B	B	B
- Water (L)	2,400	7,900	12,100	18,200	24,300
- Discharge Rate (L/min) *	1,800	3,000	5,300	7,200	9,000
Complementary Agent					
- Dry Chemical Powder (kg) or Halon (kg)	135	225	225	450	450
- or CO2	270	450	450	900	900
Vehicles					
- Minimum Number of Vehicles	1	2	2	3	3
Fire Station					
- Floor Area (m2)	300	350	350	450	450

Note (*): 50% of this discharge rate should be attained by the RIV.

Source : ICAO Annex 14

The location of the fire station should be planned to achieve a response time not exceeding three minutes to the end of the runway as well as any other part of the movement area. The ICAO's recommendation states that response time is considered to be the time when the first responding vehicle is in a position to apply foam at a rate of at least 50% of the discharge rate specified in the above table.

(7) Summary of Facility Requirements

The facility requirements for each airport in 1997-98 and 2005-06 are summarized as shown in Appendix 9.2.10 through Appendix 9.2.14.

9.2.5 Fleet Plan

The future fleet plan of PIA is estimated and tabulated in Table 9.2.5.1, based on the forecasted aircraft movements by route and projection of PIA fleet plan in the Eighth Five Year Plan. The aircraft category and the typical aircraft types of each category used in the future plan are summarized as follows:

- B747 class (B747-200,300,400 etc.)
- Wide Body I class (A300,MD-11 etc.)
- Wide Body II class (B767,A310 etc.)
- Narrow Body Jet class (B737,B707 etc.)
- New Turbo Prop class (F27 etc.)
- Twin Otter class (DHC6 etc.)

The total number of aircraft to be purchased is estimated as shown in Table 9.2.5.1.

Table 9.2.5.1 Fleet Plan

Aircraft	Required in 2005-06 (1)	Existing 1992-93 (2)	Replaced by 2005-06 (3) = (2) ÷ 2	Aircraft Purchase (4) = (1) - (2) + (3)
1. B747 class	14	8	4	10
2. Wide Body I	20	11	6	15
3. Wide Body II	11	4	2	9
4. Narrow Body Jet	8	8	4	4
5. New Turbo Prop	23	14	7	16
6. Twin Otter	1	3	2	-
Total	77	48	25	54

9.2.6 Basic Concept for Master Plan

(1) General

On the basis of future traffic demand and other information about the existing facilities conditions, the Master Plan for the air transport sector is proposed in order to meet the future traffic demand and secure the safe operation at each airport. The Master Plan is formulated the following basic policy:

(2) Basic Concept for Airport Facilities

Basic development plans for airport facilities are outlined as follows:

- The Islamabad and Lahore airports should be immediately developed as the capital airport and the international airport in Pakistan, responding to the traffic demand. The Karachi airport should be improved as the hub airport in Pakistan.
- In order to meet the increasing traffic volume and introduction of larger aircrafts, airport facilities such as runway, taxiway, apron, building and car park should be improved or expanded at each airport. Also the maintenance of runway, taxiways and aprons including periodical overlays are essential to keep the safe aircraft movements from an engineering point of view.
- The construction of feeder airports which has low traffic demand may be justified as being feasible from the view-point of being the main transportation to the residents.

And they shall be planned to accommodate F-27 Class in the near future.

(3) Basic Concept for Air Navigation Systems

Basically air navigation systems are required to be newly planned and/or upgraded to meet the aircraft requirements in correspondence with increased air traffic demand and introduction of newly developed larger aircraft, taking into consideration internationally acknowledged standard levels and the future of nav aids development.

Basic considerations for air navigation systems are outlined as follows:

- Precision Approach Category-I is proposed for the major airports.
- Precision Approach Category-I will be upgraded to Category-II in the major airports.
- Non precision IFR approach (VOR/DME or NDB) is proposed for the minor airports where the forecast does not allow turbo jet operations.

(4) Others

- Expansion of the route network and increment of the traffic capacity of airlines.
- Promotion of tourism.

9.2.7 Development Plan

(1) General

The airport development plan is established, applying the basic concept of the Master Plan. The airport development is planned in phases to meet the future air traffic demand so as to minimize the project cost to effectively overcome the attributed problems.

(2) Projects and Cost Estimation

The candidate projects and their costs are summarized in Table 9.2.7.1.

Table 9.2.7.1 Project and Cost Estimation for Airport Development

Project Name.	Outline	Cost (Rs. Million)
A. Airport Development Project		
Public Sector		9,046
1. Islamabad Airport Project	- Construction of a new airport	3,969
2. Lahore Airport Project	- Construction of a new terminal building	3,200
3. Feeder Airport Projects	- Construction of new feeder service airports	610
4. Alternate Airport Project, Sukkur Airport	- Widening of the runway, Construction of a taxiway and terminal facilities	222
5. Air Navigation System for New Islamabad Airport	- ILS Cat-II, Lighting Cat-II, RVR, TWL, etc.	531
6. Air Navigation system for Sukkur Airports	- Alternate Airport Project	178
7. Air Navigation system for Feeder Airports	- Construction of new feeder service airports	336
Corporate Sector		7,302
1. Karachi Airport Project	- Extension of the secondary runway and taxiway	1,796
	- Overlays of the Main runway	353
	- Remaining Works of Jinnah Terminal Complex	150
	- Expansion of terminal building, car park and cargo building	514
		779
2. Islamabad Airport Project	- Rehabilitation and extension of runway	196
3. Lahore Airport Project	- Construction of Departure Lounge, etc.	72

Table 9.2.7.1 (Continuation)

Project Name	Outline	Cost (Rs. Million)
4. Improvement of Existing Facilities	- Improvement and expansion of the runways, taxiways, aprons, car park and terminal buildings at other airports	2,667
5. Air Navigation System for Karachi Airport	- ILS Cat-II, ALS Cat-II, SALS, PAPI, etc. for the secondary runway	208
6. Aeronautical Communication and Control Project	- Remaining works on the on-going project	336
7. Air Navigation system for Other Airports	- Development of air navigation systems in other airports	1,400
8. On-going Other Projects		207
9. Rescue and Fire Fighting Service	- Procurement of Crash fire and Rescue vehicles	420
Total of Airport		<u>16,348</u>
<u>B. Aviation Development Project</u>		
1. Purchase & Replacement of Aircraft		88,433
	B747 class : 10	
	Wide Body I class : 15	
	Wide Body II class : 9	
	Narrow Body class : 4	
	New Turbo Prop class : 16	
2. Development of infrastructure	Construction/Development of workshops, hangars and cargo complexes etc.	2,500
Total Aviation		<u>90,933</u>

Source : JICA Study Team

9.3 The Eighth Five Year Plan

9.3.1 Basic Policies/Strategies for the Eighth Five Year Plan

Based on Master Plan discussed in " 9.2 MASTER PLAN", the following policy and strategy is selected and proposed to be implemented during the Eighth Five Year Plan period (1993-94 - 1997-98).

(1) Policy and Strategy

1) Major Airports

- The major airports of Karachi, Islamabad and Lahore play the important roles in air transport in Pakistan, therefore the improvement and development projects for these airports should be given top priority.

2) Other Airports

- Other airports should be improved according to the increase in traffic demand. Particularly, the Quetta and Peshawar international airports have been forecasted to have a large increase in demand; therefore, the improvement and expansion projects for existing facilities are quite important.

3) Air Navigation Systems

- The implementation of the Aeronautical Communication and Control (AC&C) Project will bring in safer traffic operation in the air transport system in Pakistan; therefore AC&C project should be given top priority.
- Air navigation systems, which are indispensable for safety and efficiency of air transport, are requested to be upgraded in compliance with the recommendations of ICAO.

4) Air Transport Industry

- Purchase of aircrafts based on future traffic projection.
- In order to generate competition in air transport industry, it is requested to encourage the privatization and private participation.

5) Others

- The on-going projects in the Seventh Five Year Plan need to be completed in the Eighth Five Year Plan period.

9.3.2 Candidate Projects

(1) Selection of Airport Projects

The selection of airport projects for the Eighth Five Year Plan are as follows:

1) Karachi International Airport

a. Runway and Taxiway

In case the present main runway is not usable, aircrafts have to divert to the nearest alternate airport. The main runway could be closed for maintenance or repair. In fact, current condition is that pavement of main runway has a regular pattern of cracks and is

heavily marked with rubber. Therefore, the main runway needs asphalt-overlay.

Overlay of the main runway can be only possible by either partial closure of the runway operation or reconstruction of the secondary runway. The construction of the secondary runway, 3,400 m in length, shall be recommended, since the closure of the main runway has a significant impact to the airport traffic.

b. Terminal Facilities

The Jinnah Terminal Complex was inaugurated in August, 1992. The following parts from the original plan were not be undertaken due to budgetary constraints.

- 4 additional passenger boarding bridges
- Moving Walkways
- 400 Hz Auxiliary Power Supply System

2) Islamabad International Airport

The construction of the domestic departure lounge were completed in February, 1994 and the extension of the runway to the length of 3,350m is scheduled to be completed by the end of 1994.

The New Islamabad Airport was envisaged by CAA in its Sixth Five Year Plan; however, due to CAA's financial constraints, the project could not be implemented. Since the present airport facilities are inadequate to meet the present and expected future growth of passenger traffic, it was directed that the project be implemented on BOT basis. If the project can not be implemented on BOT basis, it will be planned during the Ninth Five Year Plan period in order to lighten the burden imposed on the budget in the Eighth Plan.

3) Lahore International Airport

A new concrete runway, capable of handling wide-body aircraft was completed; however, the existing terminal building is quite old and congested. And there is a space limitation for the expansion. It is necessary to relocate the terminal area for functional efficiency and future expansion. Construction of the new terminal is planned during the Eighth Five Year Plan period in order to solve the present problems.

4) Other Airports

a. Runway and Taxiway

The runway of the Multan airport needs to be widened in order to cope with A300 aircraft operation. And also the runways of Gwadar, Turbat, Moenjodaro, Bahawalpur, Bhagtanwala, D.I Khan and Gilgit airports need to be extended to accommodate jet aircraft operation.

b. Terminal Facilities

In other airports, it is necessary to expand the terminal facilities such as aprons, car parks and passenger terminal buildings to cope with the future demands.

5) Alternate Airport to Karachi

The Sukkur airport was decided as an alternate airport to the Karachi international airport by CAA. Therefore, the runway should be widened to accommodate B-747 aircraft operation and also there is a need to extend the terminal facilities for diverted aircrafts and passengers.

6) Air Navigation System for Karachi Airport

The existing secondary runway has practically no visual aids and no lighting system. Hence a complete new visual aids system in compliance with the recommendations of ICAO is required to upgrade this runway.

7) Air Navigation System for Other Airports

The air navigation systems, which are expected to be installed to secure air safety, are shown in Appendix 9.2.14.

8) On-Going Project

The on-going projects from the Seventh Five Year Plan are itemized in Table 9.3.3.1. These on-going projects are listed based on "Annual Development Programme for 1994-95" by CAA. They should be completed by 1997-98, the end of the Eighth Five Year Plan period.

(2) Aircraft Fleet Plan

The aircraft fleet plan of PIA for the Eighth Five Year Plan is estimated based on the required capacity calculated from the traffic demand. Aircrafts which are expected to be introduced during the Eighth Five Year Plan period are as follows:

Wide Body Class (A-300)	:	1
Airbus A310-300	:	7
Boeing 737-300	:	2
New Turbo Prop (Replacement of F-27)	:	3

9.3.3 Project Cost Estimation

(1) Airport Project

The cost of the airport projects selected is estimated as shown in Table 9.3.3.1.

Table 9.3.3.1 Airport Project Cost for Eighth Five Year Plan

Project Name	Outline	Cost (Rs. Million)
Public Sector		
1. Lahore Airport	Construction of a New Terminal Complex	3,200
2. Alternate Airport to Karachi, Sukkur airport	Development of the airport as the alternate to Karachi airport	222
3. Feeder Airport		320
Mansehra	A new airport	127
D.G Khan	A new airport	193
4. Air Navigation Systems for Sukkur Airports	Development of air navigation systems for other airports	198
5. Air Navigation Systems for Feeder Airports	Development of air navigation systems for other airports	168
Sub Total		4,108

Table 9.3.3.1 Airport Project Cost for Eighth Five Year Plan

Project Name	Outline	Cost (Rs. Million)
Corporate Sector		
1. Karachi Airport		<u>1,017</u>
	- Extension of the secondary runway	353
	- Overlay of the main runway	150
	- Construction of terminal facilities	514
	4 additional passenger boarding bridges and moving walkways	
	400 Hz Auxiliary Power Supply System	
2. Islamabad Airport	Rehabilitation and Extension of the Runway	196
3. Lahore Airport		<u>72</u>
	- Construction of the Departure Lounge	50
	- Rehabilitation of Apron and Taxiway	20
	- Improvement of the Car Parks	2
4. Other Airports		<u>1,900</u>
Moenjodaro	Extension of the runway for B-737 operation	272
Multan	Widening of the runway for A-300 operation	338
Bahawalpur	Extension and Widening of the runway	
	Extension of apron, P.T.B and car park	80
D.I Khan	Extension and Widening of the runway	
	Extension of apron, P.T.B and car park	268
Gilgit	Extension of the runway for B-737 operation	246
Quetta	Extension of the apron, P.T.B and car parks	86
Gwadar	Extension and Widening of the runway	
	Extension of the apron, P.T.B and car parks	140
Pasni	Extension of the apron, P.T.B and car parks	13
Turbat	Extension of the RWY, apron, P.T.B and C/P	69
Zhob	Overlay of the runway and related works	22
Faisalabad	Extension of the apron, P.T.B and car parks	19
R.Y Khan	Extension of the RWY, apron, P.T.B and C/P	55
Bhagtanwala	Extension of the RWY, apron, P.T.B and C/P	83
Walton	Extension of the apron, P.T.B and car parks	18
Peshawar	Extension of the apron, P.T.B and car parks	146
Chitral	Overlay of the runway	27
Skardu	Extension of the apron, P.T.B and car parks	18
5. Aeronautical Communication and Control Project (AC&C)	Remaining works of the on-going project	336
6. Air Navigation Systems for Karachi Secondary Runway	ALS (Cat II), SALS, PAPI, RCLL etc.	138
7. Air Navigation Systems for Other Airports	Development of air navigation systems for other airports	585
8. Rescue and Fire Fighting Service	Procurement of crash fire and rescue vehicles	274

Table 9.3.3.1 Airport Project Cost for Eighth Five Year Plan

Project Name	Outline	Cost (Rs. Million)
9. Other On-going projects		<u>207</u>
Islamabad	- Repair of the main runway	19
	- Construction of domestic departure lounge	23
	- Improvement of the drainage system	8
Lahore	- Improvement of riding quality of the RWY	40
Sukkur	- Overlay on runway for B737 operation	42
	- Construction of P.T.B and related facilities	68
Quetta	- Rectification of the Apron Flood Lights	7
Sub Total		<u>4,725</u>
Total (Airport Project)		<u>8,833</u>

Source: JICA Study Team; Annual Development Programme for 1994-95, CAA

(2) Aviation Project

The costs for aircraft and other facilities are estimated in Table 9.3.3.2.

Table 9.3.3.2 Cost of Aviation Project in the Eighth Five Year Plan

Item	Outline	Cost (Rs. Million)
1. Purchase of Aircraft	1 - Wide Body Class (A-300)	2,400
	7 - Airbus A310-300	14,700
	2 - Boeing 737-30	2,100
	3 - New Turbo Prop	1,107
	Total	20,307
2. Replacement of Aircraft		8,400
3. Development of Infrastructure	Construction/Development of workshops, hangars and cargo complexes etc.	1,020
Total Aviation		29,727

Source: JICA Study Team

(3) Priority and Investment Schedule

The priority and investment schedule for the Eighth Five Year Plan for airport and aviation project are shown in Table 9.3.3.3 and Table 9.3.3.4 respectively, based on the considerations described in "9.3.1 Basic Policy/Strategy for the Eighth Five Year Plan".

Table 9.3.3.3 Priority and Investment Schedule for the Airport Projects (Unit : Rs. Million)

Project Name	Estimated Cost	Yearly Allocation					Total 1993-98	Beyond 1997-98	Ranking
		1993-94	1994-95	1995-96	1996-97	1997-98			
Public Sector									
1. Lahore Airport Construction of New P.T.B	3,200		800	800	800	800	3,200		A
2. Alternate Airport to Karachi	222				222		222		A
3. New Feeder Airports Mansehra	127		127				127		C
D.G Khan	193		193				193		C
4. Air Navigation System for Alternate Airport	198					198	198		A
5. Air Navigation Systems for Feeder Airports	168		168				168		C
Sub Total	4,108		1,288	800	1,022	998	4,108		
Corporate Sector									
1. Karachi Airport Secondary runway	353		200	153			353		A
Main runway	150				150		150		A
Jinnah terminal complex	514	155	84	140	135		514		A
2. Islamabad Airport Rehabilitation and Extention of RWY	196	54	100	42			196		A
3. Lahore Airport Construction of Departure Lounge	50	50					50		A
Rehabilitation of A/P & TWY	20	20					20		A
Improvement of Car Parks	2	2					2		A
4. Other Airports Moenjodaro	272		60	100	112		272		C
Multan	338				169	169	338		B
Bahawalpur	80					80	80		C
D.I Khan	268		50	218			268		C
Gilgit	246		50	196			246		C
Quetta	86					86	86		B
Gwadar	140					140	140		B
Pasni	13					13	13		C

Table 9.3.3.3 Priority and Investment Schedule for Airport Projects (Unit : Rs. Million)

Project Name	Estimated Cost	Yearly Allocation					Total 1993-98	Beyond 1997-98	Ranking
		1993-94	1994-95	1995-96	1996-97	1997-98			
Turbat	69					69	69		B
Zhob	22					22	22		C
Faisalabad	19					19	19		B
R.Y Khan	55					55	55		C
Bhagtanwala	83	20	15	48			83		C
Walton	18					18	18		C
Peshawar	146				146		146		B
Chitral	27					27	27		C
Skardu	18					18	18		C
5. AC&C Project	336	200	136				336		A
6. Air Navigation System for Karachi Secondary RWY	138		70	68			138		A
7. Air Navigation Systems for Other Airports	585	120	120	120	120	105	585		A
8. Rescue and Fire Fighting	420		90	90	94		274	146	A
9. Other On-going Projects	207	100	107				207		A
Sub Total	4,871	721	1,082	1,175	926	821	4,725		
Total	8,979	721	2,370	1,975	1,948	1,819	8,833	146	

Note: A: top priority (urgently)
B: second priority (soon)
C: third priority (desirable)

Source: JICA Study Team

Table 9.3.3.4 Priority and Investment Schedule for Aviation (Unit : Rs. Million)

Project Name	Estimated Cost	Yearly Allocation					Total 1993-98	Beyond 1997-98	Ranking
		1993-94	1994-95	1995-96	1996-97	1997-98			
1. Purchase of Aircraft									
1 - Wide Body Class	2,400				2,400		2,400		A
7 - Airbus A310-300	14,700	2,100	2,100	4,200	2,100	4,200	14,700		A
2 - Boeing 737-300	2,100		1,050		1,050		2,100		A
3 - New Turbo Prop	1,107		738	369			1,107		A
2. Replacement of Aircraft	8,400	1,680	1,680	1,680	1,680	1,680	8,400		B
3. Development of infrastructure	1,020	200	200	200	200	220	1,020		B
Total	29,727	3,980	5,768	6,449	7,430	6,100	29,727		

Note: A: top priority (urgently)
B: second priority (soon)
C: third priority (desirable)

Source: JICA Study Team

9.3.4 Preliminary Economic Evaluation of the Projects

(1) Methodology

In order to assess the viability of the proposed projects, a preliminary benefit/cost analysis was conducted.

The benefit attributable to the proposed projects can be estimated based on the assumption that if no investment is done in air transport to cope with the increasing air traffic demand that would increase and would shift to other means of transport incurring additional cost to that mode. For the purpose of preliminary economic evaluation, road transport (car) was selected as the alternative mode and the calculated benefits are:

- a. Time savings of air passengers who would have to shift to road transport.
- b. Vehicle operating cost on road incurred by air passengers who would have to shift to road transport.

Meanwhile, the cost of the proposed projects were classified as follows:

- a. Capital investment
 - Civil work
 - Navigational aid
 - Aircraft
- b. Maintenance and operation cost

The calculated economic benefits and costs were formed into a year-by-year stream by interpolation based on 1992-93, 1997-98 and 2005-06 calculated values. Then a benefit/cost ratio was calculated as well as an internal rate of return.

In addition, this evaluation focuses on domestic air transport, and does not include international air transport to both benefit and cost.

(2) Benefit

1) Time Savings

Time savings were estimated for the projected increase of air passengers according to the following assumptions/procedure:

Unit time value

Average monthly income of air passengers	: Rs. 30,000/month
Average working hours per month	: 160 Hours/month
Unit time value	: Rs. 187.5/hour

For the purpose of preliminary evaluation, 100% of this unit time value was taken and this value was assumed to be constant through out the evaluation period.

Projected increase of air traffic from 1992-93

	No. of Passengers (000)	Passenger-kms (million)
1997-98	1,807	1,171
2005-06	5,789	3,631

Time savings

Assumption	i) Speed	Air ---- 500 kph
		Road --- 30 kph
	ii) Terminal time of air passengers	--- 1 hour/passenger

<1997-98>

Road	$1,171,000,000/30$	= 39,033 (000 hours)
Air	$1,171,000,000/500 + 1,807,000$	= 4,149 (000 hours)

Savings		34,884 (000 hours)
		6,541 (Rs. million)

<2005-06>

Road	$3,631,000,000/30$	= 121,033 (000 hours)
Air	$3,631,000,000/500 + 5,789,000$	= 13,051 (000 hours)

Savings		107,982 (000 hours)
		20,247 (Rs. million)

2) Vehicle Operating Cost (VOC) Savings

VOC savings were calculated based on the following assumptions/procedure:

Economic VOC

Rs. 2,970.42/1000 kms - Car excluding passenger time cost
Speed : 30 kph
Road condition : "fair"
(For details, see Chapter 6.)

VOC savings

<1997-98>

$$1,171,000 \times 2,970.42 = 3,478 \text{ (Rs. million)}$$

<2005-06>

$$3,631,000 \times 2,970.42 = 10,786 \text{ (Rs. million)}$$

(3) Cost

The cost of the proposed air transport projects was at first estimated in market prices as shown in Table 9.3.4.1 and then converted to economic cost using the following conversion factors:

a. 0.8 for civil works

This is the same as road construction.

b. 0.9 for the rest

For aircraft acquisition, PIA usually pays Iqra and other surcharges of about 10%. Although tax/transfer portion is not clear for the rest, the same conversion factor was assumed.

In addition, the project life of civil work, navigational aid and aircraft was set at 40, 25 and 20 years, respectively.

(4) Benefit-Cost Analysis

Using the benefit and cost calculated above, a benefit-cost analysis was conducted.

Table 9.3.4.1 Financial Cost of Proposed Air Transport Projects

Year	Capital Cost				Maintenance/Operation Cost		
	Civil	Navigation	Airline	Total	Civil &	Airline	Total
	Work	System			Navigation		
1993-94	286	258	3,303	3,847	47	1,631	1,678
1994-95	1,449	479	4,787	6,715	93	3,262	3,355
1995-96	1,381	216	5,353	6,950	140	4,893	5,033
1996-97	1,287	185	6,167	7,639	186	6,524	6,710
1997-98	1,344	204	5,063	6,611	233	8,155	8,388
1998-99	630	200	6,570	7,400	262	9,995	10,257
1999-00	630	200	6,570	7,400	291	11,835	12,126
2000-01	630	200	6,570	7,400	320	13,674	13,994
2001-02	630	200	6,570	7,400	350	15,514	15,864
2002-03	630	200	6,570	7,400	379	17,354	17,733
2003-04	630	205	6,590	7,425	408	19,194	19,602
2004-05	630	205	6,590	7,425	437	21,033	21,470
2005-06	635	205	6,590	7,430	466	22,873	23,339

Firstly, all the projects proposed by the year 2005-06 were evaluated altogether as presented in Table 9.3.4.2. Benefit/cost ratio was calculated at 1.09, discounted at 12%/year and the internal rate of return was 16.9%/year.

Table 9.3.4.2 Economic Evaluation of Proposed Air Transport Projects upto the Year 2005-06

Year	(Rs. million)			
	Total Benefit	Discounted Benefit	Total Cost	Discounted Cost
1993-94	2,004	2,004	4,420	4,420
1994-95	4,008	3,579	8,056	7,193
1995-96	6,011	4,792	9,586	7,642
1996-97	8,015	5,705	11,479	8,171
1997-98	10,019	6,367	11,999	7,626
1998-99	12,642	7,173	14,126	8,015
1999-00	15,265	7,734	15,621	7,914
2000-01	17,888	8,092	17,115	7,742
2001-02	20,511	8,284	18,611	7,517
2002-03	23,134	8,342	20,106	7,251
2003-04	25,757	8,293	21,622	6,962
2004-05	28,380	8,159	23,116	6,645
2005-06	31,003	7,958	-29,099	-7,649
Total	204,637	86,481	146,758	79,628

Net Present Value : 6,853 (million Rs)

Benefit/cost ratio at a discount rate of 12%/year : 1.09

Internal rate of return : 21.8%/year

Secondly, the projects proposed for the 8th FYP period (upto the year 1997-98) were evaluated as presented in Table 9.3.4.3. Benefit/cost ratio was calculated at 1.11, discounted 12%/year and internal rate of return of 20.1%/year.

Table 9.3.4.3 Economic Evaluation of Proposed Air Transport Projects for the 8th FYP Period
(Rs. million)

Year	Total Benefit	Discounted Benefit	Total Cost	Discounted Cost
1993-94	2,004	2,004	4,420	4,420
1994-95	4,008	3,579	8,056	7,193
1995-96	6,011	4,792	9,586	7,642
1996-97	8,015	5,705	11,479	8,171
1997-98	10,019	6,367	-11,343	-7,209
Total	30,057	22,447	22,199	20,217

Net Present Value : 2,230 (million Rs)

Benefit/cost ratio at a discount rate of 12%/year : 1.11

Internal rate of return : 20.11%/year

(5) Summary

Judging from the above preliminary evaluation, the proposed projects were considered to be sound as a whole. If additional benefit is taken from the savings in road construction and the possible impact of airport construction on regional development, the economic viability of these projects will be further improved.

In the previous NTPS (1988, JICA), however, construction of local feeder airports may not be justified solely from the economic point of view. This must be discussed also from the political point of view and social equality between provinces/districts.

9.3.5 Viable Financial Plan and Arrangement

(1) Project Cost and Funding

The proposed project costs are summarized in Table 9.3.5.1, where the fund sources are classified as public sector, corporate sector and PIA, according to the classification in CAA's program. The public sector covers the projects as the infrastructure of the aviation system, and they are proposed to be constructed by the funds of the Federal Government. Cooperate sector means the CAA, and the projects are planned to be carried within the financial management of CAA.

The planned cost and realized expenditures during the 7th FYP and planned cost the 8th FYP are summarized in Table 9.3.5.1. Also this table shows the summary of costs recommended by the team for the 8th FYP (short term 1993/94~ 1997/98) and the Master Plan (medium term 1998/99~2005/06).

Table 9.3.5.1 The Project Cost(Rs. Million)

Sector	7th FYP		8th FYP		Master Plan	Total
	Plan	Expenditure	Plan	Proposed	Proposed	Proposed
Public Sector	-	59	-	4,108	4,938	9,046
Corporate Sector	4,243	6,670	4,406	4,725	2,577	7,302
PIA	952	10,642	1,300	29,727	61,206	90,933
Total	5,195	17,371	5,706	38,560	68,721	107,281

In the 7th FYP, the civil aviation system received no investment from public sector (federal, provincial and local). A small amount of Rs. 59 million (training and researches) was in the 7th FYP, but no allocation is given for public sector in the 8th FYP. Jinnah Terminal in Karachi Airport was completed in 1993 by CAA utilizing its own generated resource in which borrowings were guaranteed by Government of Pakistan. In the 8th FYP the Government maintains a policy not to invest directly to the civil aviation system. The Government policy is that CAA should mobilize funds from private sector or borrowings to complete development projects. This is a reason why no planned cost is found the public sector in the 8th FYP. There are investment plans of Rs. 4,406 by Corporate sector (CAA) in the 8th FYP. Those are projects to improve the existing facilities by financing by CAA's own manageable resources.

The realized cost of PIA at Rs. 10,642 in the 7th FYP was purchases of airplanes and facilities, these were managed by PIA. The 8th FYP supposed those funds used by PIA will be Rs. 1,300 with expectation that fleet may be increased by lease not by outright purchase.

(2) Proposed Plan

This study proposes a plan with the funding classification as in the Table 9.3.5.1, where the classification is done by :

1) Public sector

Since those are large scale and CAA's own generated funds will not offered to repay the cost. It is likely not produce lucrative profits if private funds participate in BOT or other ways. They are rather a kind of transport infrastructure, and are considered better to request public funds from the federal and provincial governments. If the public funds cannot cover the project cost, then associated funding with private sources should be explored, such as partial BOT, etc.

2) Corporate Sector

Based on the policy of self financing, a number of projects are listed to be subject of funding by CAA. The amount is Rs. 4,725 / 5 yers = Rs. 945 / yers for the short term (1993/94-1997/98) and Rs. 2,577 / 8 year = Rs. 322.1 / year for the medium term (1998/99-2005/06). The preliminary viability of CAA's funding is calculated in " (3) Viability of Self Financing by CAA " afterwards.

3) PIA

Costs are shown in the case of fleet purchase and facilities. If they are in the form of leasing the cost can be reduced. Those costing and leasing plans are left to the operators. They may change or decide afterward as years go in the future.

(3) Viability of Self Financing by CAA.

Projects are grouped into the short term (the 8th FYP) and the medium term (the 9th FYP plus 3 years), and examined whether the next surplus estimated to be generated can cover the project costs in those terms.

1) Conditions

- Borrowings for long term and short term can not be defined at the stage since they are different according to the sources private vs. public, domestic vs. international, years of repayment plan of execution, etc.
- The accumulated surplus in CAA by 1992/1993 at Rs. 2,807.2 is assumed not to be used up for the projects proposed. It should be decided by CAA's policy, but the point is that they were brought in the years up to 1992/93. A part of the accumulated surplus may be utilized for the projects proposed, but assumed not used and left for the decision of CAA.
- Depreciation allowance is also untouched since those are thought to be the fund for replacement of old facilities in this examination.
- Net surplus is assumed to grow at 10% per annum by reviewing the growth of income of CAA in the past in Appendix 9.1.12, shows the average annual increase of gross income was 15.7%.

2) Calculation

The calculation is in Table 9.3.5.2, where the investment is assumed at equal amount per year for the short term and for the medium term, respectively. The CAA's overall net surplus is assumed to increase 10% per annum.

and "Balance = Surplus - Investment" is shown in a column for the each year. The balances are negative in the beginning 5 years, then resulting in positive amount in the years after that. If those amounts in "balance" are shown by the present value at 1993/94, using a discount rate of 12%, accumulated balance for the years 1993/94 - 2005/06 becomes Rs. - 52.7 million. Although the balances total is negative, the amount is negligible and eventually "zero".

Table 9.3.5.2 Calculation of Viability of Self Financing by CAA (Rs. Million)

	Year	Investment Cost	Surplus net 10% p.a	Balance	Accumulated Balance	
0	8th FYP	1993-94	945.0	408.7	-536.3	-536.3
1		1994-95	945.0	449.6	-495.4	-442.3
2		1995-96	945.0	494.5	-450.5	-359.1
3		1996-97	945.0	544.0	-401.0	-285.4
4		1997-98	945.0	598.4	-346.6	-220.3
5	9th FYP	1998-99	322.1	658.2	336.1	190.7
6		1999-00	322.1	724.0	401.9	203.6
7		2000-01	322.1	796.4	474.3	214.6
8		2001-02	322.1	876.1	554.0	223.7
9		2002-03	322.1	963.7	641.6	231.4
10	Plus	2003-04	322.1	1,060.1	738.0	237.6
11		2004-05	322.1	1,166.1	844.0	242.6
12		2005-06	322.1	1,282.7	960.6	246.6
Total			7,301.8	10,122.4	2,720.6	-52.7

(4) Funding Plan

The funding plan in this study is proposed as in Table 9.3.5.1, where resources from the public sector (federal or provincial) are requested for those major projects. CAA seems to generate net surplus which in turn cover the cost of projects as listed in Table 9.3.5.2. PIA is expected they will manage the fund and secure the fleet by purchase and lease.

In the case of CAA, borrowings will be necessary to manage the cash flows year by year, but conditions can not be clarified at this stage. Also influential other factors are neglected at this stage of calculation. They should be examined in detail for each project. Although these matters need be refined, it is assessed the projects classified "corporate sector" are basically manageable by CAA's generated profits.