

4-3 Listing and Preliminary Evaluation of Each Project

Full Container Terminal

New Oil Berth at Karachi Port

Oil Berth at Qasim Port

Buoy Berth at Port Qasim

Fertilizer Terminal at Port Qasim

Wheat Terminal at Port Qasim

Mini-Port at Gwadar

1. Project Name: Full Container Terminal

2. Project Description

Container cargo volume for the year 1999/2000 is estimated at approx. 6.2 million tones, so a 6 -- berth container terminal will be necessary to handle this large volume.

Two of the berths shall be constructed under the urgent plan by the year 1987/1988, with a container cargo handling capacity of approx. 1.7 million tonnes.

This terminal will be constructed at Karachi Port and includes the following items:

- 1) 6 berths, each 300 m long and --12 m deep
- 2) Cargo Handling Equipment
- 3) Access Railway and Road

3. Timing of Implementation

3-1 Prospective commencement of Project . . . 1984

3-2 Prospective completion of Project 1987, 1999

4. Cost of Project

Initial Cost Urgent Plan (2-berths) Million Rs. 1,223
(FEC Million Rs. 751)
. Master Plan (6-berths) Million Rs. 3,320
(FEC Million Rs. 2,090)

5. Preliminary Evaluation

As benefits of the proposed project, the following points can be raised.

- (1) Contribution to the economic development of the country by strengthening the foundations of the nation's economy through modernization of the Port.
- (2) Reduction in cargo handling costs by raising cargo handling productivity through mechanization and containerization.
- (3) Reduction of damage to cargo through containerization and mechanization.
- (4) Reduction in packing costs through containerization.
- (5) Increase of the rate of storage through modulization.
- (6) Reduction in ship costs for berth waiting time and for loading/unloading cargo, mainly through increases in cargo handling capacity and productivity.
- (7) Reduction of transport period, inland transport period, and port area freight accumulation through the increase of efficiency of inland transportation.
- (8) Reduction in container rental fees through the shortening of transport periods.
- (9) Possible function as a center for entrepot trade, handling tranship cargo and provid-

ing container feeder services to neighbouring countries.

(10) Prompt control of accurate information through introduction of a computer system.

Quantifying the above benefits No. 2, 6, 7, and 8, economic analysis is conducted in the Feasibility Study of the Introduction of Containerization. If Karachi Port is selected as the development site, the internal rate of return for the containerization development project of the port terminal is calculated to be 16.2% (if the costs related to railway facilities are included, 14.3% as shown in Table P-1). In the case that Port Qasim is assumed to be the development site, on the other hand, it comes down to 13.9% (if the costs related to railway facilities are included, 12.2% as shown in Table P-2). Both the results recognizably exceed the opportunity value of capital, and the project is considered to be justifiable from an economic point of view.

As for the site selection, Karachi Port is considered to be more advantageous for the containerization development of port terminal than Port Qasim. This can be partly observed from the results of economic analysis which are reported to be well established figures. In addition, since almost all existing port related functions, facilities and know-how are situated in and around Karachi Port, selecting Port Qasim for a container port is considered to likely result in roundabout transportation of upcountry containers and container cargoes, that is, to Port Qasim, to the Karachi Port area and then to upcountry. Furthermore, it is discussed that from a liner operators' point of view, Karachi Port will be more favorable in consideration of the lower tariff levels and some other conditions of facilities and services.

On the assumption that (a) Karachi Port is selected as the port development site, (b) the interest rate of loan for both foreign and local currency portions is 11.6%, and (c) the current tariff will be raised by 25% on and after 1982/83, the financial rate of return is calculated to be 11.2%. It is analysed that the increase of current tariff is by and means necessary.

Table P-1 Costs/Benefits and IRR - Shadow Price (Karachi Port - Feedback Ratio 30%)

IRR = 14.3%

(Unit: '000 Rs)

No.	Fiscal Year	Costs			Benefits				
		Total	Construction	Equipment	Operation/Maintenance	Total	Reduction in Ships' Staying Cost	Reduction in Cargo Handling Cost	Reduction in Time Cost
1	'82/'83	11,692							
2	'83/'84	77,240	11,692						
3	'84/'85	225,591	77,240						
4	'85/'86	306,633	225,591						
5	'86/'87	482,110	306,633	333,650					
6	'87/'88	12,672	148,460		12,672	71,468	53,896	4,732	12,840
7	'88/'89	21,394			21,394	117,374	70,072	25,186	22,117
8	'89/'90	33,848			33,848	238,392	160,806	44,025	33,561
9	'90/'91	43,778			43,778	270,904	177,180	49,807	43,916
10	'91/'92	43,778			43,778	270,904	177,180	49,807	43,916
11	'92/'93	43,778			43,778	270,904	177,180	49,807	43,916
12	'93/'94	43,778			43,778	270,904	177,180	49,807	43,916
13	'94/'95	43,778			43,778	270,904	177,180	49,807	43,916
14	'95/'96	43,778			43,778	270,904	177,180	49,807	43,916
15	'96/'97	43,778			43,778	270,904	177,180	49,807	43,916
16	'97/'98	43,778			43,778	270,904	177,180	49,807	43,916
17	'98/'99	43,778			43,778	270,904	177,180	49,807	43,916
18	'99/2000	43,778			43,778	270,904	177,180	49,807	43,916
19	2000/'1	43,778			43,778	270,904	177,180	49,807	43,916
20	'1/'12	43,778			43,778	270,904	177,180	49,807	43,916
21	'2/'13	43,778			43,778	270,904	177,180	49,807	43,916
22	'3/'14	43,778			43,778	270,904	177,180	49,807	43,916
23	'4/'15	43,778			43,778	270,904	177,180	49,807	43,916
24	'5/'16	43,778			43,778	270,904	177,180	49,807	43,916
25	'6/'17	43,778			43,778	270,904	177,180	49,807	43,916
26	'7/'18	43,778			43,778	270,904	177,180	49,807	43,916
27	'8/'19	43,778			43,778	270,904	177,180	49,807	43,916
28	'9/'10	43,778			43,778	270,904	177,180	49,807	43,916
29	'10/'11	43,778			43,778	270,904	177,180	49,807	43,916
Total		2,090,514	769,616	333,650	987,248	6,116,210	4,005,560	111,989	990,762

Source: Feasibility Study Report on the Introduction of Containerization in the Islamic Republic of Pakistan, 1982.

Table P-2 Costs/Benefits and IRR - Shadow Price (Qasim Port - Feedback Ratio 30%)

(Unit: '000 Rs)

IRR = 12.2%

No.	Fiscal Year	Costs			Benefits				
		Total	Construction	Equipment	Operation/ Maintenance	Total	Reduction in Ships' Staying Cost	Reduction in Cargo Handling Cost	Reduction in Time Cost
1	'82/'83	10,484							
2	'83/'84	62,766	10,484						
3	'84/'85	173,201	62,766						
4	'85/'86	265,617	173,201						
5	'86/'87	532,610	265,617						
6	'87/'88	39,125	198,960	333,650					
7	'88/'89	53,321			39,125	71,468	4,732	12,840	
8	'89/'90	72,557			53,321	117,374	25,186	22,117	
9	'90/'91	88,169			72,557	238,392	160,806	33,561	
10	'91/'92	88,169			88,169	270,904	49,807	43,916	
11	'92/'93	88,169			88,169	270,904	49,807	43,916	
12	'93/'94	88,169			88,169	270,904	49,807	43,916	
13	'94/'95	88,169			88,169	270,904	49,807	43,916	
14	'95/'96	88,169			88,169	270,904	49,807	43,916	
15	'96/'97	88,169			88,169	270,904	49,807	43,916	
16	'97/'98	88,169			88,169	270,904	49,807	43,916	
17	'98/'99	88,169			88,169	270,904	49,807	43,916	
18	'99/2000	88,169			88,169	270,904	49,807	43,916	
19	2000/'1	88,169			88,169	270,904	49,807	43,916	
20	'1/'2	88,169			88,169	270,904	49,807	43,916	
21	'2/'3	88,169			88,169	270,904	49,807	43,916	
22	'3/'4	88,169			88,169	270,904	49,807	43,916	
23	'4/'5	88,169			88,169	270,904	49,807	43,916	
24	'5/'6	88,169			88,169	270,904	49,807	43,916	
25	'6/'7	88,169			88,169	270,904	49,807	43,916	
26	'7/'8	88,169			88,169	270,904	49,807	43,916	
27	'8/'9	88,169			88,169	270,904	49,807	43,916	
28	'9/'10	88,169			88,169	270,904	49,807	43,916	
29	'10/'11	88,169			88,169	270,904	49,807	43,916	
	Total	2,971,338	709,295	333,650	1,928,391	5,845,307	1,070,081	946,846	

Source: Feasibility Study Report on the Introduction of Containerization in the Islamic Republic of Pakistan, 1982.

1. Project Name: New Oil Berth at Karachi Port

2. Project Description

To increase the liquid cargo handling capacity of Karachi Port by removing the existing two old oil berths (Nos. 2 and 3) and constructing a new oil berth in their place at the same location. After completion of this new oil berth, Karachi Port will be able to handle up to 10 million tones of liquid cargo per year. This project consists of the following items:

- 1) One berth and loading platform (70 m long and -11 m deep)
- 2) Maximum size of Tankers will be 32,000 DWT
- 3) Equipment and Piping Systems

3. Timing of Implementation

3-1 Prospective commencement of Project 1983

3-2 Prospective completion of Project 1985

4. Cost of Project

Initial Cost Million Rs. 120
(FEC Million Rs. 80)

5. Preliminary Evaluation

Based upon the Policy, up to 10 million tons of annual liquid products will be handled at Karachi Port. Assuming that the existing temporary structure of OP No. 2 somehow manages 1 million tons, the demand for the 2 existing liquid berths, namely OP No. 1 and OP No. 4, is estimated as shown in Table P-3, if the proposed project is not implemented.

In this case, the traffic intensity ρ is estimated to be 1.23, as

$$\rho = \lambda/S\mu$$

λ : the mean arrival rate = 0.96

μ : the mean service rate = 0.48

S: the number of berths = 2

(Operation days are assumed to be 300 per year)

Since $\rho > 1.0$, the berths will be unable to keep up with the incoming traffic.

With the proposed project, on the other hand, ρ is estimated as 0.90 based upon the demand forecasting shown in Table P-4. Here, $\lambda = 1.06$, $\mu = 0.48$ and $S = 3$. In this case, $\rho < 1.0$ and the system can be assumed to approach the statistical equilibrium. Therefore,

the proposed project is required early in the 6th Five Year Plan period.

It is generally known that M/E₃/S, that is, random arrival and Erlang service time, can be applied to this type of port system. Referring to Table P-5, the expected length L_q = 4.94. Hence, the expected waiting time W_q = 4.7 days (W_q = L_q/λ). This average waiting time are recognizably more than what can be generally allowed. Efforts are most encouraged to reduce this by raising the average load of vessels, reducing berth occupancy time and/or expanding operation days. In a long run, shipping conditions need to be improved to raise the average load of vessels. In a short run, the equipments of oil berth should be designed so as to increase its handling rate and reduce the berth occupancy time.

Table P-3 Estimated Demand for 2 Existing Liquid Berths (OP No. 1 and No. 4) at Karachi Port without the Proposed Project

Year	Import/Export (1000t)	Number of Vessels per Year	Number of Vessels per Day
1983 / 84	7,950	306	0.84
1984 / 85	8,514	328	0.90
1985 / 86	9,000	347	0.96
1986 / 87	9,000	347	0.96
1987 / 88	9,000	347	0.96
1988 / 89	9,000	347	0.96
1989 / 90	9,000	347	0.96
1990 / 91	9,000	347	0.96
1991 / 92	9,000	347	0.96
1992 / 93	9,000	347	0.96
1993 / 94	9,000	347	0.96
1994 / 95	9,000	347	0.96
1995 / 96	9,000	347	0.96
1996 / 97	9,000	347	0.96
1997 / 98	9,000	347	0.96
1998 / 99	9,000	347	0.96
1999 / 00	9,000	347	0.96

Source: Study Team

Note: (1) A constant annual average growth rate is assumed to project the intermediate years.

(2) The average load per vessel is assumed to be 26,000t.

Table P-4 Estimated Demand for 3 Liquid Berths
Including the Proposed One at Karachi Port

Year	Import/Export(1000t)	Number of Vessels per Year	Number of Vessels per Day
1983 / 84	8,950	345	0.95
1984 / 85	9,514	366	1.01
1985 / 86	10,000	385	1.06
1986 / 87	10,000	385	1.06
1987 / 88	10,000	385	1.06
1988 / 89	10,000	385	1.06
1989 / 90	10,000	385	1.06
1990 / 91	10,000	385	1.06
1991 / 92	10,000	385	1.06
1992 / 93	10,000	385	1.06
1993 / 94	10,000	385	1.06
1994 / 95	10,000	385	1.06
1995 / 96	10,000	385	1.06
1996 / 97	10,000	385	1.06
1997 / 98	10,000	385	1.06
1998 / 99	10,000	385	1.06
1999 / 00	10,000	385	1.06

Source: Study Team

Note: (1) A constant annual average growth rate is assumed to project the intermediate years.

(2) The average load per vessel is assumed to be 26,000t.

Table P-5 Expected Length of Queue for $M/E_3/S$

ρ	S				
	1	2	3	4	5
0.10	0.74074E-02	0.14829E-02	0.31947E-03	0.71166E-04	0.16161E-04
0.20	0.33333E-01	0.11975E-01	0.46423E-02	0.18660E-02	0.76599E-03
0.30	0.85714E-01	0.41923E-01	0.22024E-01	0.11991E-01	0.66699E-02
0.40	0.17778E 00	0.10620E 00	0.67576E-01	0.44429E-01	0.29808E-01
0.50	0.33333E 00	0.22975E 00	0.16697E 00	0.12481E 00	0.94971E-01
0.55	0.44815E 00	0.32724E 00	0.25061E 00	0.19688E 00	0.15720E 00
0.60	0.60000E 00	0.46098E 00	0.36945E 00	0.30284E 00	0.25196E 00
0.65	0.80476E 00	0.64697E 00	0.53948E 00	0.45890E 00	0.39539E 00
0.70	0.10889E 01	0.91164E 00	0.78740E 00	0.69617E 00	0.61433E 00
0.75	0.15000E 01	0.13027E 01	0.11609E 01	0.10490E 01	0.95669E 00
0.80	0.21333E 01	0.19155E 01	0.17552E 01	0.16264E 01	0.15179E 01
0.85	0.32111E 01	0.29722E 01	0.27929E 01	0.26461E 01	0.25206E 01
0.90	0.54000E 01	0.51395E 01	0.49405E 01	0.47751E 01	0.46316E 01
0.95	0.12033E 02	0.11751E 02	0.11532E 02	0.11347E 02	0.11184E 02
0.98	0.32013E 02	0.31717E 02	0.31486E 02	0.31288E 02	0.31115E 02
0.99	0.65340E 02	0.65040E 02	0.64804E 02	0.64603E 02	0.64425E 02

Source: Hillier and Yu, Queueing Tables and Graphs

1. Project Name: Oil Berth at Qasim Port

2. Project Description

In order to handle 1.5 million tones of liquid cargo in the year 1988 at Qasim Port, one oil berth will be constructed by 1988 in the port.

This project will consist of the following items:

- 1) One berth and loading platform (70 m long and -12 m deep)
- 2) Maximum Tanker size will be 40,000 DWT
- 3) Equipment and Piping Systems

3. Timing of Implementation

3-1 Prospective commencement of Project 1985

3-2 Prospective completion of Project 1987

4. Cost of Project

Initial Cost Million Rs. 158
(FEC Million Rs. 95)

5. Preliminary Evaluation

Based upon the Policy, liquid products beyond 10 million tons per year will be handled at Port Qasim. Consequently, the demand for liquid berths at Port Qasim can be estimated as shown in Table P-6. The proposed oil berth needs to be constructed before this demand reaches a considerable amount.

Table P-6 Estimated Demand for Liquid Berths
at Port Qasim

Year	Import/Export (1000t)	Number of Vessels per Year	Number of Vessels per Day
1985 / 86	113	5	0.01
1986 / 87	750	29	0.08
1987 / 88	1,449	56	0.15
1988 / 89	2,170	84	0.23
1989 / 90	2,937	113	0.31
1990 / 91	3,752	145	0.40
1991 / 92	4,618	178	0.49
1992 / 93	5,539	214	0.59
1993 / 94	6,518	251	0.69
1994 / 95	7,559	291	0.80
1995 / 96	8,665	334	0.92
1996 / 97	9,841	379	1.04
1997 / 98	11,091	427	1.17
1998 / 99	12,420	478	1.31
1999 / 00	13,795	531	1.45

Source: Study Team

Note: (1) A constant annual average growth rate is assumed to project the intermediate years.

(2) The average load per vessel is assumed to be 26,000t.

1. Project Name: Buoy Berth at Port Qasim

2. Project Description

In order to meet the forecasted demand assigned to Port Qasim by the Policy, a buoy berth is proposed to be constructed at an appropriate site of the outer anchorage area in Port Qasim. While more detail investigations are required to select the site and system design, the components of tentative plan may be assumed as follows.

- 1) Single Buoy
- 2) Pipeline (double)
- 3) Booster Pump Station

3. Timing of Implementation

3-1 Prospective commencement of Project 1988

3-2 Prospective completion of Project 1990

4. Cost of Project

Initial Cost Million Rs. 1,300
(FEC Million Rs. 910)

5. Preliminary Evaluation

Based upon the Policy, liquid products beyond 10 million tons per year will be handled at Port Qasim. If the proposed first oil berth project is implemented, the rest of demand for liquid berths at Port Qasim can be estimated as shown in Table P-7.

Handling this demand by the buoy berth at the outer anchorage area instead of the conventional oil berth at Bundal Island is advantageous under the given conditions in the respects including the below.

- (1) The total construction cost is estimated less.
- (2) The congestions in the channel expected in the long-term future can be partly eased.
- (3) The navigation of tankers along the channel of approximately 15 km portion can be saved.

The first point can be further explained as follows. Due to the navigation in the channel and some other conditions of vessel movements, the apparent mean service rate of the normal oil berth constructed in the Port seems less. If 4 berths are planned for 1999/2000, the traffic intensity ρ is estimated to be 1.03, as

$$\rho = \lambda/S\mu$$

λ : the mean arrival rate = 1.30

μ : the mean service rate = 0.38

S: the number of berths = 4

(Operation days are assumed to be 300 per year)

Since $\rho > 1.0$, the berths will be unable to keep up with the incoming traffic. Consequently, 5 berths are required, and in this case $\rho = 0.82$ and the expected waiting time Wq is 1.48 days. Even if the efforts of raising the average load of vessels, reducing berth occupancy time and/or expanding operation days go successful, 4 berths seem to be the least requirement to handle the demand.

The construction of 4 oil berths at Qasim Post is estimated to cost approximately 1.4 billion Rupees, which is more than the estimated cost of the buoy berth and related facilities of equivalent capacity. Consideration of the second and third point mentioned above will further favor the buoy berth construction. It can be also noted that an additional advantage of buoy berth constructed at the outer anchorage area would be the security from accidents due to the avoidance of large tankers coming into the channel.

Table P-7 Estimated Demand for Liquid Berths
Excluding the First One at Port Qasim

Year	Import/Export(1000t)	Number of Vessels per Year	Number of Vessels per Day
1988 / 89	670	26	0.07
1989 / 90	1,437	56	0.15
1990 / 91	2,252	87	0.24
1991 / 92	3,118	120	0.33
1992 / 93	4,039	156	0.43
1993 / 94	5,018	193	0.53
1994 / 95	6,059	234	0.64
1995 / 96	7,165	276	0.76
1996 / 97	8,341	321	0.88
1997 / 98	9,591	369	1.01
1998 / 99	10,920	420	1.15
1999 / 00	12,295	473	1.30

Source: Study Team

Note: (1) A constant annual average growth rate is assumed to project the intermediate years.

(2) The average load per vessel is assumed to be 26,000t.

1. Project Name: Fertilizer Terminal at Port Qasim

2. Project Description

According to the demand forecast, in the year 2000, 2.3 million tones of Fertilizers and 0.8 million tones of Phosphate Rock will be handled.

To handle this quantity of Fertilizer and Phosphate Rock, an independent fertilizer terminal will be constructed between the No. 7 berth and the IOC berth in Qasim Port.

The terminal will be equipped with unloaders, storage facilities, a bagging plant and reclaim and loadout facilities.

3. Timing of Implementation

3-1 Prospective commencement of Project 1983

3-2 Prospective completion of Project 1988

4. Cost of Project

Initial Cost Million Rs. 490
(FEC Million Rs. 201)

5. Preliminary Evaluation

The handling rate of fertilizer in the conventional unloading system is reported to be 1,750 tons per day. If the average load per vessel is assumed to be 13,000 tons, the berth occupancy is estimated to be more than 8 days.

Under such an assumption, the required number of berths to keep up with the incoming traffic shown in Table P-8 will be about 4 by 1987/88 and 7 by 1999/2000. These numbers are far beyond what can be achieved, and devices to reduce the berth occupancy are indispensable.

The proposed equipments will raise the handling rate of fertilizer and phosphate rock/sulphur several times. This project, whose cost is almost equivalent to the construction cost of 1.5 berth, is expected to make it possible to handle the demand for 1999/2000 with one terminal of 279 m long.

Table P-8 Estimated Trade Demand of Fertilizer and Phosphate / Sulpher

Year	Fertilizer ('000tons)	Phosphate Rock /Sulpher ('000tons)	Total ('000tons)	Number of Vessels per Year	Number of Vessel per Day
1987 / 88	1193	278	1471	114	0.31
1999 / 00	2341	779	3120	240	0.66

Source: Study Team

Note: The average load per vessel is assumed to be 13,000 tons.

1. Project Name: Wheat Terminal at Port Qasim

2. Project Description

According to the demand forecast, 0.53 million tonnes of wheat will be imported the year 1987/1988, and 0.64 million tonnes of wheat will be exported in the year 1999/2000.

To handle the above quantities, a wheat terminal will be constructed on the multi-purpose berth No. 7.

It will be equipped with portable pneumatic unloading units, storage silos, bulk load out rail cars, a bagging plant and reclaim and bulk export facilities. An import Wheat Terminal will be constructed under the urgent plan, but it is expected that it will be converted for export use at some point.

3. Timing of Implementation

3-1 Prospective commencement of Project 1983

3-2 Prospective completion of Project 1986, 1990

4. Cost of Project

Initial Cost Urgent Plan Million Rs. 151, Master Plan Million Rs. 256
(FEC Million Rs. 70) (FEC Million Rs. 116)

5. Preliminary Evaluation

Table P-9 shows the trade demand of wheat, and it can be understood that the estimated traffic is rather small. Applying the conventional handling rate, 3,500 tons per day, the traffic intensity of one berth is calculated to be somewhere around 0.5. Upon implementation of the proposed project, the handling rate will be improved and consequently the berth occupancy will be reduced.

The major aim of this project is to clear the apron occupancy of bulk wheat by the conventional handling way. Although the project is not necessarily requisite from a point of view of berth congestions as explained above, an early implementation is favored from a point of view of berth apron management.

Table P-9 Trade Demand of Wheat

Year	Import ('000t)	Export ('000t)	Number of Vessels per Year	Number of Vessels per Day
1987 / 88	527	-	22	0.06
1999 / 00	-	643	27	0.07

Source: Study Team

Note: The average load per vessel is assumed to be 24,000t.

1. Project Name: Mini-Port at Gwadar

2. Project Description

This project will inaugurate modern development of the Makran Coast.

The project is an outcome of the federal policy of promoting development of the fishing industry, and will also aid in the transport of commodities.

This project shall thus serve to raise the standard of living along the Makran Coast.

The project will consist of the following items;

- 1) 500 m Revetment and 980 m Groin
- 2) 330 m Fishing Berth and 70 m General Cargo Berth
- 3) 321,000 m³ Dredging and 112,200 m³ land Reclamation
- 4) Fishery related facilities

3. Timing of Implementation

3-1 Prospective commencement of Project 1984

3-2 Prospective completion of Project 1986

4. Cost of Project

Initial Cost Million Rs. 326
(FEC Million Rs. 270)

5. Preliminary Evaluation

It is reported that the future catch may stagnate at a level of 250,000 tons if additional fisheries port capacity besides Karachi Port is not made available. The fishery product for the 6th Five Year Plan is estimated to be far beyond this, requiring the early construction of new fishery ports (see Table P-10).

The construction of a miniport in Gwadar was studied in 1980 and the following benefits were identified.

- (1) The availability of a modern fishing port will improve the fishing productivity in the region and increase the protein supply in the region as well as Pakistan.
- (2) The export of a large quantity of highgrade shrimp will become possible, contributing to securing more foreign currencies.
- (3) 150-ton class coastal steamers will become able to berth at the proposed miniport, accelerating the use of coastal shipping.
- (4) After the development of miniport, larger barges may be used, reducing the cargo-handling time and the anchorage days of coastal trade vessels.
- (5) The project is expected to play an important role for the development of Baluchistan Province and in particular Gwadar City.

Quantifying the first four effects, the cost benefit analysis was concluded with the internal rate of return of 3.8% (see Table P-11). This appears to be a rather low return. Upon implementation of the project, therefore, the expansion of Gwadar based fishery activities in an efficient manner will have to be most encouraged.

At the same time, the indirect effects of the project including the last one in the above list are to be taken into consideration.

Table P-10 Estimated Fishery Production

(tons)

Year	Annual Production	Average Daily Production
1982 / 83	322,000	1,074
1983 / 84	340,000	1,134
1984 / 85	359,000	1,197
1985 / 86	379,000	1,264
1986 / 87	400,000	1,334
1987 / 88	424,000	1,414
1988 / 89	447,000	1,490
1989 / 90	471,000	1,570
1990 / 91	496,000	1,654
1991 / 92	523,000	1,744
1992 / 93	551,000	1,837
1993 / 94	581,000	1,937
1994 / 95	612,000	2,040
1995 / 96	645,000	2,150
1996 / 97	680,000	2,267
1997 / 98	717,000	2,390
1998 / 99	756,000	2,520
1999 / 00	795,000	2,650

Source: Study Team

Note: A constant annual average growth rate is assumed to project the intermediate years. Work days are assumed to be 300 per year.

Table P-11 Cost Benefit Table of Gwadar Mini-port Development Project

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1981	125,000		125,000	
2	1982	125,000		125,000	
3	1983		9,066	9,066	23,924
4	1984		9,066	9,066	23,924
5	1985		9,066	9,066	23,924
6	1986		9,066	9,066	23,924
7	1987		9,066	9,066	23,924
8	1988		9,066	9,066	23,924
9	1989		9,066	9,066	23,924
10	1990		9,066	9,066	23,924
11	1991		9,066	9,066	23,924
12	1992		9,066	9,066	23,924
13	1993		9,066	9,066	23,924
14	1994		9,066	9,066	23,924
15	1995		9,066	9,066	23,924
16	1996		9,066	9,066	23,924
17	1997		9,066	9,066	23,924
18	1998		9,066	9,066	23,924
19	1999		9,066	9,066	23,924
20	2000		9,066	9,066	23,924
21	2001		9,066	9,066	23,924
22	2002		9,066	9,066	23,924
23	2003		9,066	9,066	23,924
24	2004		9,066	9,066	23,924
25	2005		9,066	9,066	23,924
26	2006		9,066	9,066	23,924
27	2007		9,066	9,066	23,924
28	2008		9,066	9,066	23,924
29	2009		9,066	9,066	23,924
30	2010		9,066	9,066	23,924
IRR=3.76%					

Source: Study Report on the Construction Project of a Mini-port in Gwadar, 1980.

5. Listing and Preliminary Evaluation of Airport Projects

5-1 Approaches and Methodologies of Preliminary Evaluation

Among development expenditures of the airports and navigation systems to cater for the projected demands, the most expensive is civil works for airport facilities. The expansion and maintenance of runways, taxiways and aprons including periodical overlays are essential to keep the safe aircraft movements from an engineering point of view. Since the required number of apron berths are planned based upon the forecasted peak hour movements and apron occupancy time of aircrafts as criteria, the development of additional apron berths needs to be implemented without delay.

The requirement of terminal buildings and car parkings are also planned based upon the forecasted peak hour traffic. While some flexibility concerning the implementation timing is allowed within the permissible extent of congestions, excessive postponement of such facility development will involve serious confusions beside the problems of low amenity.

Another important system element to maintain the safe aircraft operations is navigation systems of airports and enroutes. To ensure the safety performances of such systems as radars, communications, radio navigation aids and aeronautical lightings, the international standards are often aimed at.

Beside safety and amenity factors, policies play an important role in discussing the priorities of projects. The policy factor was taken into account based upon discussions with the concerned Pakistani officers, particularly for development of major airports and new local airports. Approaches of preliminary evaluation involving such factors as safety, amenity and policy usually take descriptive analysis as demonstrated for each project in the project list.

On the other hand, quantitative analysis is effective for preliminary evaluation of projects which aim at economic efficiency improvement. Since safety is the first condition in aircraft operation, absence of the necessary facilities is often forced to neglect the operation efficiency in order to secure the least safety. Cost-benefit analysis is conducted in such a manner to compare the development cost of the missing facilities and the saving of economic losses. Table 5-1 and 5-2 show the hours and costs of aircraft holding respectively which are often introduced in the analyses.

Table 5-1 Annual Holding Hours of the PIA Aircrafts
(1981/82)

Aircraft	(Hours)				Total
	RWP	KHI	LHE	URT	
B747	30	103	-	-	133
DC10	90	180	10	-	280
A300	15	307	64	-	386
B707	25	148	11	5	189
B720	15	112	7	16	150
F-27	160	100	83	4	347
Total	335	950	175	25	1,485

Source: PIA

Table 5-2 Holding Cost of the Aircrafts

		(Rs./ hr)					
		B-747	DC-10	A300	B-707	B-720	F-27
Fuel	Financial	57,800	42,500	29,750	28,900	27,030	3,230
	Economic	56,644	41,650	29,155	28,322	26,489	3,165
Maintenance	Financial	8,000	5,400	3,100	2,000	2,000	1,500
	Economic	7,260	4,914	2,821	1,820	1,820	1,365
Standing	Financial	25,477	19,578	22,105	4,261	2,721	600
	Economic	23,184	17,816	20,116	3,878	2,476	546
Crew Salaries	Financial	3,200	2,600	2,400	1,700	1,700	650
	Economic	2,861	2,324	2,146	1,520	1,520	581
Total	Financial	94,477	70,078	57,355	36,861	33,451	5,980
	Economic	89,949	66,704	54,238	35,540	32,305	5,657

Source: PIA for Financial Cost, Study Team for Economic Cost.

5-2 Major Outcomes of Preliminary Evaluation

(1) Civil and Building Works at Major Airports

Among the major civil work projects are the runway and taxiway development projects at Karachi and Lahore. The necessity of these projects mainly arises from that of rehabilitating, or expanding the existing runways. Since runway construction works take a period of runway closure which is not possible at such major airports, the development of the other runway to be fit for the substitute is proposed. Based upon the examination from an engineering point of view, they are urged to be implemented during the 6th Five Year Plan period.

Beside the runway and taxiway development project, Karachi Airport needs to undergo a number of projects including expansion and rehabilitation of various types of aprons, development of cargo terminal area, international passenger terminal and domestic passenger terminal. As discussed earlier, expansion and maintenance of such basic facilities should be regarded as requisite to cater for the rapidly increasing traffic. Also in view of the importance of Karachi Airport as the main gateway to the nation, it can be taken as a policy to give higher priorities on the development of terminal facilities at Karachi during the 6th Five Year Plan period.

The development of Islamabad Airport can be divided into three phases, besides the periodical overlay of runway and taxiway. The major parts of the first phase include the extension of runway to make it more appropriate as a primary international airport and the development of parallel taxiway. The absence of parallel taxiway is a part of the causes for air traffic congestions at Islamabad shown in Table 5-1. This is because the runway occupancy by landed aircrafts becomes high for taxing back on the runway. Table 5-3 shows the outcomes of cost-benefit analysis for the assumption sets of holding hour reduction and installation timing (see Table 5-4 for an example of cost-benefit stream). According to the discussion between the concerned Pakistani officers and the Study Team, the reduction of holding hours is expected to be a few tens percents. Therefore, the economic feasibility of the project's early implementation is not fully assured from the above quantitative analysis.

Trafficwise, since the peak hour aircraft movements at Islamabad Airport are estimated 6 in 1987/88 and 8 in 1999/2000, the case is still controversial. In consideration of further factors, it can be pointed out the joint use of the airport for PAF and civil is actually making the traffic condition worse than explained above. Also, Islamabad Airport as the Capital International Airport of Pakistan is expected to receive some intangible benefit from the parallel taxiway provision project. Synthesizing the above discussion, the parallel taxiway is proposed to be developed late in the 6th Five Year Plan period. This is also desirable from a planning point of view, because the runway extension project and terminal area development project can be conveniently coordinated.

Table 5-3 Economic Return (IRR) of Islamabad Airport Parallel Taxiway Project

(%)

Reduction of Holding Hours (%)	Installation Timing (Project Start)		
	1983/84	1986/87	1988/89
10	-	-	-
20	3.43	5.20	6.34
30	9.21	11.24	12.54
40	13.77	16.12	17.61

Source: Study Team

Table 5-4 Islamabad Airport Parallel Taxiway Project, Stream of Economic Costs and Benefits (Holding Hours: 20% Reduction, Installation Timing: 1983/84)

Unit:Rs.

Year	Cost			Benefit
	Construction Cost	Maintenance & Operating Cost	Total	
1 1983/84	25,557,500		25,557,500	
2 1984/85	25,557,500		25,557,500	
3 1985/86		1,357,000	1,357,000	3,612,750
4 1986/87		1,357,000	1,357,000	3,934,284
5 1987/88		1,357,000	1,357,000	4,284,435
6 1988/89		1,357,000	1,357,000	4,460,097
7 1989/90		1,357,000	1,357,000	4,642,960
8 1990/91		1,357,000	1,357,000	4,833,321
9 1991/92		1,357,000	1,357,000	5,031,487
10 1992/93		1,357,000	1,357,000	5,237,777
11 1993/94		1,357,000	1,357,000	5,452,525
12 1994/95		1,357,000	1,357,000	5,676,077
13 1995/96	13,649,000	1,357,000	15,006,000	5,908,797
14 1996/97		1,357,000	1,357,000	6,515,056
15 1997/98		1,357,000	1,357,000	6,403,249
16 1998/99		1,357,000	1,357,000	6,665,781
17 1999/00		1,357,000	1,357,000	6,939,076
18 2000/01		1,357,000	1,357,000	7,223,578
19 2001/02		1,357,000	1,357,000	7,519,743
20 2002/03		1,357,000	1,357,000	7,828,052
21 2003/04		1,357,000	1,357,000	8,149,003
22 2004/05		1,357,000	1,357,000	8,483,111
IRR = 3.43				

Source: Study Team

The rest of the first phase and the following two phases of Islamabad Airport Scheme are mostly for the development of terminal area including aprons, terminal building and car parkings. The Study is proceeded based upon the concept of developing the terminal area north of the existing runway. This concept is supported by the following points.

- 1) The capacity of existing terminal facilities is by any means inadequate for the estimated traffic in 1987/88, but the site has very limited area for expansion.
- 2) The existing runway is estimated to be capable of managing the estimated traffic if the parallel taxiway is constructed. The development of new terminal facilities north of the existing runway is expected to be successful in a) separation between the PAF and civil traffics, b) taking advantage of the existing terminal facilities and c) better access connection to Islamabad. Also, the area of site is large enough to design a terminal attractive enough as the Capital airport.
- 3) While no significant additional benefits can be found in developing a completely new airport at a different site, several losses and disadvantages can be identified. Included among them are construction of additional runway and related facilities, abandonment of the existing terminal facilities, and relatively disadvantageous access condition.

(2) Air Navigation System Development

Air navigation systems of airports and enroutes are planned applying certain standards as criteria. The enroute A/G communication, enroute radar and other enroute facilities will be brought to the international standard. Radio navigation aids and aeronautical lighting systems at the major three airports will be upgraded to Precision Approach Category II in a phased approach, while the airports with turbo-jet operations will be upgraded to Precision Approach Category I and the airports without turbo-jet operations to Non-precision IFR Approach.

Development of airport radars is expected not only to ensure the security but also to improve the economic efficiency of aircraft operations. The present ASR at Karachi Airport was installed in 1965 and is now operated only on a test basis during morning hours suffering from maintenance problems. It is observed that most of the congestions in the Controlled Terminal Area shown in Table 5-1 are due to the conflicting traffic during the absence of active ASR. Upon replacement of ASR at Karachi, therefore, much of the congestions are expected to be solved. Cost-benefit analysis on the assumption that 10% of holding hours will be saved is concluded, as shown in Table 5-5, with IRR of 47.5%. If 20% of holding hours is assumed to be saved, IRR is estimated to be 95.5%. Judging from these results, the project appears quite feasible in these cases. At the same time, the actual reduction of holding hours will without any doubt exceeds these percentages. It can be concluded that even an immediate implementation of the ASR/SSR project is justifiable.

**Table 5-5 Stream of Economic Costs and Benefits
(Holding Hours: 10% Reduction)
Karachi Airport ASR/SSR Project**

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	32,301,000		32,301,000	
2	1984/85		2,442,900	2,442,900	15,347,230
3	1985/86		2,442,900	2,442,900	16,575,008
4	1986/87		2,442,900	2,442,900	17,901,007
5	1987/88		2,442,900	2,442,900	19,333,086
6	1988/89		2,442,900	2,442,900	20,229,740
7	1989/90		2,442,900	2,442,900	21,314,725
8	1990/91		2,442,900	2,442,900	22,380,461
9	1991/92		2,442,900	2,442,900	23,499,482
10	1992/93		2,442,900	2,442,900	24,674,455
11	1993/94	12,920,400	2,442,900	15,363,300	25,908,178
12	1994/95		2,442,900	2,442,900	27,203,585
13	1995/96		2,442,900	2,442,900	28,563,761
14	1996/97		2,442,900	2,442,900	29,991,948
15	1997/98		2,442,900	2,442,900	31,491,545
16	1998/99		2,442,900	2,442,900	33,066,121
17	1999/00		2,442,900	2,442,900	34,719,428
18	2000/01		2,442,900	2,442,900	36,455,398
19	2001/02		2,442,900	2,442,900	38,278,163
20	2002/03		2,442,900	2,442,900	40,192,071
21	2003/04		2,442,900	2,442,900	42,201,663
IRR= 47.53					

Source: Study Team

The present aircraft holding at the Islamabad Airport is attributable partly to the absence of radar and also partly to the absence of parallel taxiway which increases the runway occupancy by the landed aircrafts for taxiing back. Table 5-6 shows the outcomes of cost-benefit analysis of the assumption sets of holding hour reduction and installation timing. In actual, discussion has been held between the concerned Pakistani officers and Study Team that nearly half of the holding hours is the least expectation for reduction due to the more skillful separation of aircrafts enabled by the radar. Taking into consideration such further benefits as the holding hour reduction of other Pakistani and foreign aircrafts and the prestige of the capital city airport, the installation project of remote radar at the Islamabad Airport is justifiable during the 6th Five Year Plan period.

Table 5-6 Economic Return(IRR) of Remote Radar Installation Project

(%)

Reduction of Holding Hours (%)	Installation Timing (Project Start)			
	1983/84	1986/87	1988/89	1991/92
10	-	-	-	-
20	0.95	3.50	5.07	7.46
30	8.96	11.93	13.71	16.53
40	15.20	18.87	20.98	24.40
50	20.73	25.23	27.74	31.84
60	25.91	31.34	34.27	39.10
70	30.88	37.32	40.70	46.27
80	35.73	43.23	47.07	53.40
90	40.50	49.10	53.40	60.50
100	45.21	54.96	59.72	67.59

Source: Study Team

Due to the fact that the Lahore Airport is situated very close to the Indian border and there are a number of overflying traffic, some opinions support the installation of radar. The peak day aircraft movements at Lahore are forecasted to be 39 in 1987/88 and 46 in 1999/2000. Under such a circumstance, the installation of radar will be justified at least in future, but the installation timing is remaining controversial. Table 5-7 shows the outcomes of cost benefit analysis of the cross-sectional assumption of holding hour reduction and installation timing. It can be interpreted from these figures that 70 to 80% of the reduction of holding hours are expected to economically pay off the cost. This indicates that the air traffic congestions are much less serious at the Lahore Airport than Karachi or Islamabad and that the installation of remote radar at Lahore seems better to be left for the 7th Year Plan period or after.

Table 5-7 Economic Return(IRR) of Remote Radar Installation Project at Lahore Airport

(%)

Reduction of Holding Hours (%)	Installation Timing (Project Start)			
	1983/84	1986/87	1988/89	1991/92
10	-	-	-	-
20	-	-	-	-
30	-	-	-	-
40	-	1.09	2.65	5.00
50	2.95	5.55	7.14	9.60
60	6.52	9.31	10.99	13.64
70	9.64	12.68	14.49	17.36
80	12.48	15.81	17.76	20.89
90	15.13	18.78	20.89	24.30
100	17.64	21.65	23.93	27.63

Source: Study Team

(3) New Airport Development Projects

A number of candidate local airport sites which come up for discussion can be roughly grouped into three. Those of the first group including Zhob, Sibi and Khuzdar are situated in rather remote areas of Baluchistan, expecting relatively small public demand as shown in Table 5-8.

The airport development at these sites is proposed for the future economic development of area and the administrative and other governmental purposes. Although it is admitted from an economic and safety point of view that highest priorities during the 6th Five Year Plan period are to be placed on the major and other existing airports, some airports out of the first group will be developed based upon the policy.

The second group of candidate sites including Sargodha, Rahimyar Khan, Bahawalpur and D.G.Khan have relatively higher potentials for development in and after the 7th Five Year Plan period particularly in terms of forecasted demand volume. These sites are considered to make the nationwide airport network more extensive, occasionally taking advantage of some existing facilities developed in early days. Finally, a very limited number of airport sites might be developed before the year 2000 out of the third group candidate sites including Abbottabad, Jacobabad, Sialkot, Sahiwal, Sehwarsharief, Mirpurkhas and so on.

Table 5-8 Forecasted Demand for New Local Airports

Airport	(Trips)	
	1987/88	1999/2000
Bannu	10,232	15,174
Sargodha	66,612	132,156
D.G.Khan	11,444	17,688
Bahawalpur	20,358	31,724
Rahimyar Khan	20,402	34,804
Zhob	4,570	6,938
Sibi	1,540	2,604
Khuzdar	27,960	50,276
Ormara	15,478	24,520

Source: Study Team

(4) Alternate Airport for Karachi

While the actual air traffic managed at the Nawabshah Airport is not much to speak of as a local airport, Nawabshah is supposed to maintain the function as the alternate aerodrome for Karachi Airport. Even though Nawabshah is designated so in AIP, the required facilities to meet this function are not made available yet. Due to this situation, the wide-bodied aircrafts of PIA are unable to plan to be diverted to Nawabshah in case of emergency. Then, these aircrafts are incurring extra expenditure of burning extra fuel for such more distant alternate airports as Islamabad and Lahore. According to PIA, the extra expenditure for 1981 is estimated as shown in Table 5-9 in financial terms.

Taking the saving of these extra burn off as the benefits, economic cost-benefit analysis has been conducted to analyze the development project of Nawabshah Airport to the full alternate aerodrome for Karachi. In the case the facilities are fully developed the internal rate of return is estimated to be 19.2%, while that of the case the building development is in a half scale is 22.2%. It can be interpreted that an early and full implementation is economically feasible. Taking into consideration such further benefits as the saving of fuel consumption brought to other aircrafts and the accomplishment of reliable image of Karachi Airport, this project is recommended to carry out in an early timing of the 6th Five Year Plan period.

Table 5-9 Extra Expenditure (Financial) Due to Non-availability of Nawabshah as the Alternate for Widebodied Aircrafts

Aircraft	Number of Incoming Flights	Extra Burn off (gal/Hr)	Average Price (Rs/gal)	Extra Expenditure (Rs)
B-747	832	148	15.3	2,825,971
DC-10	1,976	112	15.4	5,112,307
A-300	3,068	76	15.4	5,386,181
Total	5,876	-	-	13,324,459

Source: PIA

Note: Average flying time is assumed to be 1.5 hrs.

5-3 Listing and Preliminary Evaluation of Each Project

Peshawar Airport Project
D.I. Khan Airport Project
Saidu Sharif Airport Project
Chitral Airport Project
Faisalabad Airport Project
Multan Airport Project
Hyderabad Airport Project
Nawabshah Airport Project
Moenjodaro Airport Project
Sukkur Airport Project
Quetta Airport Project
Panjgur Airport Project
Turbat Airport Project
Pasni Airport Project
Gwadar Airport Project
Jiwani Airport Project
Sui Airport Project
New Airport Project
Islamabad Airport Project
Runway and Taxiway Project at Lahore Airport
Terminal Area Expansion Project at Lahore Airport
Runway and Taxiway Project at Karachi Airport
Pax Loading Apron Expansion Project at Karachi Airport
Cargo Loading Apron Project at Karachi Airport
Night Stay Apron Project at Karachi Airport
Existing Apron Project at Karachi Airport
International Pax Terminal Bldg and Car Parking Project at Karachi Airport
Karachi Airport
Domestic Pax Terminal Bldg and Car Parking Project at Karachi Airport
Ormara Airport Project
Bannu Airport Project
Regional Air Navigation System and Related Building Plan for Pakistan
ARSR/SSR En-Route Radar Network Plan
Air Navigation Systems Plan for Karachi International Airport
Air Navigation Systems Plan for Lahore International Airport
Air Navigation Systems Plan for Islamabad International Airport
Air Navigation Systems Plan in Minor Airports, Fiscal Years 1983 – 1988

Air Navigation Systems Plan in Minor Airports, Fiscal Years 1988 – 1993
Air Navigation Systems Plan in Minor Airports, Fiscal Years 1993 – 2000

1. Name of Project: Peshawar Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1984/85, 1991/92

3-2 Time required for project completion 2 Years, 1 Year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 45.7

1989 – 2000: 28.9

4-2 Annual Expenditure from 1988 to 2000: 1.17

after 2000: 1.51

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m		2,750	Overlay
		Taxiway	m		840	Overlay
	Work	Apron	spot			
		Car parking	m ²	8,150	2,750	
PAX Terminal BLDG.			m ²	5,250	1,470	
Cargo Terminal BLDG.			m ²	2,500		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is pre-requisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: D. I. Khan Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1995/96

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 6.8

1989 – 2000: 4.9

4-2 Annual Expenditure from 1988 to 2000: 0.16

after 2000 0.18

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m		1,500	Overlay
		Taxiway	m		260	Overlay
	Work	Apron	spot			
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	900		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is prerequisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Saidu Sharif Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start : 1987/88, 1995/96

3-2 Time required for project completion : 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 6.3

1989 – 2000: 10.7

4-2 Annual Expenditure from 1988 to 2000: 0.15

after 2000: 0.19

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m		1,830	Overlay
		Taxiway	m		75	Overlay
	Work	Apron	spot			
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	830		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is prerequisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Chitral Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Apron spot, Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1995/96

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 9.1

1989 – 2000: 10.7

4-2 Annual Expenditure from 1988 to 2000: 0.24

after 2000: 0.27

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL WORK	Pavement Work	Runway	m		1,830	Overlay
		Taxiway	m		75	Overlay
		Apron	spot	1;F27		
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	1,050		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berth are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Faisalabad Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1995/96

3-2 Time required for project completion 2 years, 1 year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 6.0

1989 – 2000: 31.8

4-2 Annual Expenditure from 1988 to 2000: 0.15

after 2000 0.40

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m		2,750	Overlay
		Taxiway	m		463	Overlay
	Work	Apron	spot			
		Car parking	m ²		580	
PAX Terminal BLDG.			m ²	560	870	
Cargo Terminal BLDG.			m ²	800		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is prerequisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Multan Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Apron spot, Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1991/92

3-2 Time required for project completion 1 year, 2 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 13.3

1989 – 2000: 41.0

4-2 Annual Expenditure from 1988 to 2000: 0.34

after 2000: 0.85

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m		2,750	Overlay
		Taxiway	m		3,800	Overlay
	Work	Apron	spot		1;T jet	
		Car parking	m ²	1,480	2,460	
PAX Terminal BLDG.			m ²	1,080	1,320	
Cargo Terminal BLDG.			m ²	2,000		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berth are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Hyderabad Airport Project

2. Description

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1995/96

3-2 Time required for project completion 1 year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: NIL

1989 – 2000: 7.4

4-2 Annual Expenditure from 1988 to 2000: NIL

after 2000: NIL

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL Work	Pavement Work	Runway	m		2,150	Overlay
		Taxiway	m		150	Overlay
		Apron	spot			
		Car parking	m ²			
PAX Terminal BLDG.			m ²			

5. Preliminary Evaluation

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Nawabshah Airport Project

2. Description

Therefore, terminal facilities, i.e., Apron including Taxiway, Car parking including Access Road, Pax terminal Bldg., Control Tower Pol., are planned to expand or newly construct.

Runway and Taxiway shall be overlaid in each stage.

3. Time of Implementation

3-1 Prospective timing of project start 1984/85, 1995/96

3-2 Time required for project completion 4 years, 2 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 - 1988: 109.8

1989 - 2000: 76.3

4-2 Annual Expenditure from 1988 to 2000: 2.82

after 2000: 4.77

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement Work	Runway	m	2,750	2,750	Overlay
		Taxiway	m	1,186	420	New
					1,186	Overlay
		Apron	spot	3:B4, 2:F27	3:B4	
		Car parking	m ²	1,600		
		Access road	m	2,500		
BLDG. Work	PAX Terminal BLDG.		m ²	6,980	6,830	
	Control Tower		set	1		
	POL.		set	1		

5. Preliminary Evaluation

While the actual air traffic managed at the Nawabshah Airport is not anything to speak of as a local airport, Nawabshah is supposed to maintain the function as the alternate aerodrome for Karachi Airport. Even though Nawabshah is designated so in AIP, the required facilities to meet this function are not made available yet.

Due to this situation, the wide-bodied aircrafts of PIA are unable to plan to be diverted to Nawabshah in case of emergency. Then, these aircrafts are incurring extra

expenditure of burning extra fuel for such more distant alternate airports as Islamabad and Lahore. According to PIA, the extra expenditure for 1981 is estimated as shown in Table A-1 in financial terms.

Taking the saving of these extra burn off as the benefits, cost benefit analysis has been conducted to analyze the development project of Nawabshah Airport to the full alternate aerodrome for Karachi. Table A-2 shows the outcome of the analysis in the case the facilities are fully developed, while Table A-3 in the case the building development is in a half scale. It can be interpreted that an early and full implementation is economically feasible.

Taking into consideration such further benefits as the saving of fuel consumption brought to other aircrafts and the accomplishment of reliable image of Karachi Airport, this project is recommended to carry out in an early timing of the 6th Five Year Plan period.

Table A-1 Extra Expenditure (Financial) Due to Non-availability of Nawabshah as the Alternate for Widebodied Aircrafts (1981)

Aircraft	Number of Incoming Flights	Extra Burn off (gal/Hr)	Average Price (Rs/gal)	Extra Expenditure (Rs)
B-747	832	148	15.3	2,825,971
DC-10	1,976	112	15.4	5,112,307
A-300	3,068	76	15.4	5,386,181
Total	5,876	-	-	13,324,459

Source: PIA

Note: Average flying time is assumed to be 1.5 hrs.

Table A-2 Nawabshah Airport Development Project
Stream of Economic Costs and Benefits
(Full development)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	31,958,000		31,958,000	
2	1984/85	31,958,000		31,958,000	
3	1985/86	31,958,000		31,958,000	
4	1986/87		2,940,000	2,940,000	20,721,396
5	1987/88		2,940,000	2,940,000	22,379,106
6	1988/89		2,940,000	2,940,000	23,498,060
7	1989/90		2,940,000	2,940,000	24,672,961
8	1990/91		2,940,000	2,940,000	25,906,609
9	1991/92		2,940,000	2,940,000	27,201,937
10	1992/93		2,940,000	2,940,000	28,562,033
11	1993/94		2,940,000	2,940,000	29,990,134
12	1994/95		2,940,000	2,940,000	31,489,639
13	1995/96		2,940,000	2,940,000	33,064,117
14	1996/97	45,046,000	2,940,000	48,086,000	34,717,322
15	1997/98		4,313,000	4,313,000	36,453,188
16	1998/99		4,313,000	4,313,000	38,275,846
17	1999/00		4,313,000	4,313,000	40,189,639
18	2000/01		4,313,000	4,313,000	42,199,120
19	2001/02		4,313,000	4,313,000	44,309,070
20	2002/03		4,313,000	4,313,000	46,524,523
21	2003/04		4,313,000	4,313,000	48,850,736
22	2004/05		4,313,000	4,313,000	51,293,270
23	2005/06		4,313,000	4,313,000	53,857,936
IRR = 19.21					

Source: Study Team

**Table A-3 Nawabshah Airport Development Project
Stream of Economic Costs and Benefits
(Building development in a half scale)**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	27,534,000		27,534,000	
2	1984/85	27,534,000		27,534,000	
3	1985/86	27,534,000		27,534,000	
4	1986/87		2,571,000	2,571,000	20,721,396
5	1987/88		2,571,000	2,571,000	22,379,106
6	1988/89		2,571,000	2,571,000	23,498,060
7	1989/90		2,571,000	2,571,000	24,672,961
8	1990/91		2,571,000	2,571,000	25,906,609
9	1991/92		2,571,000	2,571,000	27,201,937
10	1992/93		2,571,000	2,571,000	28,562,033
11	1993/94		2,571,000	2,571,000	29,990,134
12	1994/95		2,571,000	2,571,000	31,489,639
13	1995/96		2,571,000	2,571,000	33,064,117
14	1996/97	32,593,000	2,571,000	35,164,000	34,717,322
15	1997/98		3,607,000	3,607,000	36,453,188
16	1998/99		3,607,000	3,607,000	38,275,846
17	1999/00		3,607,000	3,607,000	40,189,639
18	2000/01		3,607,000	3,607,000	42,991,120
19	2001/02		3,607,000	3,607,000	44,309,070
20	2002/03		3,607,000	3,607,000	46,524,523
21	2003/04		3,607,000	3,607,000	48,850,736
22	2004/05		3,607,000	3,607,000	51,293,270
23	2005/06		3,607,000	3,607,000	53,857,936
IRR= 22.16					

Source: Study Team

1. Name of Project: Moenjodaro Airport Project:

2. Description

In order to accommodate the growing demands, the terminal facilities (Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1995/96

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 17.2

1989 – 2000: 6.8

4-2 Annual Expenditure from 1988 to 2000: 0.15

after 2000: 0.17

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL WORK	Pavement	Runway	m	1,980	1,980	Overlay
		Taxiway	m		230	Overlay
	Work	Apron	spot			
		Car parking	m ²			
PAX Terminal BLDG.			m ²	700		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is pre-requisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Sukkur Airport Project:

2. Description

In order to accommodate the growing demands, the terminal facilities (Apron spot, Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1989/90

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 - 1988: 8.0

1989 - 2000: 20.7

4-2 Annual Expenditure from 1988 to 2000: 0.21

after 2000: 0.28

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL WORK	Pavement	Runway	m		2,750	Overlay
		Taxiway	m		2,990	Overlay
	Work	Apron	spot	1;F27		
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	980		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berth are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Quetta Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1991/92

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 - 1988: 0.8

1989 - 2000: 38.6

4-2 Annual Expenditure from 1988 to 2000: 0.01

after 2000: 0.16

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m		3,660	Overlay
		Taxiway	m		600	Overlay
	Work	Apron	spot			
		Car parking	m ²	1,630	2,860	
PAX Terminal BLDG.			m ²			
Cargo Terminal BLDG.			m ²	90	60	

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is pre-requisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Panjgur Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Apron spot, Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1995/96

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 15.8

1989 – 2000: 6.9

4-2 Annual Expenditure from 1988 to 2000: 0.18

after 2000: 0.23

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement	Runway	m	1,560	1,560	Overlay
		Taxiway	m	120	120	Overlay
	Work	Apron	spot		1;F27	
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	840		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berth are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Turbat Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Apron spot, Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1995/96

3-2 Time required for project completion 2 years, year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 - 1988: 14.7

1989 - 2000: 8.2

4-2 Annual Expenditure from 1988 to 2000: 0.23

after 2000: 0.29

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL WORK	Pavement	Runway	m	1,800	1,800	Overlay
		Taxiway	m	370	370	Overlay
	Work	Apron	spot	1;F27	1;F27	
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	960		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berth are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Pasni Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1992/93

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 - 1988: 6.6

1989 - 2000: 13.7

4-2 Annual Expenditure from 1988 to 2000: 0.16

after 2000: 0.21

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL Work	Pavement	Runway	m		2,750	Overlay
		Taxiway	m		150	Overlay
	Work	Apron	spot			
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	980		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is pre-requisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Gwadar Airport Project

2. Description

The runway is desired to extend and widen suitable for international flight, and to be overlaid for good pavement condition.

In order to accommodate the growing demands, the terminal facilities (Apron spot, Car parking and Pax Terminal Bldg.) shall be expanded.

3. Time of Implementation

3-1 Prospective timing of project start 1986/87, 1995/96

3-2 Time required for project completion 2 years, 1 year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 45.1

1989 – 2000: 11.9

4-2 Annual Expenditure from 1988 to 2000: 1.15

after 2000: 1.22

Item	Year	UNIT	1983-1988	1989-2000	REMARK	
CIVIL WORK	Pavement	Runway	m	500		Extension
			m	1,500		Widening 23+45
		m	1,500	2,000	Overlay	
	Work	Taxiway	m		235	Overlay
	Apron	spot			1:F-27	
	Car parking	m ²	1,600			
PAX Terminal BLDG.		m ²	1,050			

5. Preliminary Evaluation

Since Gwadar is designated as an international airport, it is to be provided with the runway which enables the international flights to make safest movements. The expansion and widening of the existing runway are proposed to be implemented during the 6th Five Year Plan period for this purpose.

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berths are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the

requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Jiwani Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1995/96

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 23.5

1989 – 2000: 9.3

4-2 Annual Expenditure from 1988 to 2000: 0.22

after 2000: 0.25

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement Work	Runway	m	1,500	1,800	Overlay
		Taxiway	m	300	300	Overlay
		Apron	spot			
		Car parking	m ²	1,600		
PAX Terminal BLDG.			m ²	1,040		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is pre-requisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Sui Airport Project

2. Description

In order to accommodate the growing demands, the terminal facilities (Car parking and Pax Terminal Bldg.) shall be expanded.

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1987/88, 1995/96

3-2 Time required for project completion 1 year each

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 8.0

1989 – 2000: 10.2

4-2 Annual Expenditure from 1988 to 2000: 0.21

after 2000: 0.24

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL WORK	Pavement	Runway	m		1,500	Overlay
		Taxiway	m		150	Overlay
	Work	Apron	spot			
	Car parking	m ²	1,600			
PAX Terminal BLDG.			m ²	1,200		

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the passenger terminal building and/or car parking is pre-requisite. While the facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement, as for the implementation timing some flexibility is left within the extent the consequent congestions can be allowed.

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: New Airport Project

2. Description

From the viewpoint of civil minimum, construction of local airports may be justified feasible. Therefore, whole facilities are planned to be provided suitable for F-27 class aircraft.

3. Time of Implementation

3-1 Prospective timing of project start Not known at this stage yet

3-2 Time required for project completion 2 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988:
1989 – 2000: 174.7

4-2 Annual Expenditure from 1988 to 2000: 4.09
after 2000: 4.49

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL Work	Pavement Work	Runway	m		2,000	
		Taxiway	m		75	
		Apron	spot		2:F-27	
		Car parking	m ²		1,600	
		Access road	m		2,000	
PAX Terminal BLDG.			m ²		1,200	

5. Preliminary Evaluation

Beside the two airports presently under construction, Bannu and Ormara, there are a number of new local airports which come up for discussion. Paying attention to their back-grounds, they can be grouped into three.

Firstly, Zhob, Sibi and Khuzdar have been examined as the candidate project sites with highest priorities. These sites are situated in the rather remote areas of Baluchistan, expecting relatively small public demand as shown in Table A-4, but given attention rather from a point of view of regional development and some other governmental aspects.

(1) Sibi

Sibi is the headquarter of the District with the population of approximately 400,000,

whose principal occupation is agriculture (wheat, rice, barley and etc.) while a small portion of the population is engaged in the service sector. Sibi is linked to the major cities by the National Highway as well as the Sukkur-Quetta Railway line. Under such a circumstance, a rather limited volume of public demand are expected to Karachi, Sukkur and Quetta. However, the airport development is required for the future development of area and the administrative and other governmental purposes. The Policy of Study basically accepts this stand.

(2) Zhob

Another site positively supported by the Study Policy is Zhob. The case of Zhob holds some similarity to Sibi in the sense that the requirement is based on the social and governmental needs rather than public demand. The existing runway is proposed to be improved to fit the F-27 operations.

(3) Khuzdar

Khuzdar is the headquarter of the District with the population of approximately 300,000, whose principal occupation is agriculture of the variety crops including wheat, barley and potatoes. The public in Khuzdar has needs for travel to Quetta and Karachi which at present is managed only by road. Diversion from the existing road transport can be expected to the air upon the project implementation. Although the estimated air traffic demand is a little higher than the Sibi case, the basic concept of airport development is the same as that of Sibi.

Table A-4 Forecasted Demand for New Local Airports

(Trips)

Airport	1987/88	1999/2000
Bannu	10,232	15,174
Sargodha	66,612	132,156
D.G.Khan	11,444	17,688
Bahawalpur	20,358	31,724
Rahimyar Khan	20,402	34,804
Zhob	4,570	6,938
Sibi	1,540	2,604
Khuzdar	27,960	50,276
Ormara	15,478	24,520

Source: Study Team

The second group of sites for potential airport development includes Sargodha, Rahimyar Khan, Bahawalpur and D.G. Khan. As seen in Table 2-A-4, these candidate sites have relatively higher potentials in terms of forecasted demand volume. These sites are considered to develop the airport network of Pakistan more extensive, sometimes taking advantage of some existing facilities developed in early days.

The third group of sites for potential airport development includes Abbottabad, Jacobabad, Sialkot, Sahiwal, Sehwarsharief and Mirpurkhas. These sites have been mentioned by some Pakistani officers rather intuitively, but much consideration has not been made yet. However, it can be understood that there are some opinions to further extend the airport network of Pakistan.

Incidentally, two additional airports situated in Kashmir are also under consideration, namely, Muzaffarabad and Mirpur. The potential of airport development at these two sites are observed rather favorably for the former being the Capital City of Kashmir and the latter sending many migrants to the Middle East.

In consideration of the facts that the investments in the major and other existing airports have been kept down for the past years, their requirement for investment is expected to rush during the 6th Five Year Plan period. From an economic and safety point of view, it is basically admitted that higher priorities should be placed on the major and other existing airports during the 6th Five Year Plan period.

Once it comes to the stage where new airports can be invested in, the sites of the first group, namely Sibi, Zhob and Khuzdar, have high priorities from a point of view of regional development and some other governmental aspects. This will be followed by the sites of the second group, namely Sargodha, Rahimyar Khan, Bahawalpur and D.G. Khan. Then, a small number of the airports may be developed at the sites mentioned in the third group before the year 2000.

1. Name of Project: Islamabad Airport Project

2. Description

Islamabad International airport is going to play more important role in Pakistan aviation as an airport of capital. So, it is necessary to develop the 3,200 m runway for operation of long haul aircraft and to relocate the whole facilities of terminal area to north side of runway from a viewpoint of it's function and expansibility. In addition, the runway and taxiway are to be overlaid for good pavement condition in the long term planning.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1988/89

3-2 Time required for project completion 5 years, 10 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 553.7

1989 – 2000: 373.5

4-2 Annual Expenditure from 1988 to 2000: 12.33

after 2000: 21.14

Item		Year	UNIT	1983-1988	1989-2000	REMARK	
Civil Work	Pavement	Runway	m	450		Extension	
					3,200	Overlay	
	Work	Taxiway	m	3,138		New	
					3,138	Overlay	
	Apron	spot	3:B-747 1:T-jet			4:B-747 2:F-27	PAX loading
			1:B-747			1:B-747	Cargo
			3:B-747 2:T-jet 4:F-27			4:B-747	Night stay
			2:B-747				VIP
	Car parking	m ²		8,340	30,190		
	PAX Terminal BLDG			m ²	10,430	19,130	
VIP BLDG			m ²	5,000			
Control tower			set	1			
Administration office			set	1			
POL			m ²	4,700	1,800		
Cargo Terminal BLDG.			m ²	5,520	6,250		

5. Preliminary Evaluation

The development of Islamabad Airport may be basically divided into three phases, beside the periodical overlay of runway and taxiway. The major parts of the first phase include the extension of runway and the development of parallel taxiway.

The present runway length of 2,750 m seems adequate to receive such large aircrafts as DC-10 and B-747 operated on domestic routes. However, it is more appropriate for Islamabad Airport as a primary international airport to be provided with the runway of 3,200 m.

The absence of parallel taxiway is a part of the causes for air traffic congestions at Islamabad shown in Table A-5. This is because the runway occupancy by landed aircrafts becomes high for taxiing back on the runway. Then, Table A-6 shows the outcomes of cost benefit analysis for the assumption sets of holding hour reduction and installation timing (see Tables A-7 to A-9 for the examples of cost benefit stream). According to the discussion between the concerned Pakistani officers and the Study Team, the reduction of holding hours is expected to be a few tens percents. Therefore, the economic feasibility of the project's early implementation is not fully assured from the above quantitative analysis.

The traffic standard applied in Japan for provision of parallel taxiway is that number of landing and take-off under instrument flight rule during peak hours is 8 times or more. In the case of Islamabad, the peak hour aircraft movements are estimated 6 in 1987/88 and 8 in 1999/2000. Trafficwise, the situation just reaches the standard in the long-term target year.

In consideration of further factors, first of all, it can be pointed out the joint use of the airport for PAF and civil is actually making the traffic condition worse than explained above. Also, Islamabad Airport as a Capital International Airport of Pakistan is expected to receive some intangible benefit from the parallel taxiway provision project.

Synthesizing the above discussion, the parallel taxiway is proposed to be developed, if possible, late in the 6th Five Year Plan period, and if not early in the 7th. This is also desirable from a planning point of view, because the runway extension project and terminal area development project can be conveniently coordinated.

The rest of the first phase and the following two phases are mostly for the development of terminal area including aprons, terminal building and car parkings. The Study is proceeded based upon the concept of developing the terminal area north of the existing runway. This concept is supported by the following points.

- (1) The capacity of existing terminal facilities is by no means inadequate for the estimated traffic in 1987/88, but the site has very limited area for expansion.
- (2) The existing runway is estimated to be capable of managing the estimated traffic if the parallel taxiway is constructed. The development of new terminal facilities

north of the existing runway is expected to be successful in (a) separation between the PAF and civil traffics, (b) taking advantage of the existing terminal facilities and (c) better access connection to Islamabad. Also, the area of site is large enough to design a terminal attractive enough as the Capital airport.

- (3) While no significant additional benefits can be found in developing a completely new airport at a different site, several losses and disadvantages can be identified. Included among them are construction of an additional runway and related facilities, abandonment of the existing terminal facilities, and relatively disadvantageous access condition.

Table A-5 Annual Economic Holding Cost of the PIA Aircrafts at Islamabad Airport (1981)

Type of Aircrafts	Holding Hours(Hrs)	Unit Cost(Rs/Hr)	Total Cost (Rs)
B747	30	89,969	2,699,070
DC10	90	66,704	6,003,360
A300	15	54,238	813,570
B707	25	35,540	888,500
B720	15	32,305	484,575
F27	160	5,657	905,120
Total	335	-	11,794,195

Source: PIA (Economic cost is calculated by Study Team)

Table A-6 Economic Return (IRR) of Islamabad Airport Parallel Taxiway Project

(%)

Reduction of Holding Hours (%)	Installation Timing (Project Start)		
	1983 / 84	1986 / 87	1988 / 89
10	-	-	-
20	3.43	5.20	6.34
30	9.21	11.24	12.54
40	13.77	16.12	17.61

Source: Study Team

Table A-7 Islamabad Airport Parallel Taxiway Project
Stream of Economic Costs and Benefits
(Holding Hours: 20% Reduction, Installation
Timing: 1983/84)

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	25,557,500		25,557,500	
2	1984/85	25,557,500		25,557,500	
3	1985/86		1,357,000	1,357,000	3,612,750
4	1986/87		1,357,000	1,357,000	3,934,284
5	1987/88		1,357,000	1,357,000	4,284,435
6	1988/89		1,357,000	1,357,000	4,460,097
7	1989/90		1,357,000	1,357,000	4,642,960
8	1990/91		1,357,000	1,357,000	4,833,321
9	1991/92		1,357,000	1,357,000	5,031,487
10	1992/93		1,357,000	1,357,000	5,237,777
11	1993/94		1,357,000	1,357,000	5,452,525
12	1994/95		1,357,000	1,357,000	5,676,077
13	1995/96	13,649,000	1,357,000	15,006,000	5,908,797
14	1996/97		1,357,000	1,357,000	6,515,056
15	1997/98		1,357,000	1,357,000	6,403,249
16	1998/99		1,357,000	1,357,000	6,665,781
17	1999/00		1,357,000	1,357,000	6,939,076
18	2000/01		1,357,000	1,357,000	7,223,578
19	2001/02		1,357,000	1,357,000	7,519,743
20	2002/03		1,357,000	1,357,000	7,828,052
21	2003/04		1,357,000	1,357,000	8,149,003
22	2004/05		1,357,000	1,357,000	8,483,111

IRR= 3.43

Source: Study Team

Table A-8 Islamabad Airport Parallel Taxiway Project
Stream of Economic Costs and Benefits
(Holding Hours: 30% Reduction, Installation
Timing: 1983/84)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	25,557,500		25,557,500	
2	1984/85	25,557,500		25,557,500	
3	1985/86		1,357,000	1,357,000	5,419,124
4	1986/87		1,357,000	1,357,000	5,901,426
5	1987/88		1,357,000	1,357,000	6,426,653
6	1988/89		1,357,000	1,357,000	6,690,145
7	1989/90		1,357,000	1,357,000	6,964,440
8	1990/91		1,357,000	1,357,000	7,249,981
9	1991/92		1,357,000	1,357,000	7,547,230
10	1992/93		1,357,000	1,357,000	7,856,665
11	1993/94		1,357,000	1,357,000	8,178,787
12	1994/95		1,357,000	1,357,000	8,514,116
13	1995/96	13,649,000	1,357,000	15,006,000	8,863,195
14	1996/97		1,357,000	1,357,000	9,226,585
15	1997/98		1,357,000	1,357,000	9,604,873
16	1998/99		1,357,000	1,357,000	9,998,672
17	1999/00		1,357,000	1,357,000	10,408,614
18	2000/01		1,357,000	1,357,000	10,835,366
19	2001/02		1,357,000	1,357,000	11,279,614
20	2002/03		1,357,000	1,357,000	11,742,078
21	2003/04		1,357,000	1,357,000	12,223,504
22	2004/05		1,357,000	1,357,000	12,724,666

IRR= 9.20

Source: Study Team

**Table A-9 Islamabad Airport Parallel Taxiway Project
Stream of Economic Costs and Benefits
(Holding Hours: 40% Reduction, Installation
Timing: 1983/84)**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	25,557,500		25,557,500	
2	1984/85	25,557,500		25,557,500	
3	1985/86		1,357,000	1,357,000	7,225,499
4	1986/87		1,357,000	1,357,000	7,868,568
5	1987/88		1,357,000	1,357,000	8,568,871
6	1988/89		1,357,000	1,357,000	8,920,194
7	1989/90		1,357,000	1,357,000	9,285,920
8	1990/91		1,357,000	1,357,000	9,666,642
9	1991/92		1,357,000	1,357,000	10,062,973
10	1992/93		1,357,000	1,357,000	10,475,554
11	1993/94		1,357,000	1,357,000	10,905,049
12	1994/95		1,357,000	1,357,000	11,352,155
13	1995/96	13,649,000	1,357,000	15,006,000	11,817,593
14	1996/97		1,357,000	1,357,000	12,302,113
15	1997/98		1,357,000	1,357,000	12,806,498
16	1998/99		1,357,000	1,357,000	13,331,562
17	1999/00		1,357,000	1,357,000	13,878,152
18	2000/01		1,357,000	1,357,000	14,447,155
19	2001/02		1,357,000	1,357,000	15,039,486
20	2002/03		1,357,000	1,357,000	15,656,104
21	2003/04		1,357,000	1,357,000	16,298,005
22	2004/05		1,357,000	1,357,000	16,966,222
IRR= 13.77					

Source: Study Team

1. **Name of Project: Runway and Taxiway Project at Lahore Airport**

2. **Description**

The present runway strength is so weak that improvement of the runway is essential for operation of wide-bodied aircraft. But it is difficult to strengthen the runway without closing down completely. Therefore, parallel runway shall be newly provided and the existing runway is to be converted into parallel taxiway, which is overlaid for operation of wide-boiled aircraft.

3. **Time of Implementation**

3-1 **Prospective timing of project start** 1983/84, 1988/89

3-2 **Time required for project completion** 2 hears each

4. **Cost of Project (Rupees in million)**

4-1 **Initial Cost** 1983 – 1988: 458.7

1989 – 2000: 152.8

4-2 **Annual Expenditure** from 1988 to 2000: 10.89

after 2000: 14.80

Item		Year		UNIT	1983-1988	1989-2000	REMARK
		1983-1988	1989-2000				
CIVIL WORK	Pavement	Runway	m	3,250		New	
					6,000	Overlay	
	Taxiway	m	143	1,213	New		
				143	Overlay		

5. **Preliminary Evaluation**

The necessity of this project arises from that of extending and improving the existing runway. Although the present runway length of 2,750 m seems adequate to receive wide-bodied jet aircrafts operated on domestic routes, it is more appropriate for Lahore Airport as a major international airport to be provided with the runway of 3,250 m. Also, it needs to be strengthened to cater for the operation of increasing number of large aircrafts.

Due to the weak foundation of runway, a fairly long period of runway closure is required. A feasible solution is the construction of parallel runway followed by the conversion of the existing runway into the parallel taxiway.

The project timing is dependent on how urgently the runway improvement is needed.

Desirably, the parallel runway is proposed to be constructed during the 6th Five Year Plan period. If it is not possible for some financial reason, it is recommended to implement the project as early as possible after that.

1. Name of Project: Terminal Area Expansion Project at Lahore Airport

2. Description

Since the existing terminal area is distant from the runway and limited in space for development, it is necessary to relocate the terminal area near the runway from a view-point of its function and expansibility.

3. Time of Implementation

3-1 Prospective timing of project start 1985/86, 1988/89

3-2 Time required for project completion 3 years, 10 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 455.7

1989 – 2000: 129.9

4-2 Annual Expenditure from 1988 to 2000: 10.19

after 2000: 13.27

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL Work	Pavement Work	Apron	spot	5:B-747	1:Wide II	PAX loading
				2:T-jet		
				2:F-27		
				1:B-747		
3:F-27	1:F-27	Night stay				
1:B-747	1:B-747	VIP				
	Car parking	m ²	25,600	12,600		
PAX Terminal BLDG			m ²	17,950	7,750	
VIP BLDG			m ²	2,500	2,500	
Control tower			set	1		
Administration office			set	1		
POL			m ²	5,300	1,100	
Cargo Terminal BLDG.			m ²	3,100	3,550	

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of terminal facilities including the apron bay, passenger terminal building and car parking is the prerequisite. The required number of apron berths are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. Similarly, the

requirement for terminal building and car parking is obtained based upon the number of peak hour passengers and the unit space requirement.

The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts. So does the overlay of runway and taxiway. As for the expansion of terminal building and car parking, a postponement for a short period of time may be allowed if the consequent congestions are within the permissible extent.

1. Name of Project: Runway and Taxiway Project at Karachi Airport

2. Description

The existing main runway has a regular pattern of cracks, and is heavily marked with rubber. Therefore, the main runway is to be overlaid for good traffic condition. But it is difficult to overlay the runway without closing of aircraft operation because of the continuous traffic. In consideration of this situation, the secondary runway shall be extended to the same length of 3,200 m as the main runway, and new several taxiways shall be installed for use of these, while the main runway will be repaired and strengthened.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1988/89

3-2 Time required for project completion 4 years, 5 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 343.8

1989 – 2000: 82.6

4-2 Annual Expenditure from 1988 to 2000: 8.81

after 2000: 10.93

Item		Year	UNIT	1983-1988	1989-2000	REMARK
Civil Work	Pavement Work	Runway	m	915		Extension
				5,485	6,400	Overlay
	Taxiway	m	7,060		New	
				1,990	Overlay	

5. Preliminary Evaluation

The necessity of this project mainly arises from that of improving the existing main runway. Although this requires a period of runway closure, the impact on the international and domestic traffic is beyond the permissible extent if no other device is conceived.

What is proposed is, therefore, the development of the existing secondary runway to be fit for the substitute during the construction period of the main runway. Since the annual passengers at Karachi Airport is estimated to reach ten million including the transit by the year 2000, the upgraded secondary runway itself does not seem to be redundant in a long run.

The project timing is dependent on how urgently the improvement of existing main

runway is needed. Based on the examination from an engineering point of view, it is proposed to be implemented during the 6th Five Year Plan period. If it is not possible for some budgetary reason, it is recommended to implement the project at an earliest time possible after that.

1. Name of Project: Pax Loading Apron Expansion Project at Karachi Airport

2. Description

In order to meet with the growing demands, the terminal area is desirable to be radically improved and developed as a main gateway to the country side for international traffic.

From this standpoint, Pax loading apron is planned to expand in suitable site in correspondence with Pax terminal buildings.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1988/89

3-2 Time required for project completion 5 years, 10 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 242.8

1989 – 2000: 27.9

4-2 Annual Expenditure from 1988 to 2000: 6.21

after 2000: 6.93

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL WORK	Pavement	Taxiway	m	480		New
					480	Overlay
	Work	Apron	spot	10:B-747 1:Wide II 2:T-jet	4:B-747	PAX loading
				1:B-747	1:B-747	VIP

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of apron berths is the prerequisite. The required number of apron berths are planned based upon the forecasted peak hour movement and the apron occupancy time of aircrafts. The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts.

1. Name of Project: Cargo Terminal Area Project at Karachi Airport

2. Description

In order to accommodate the growing cargo demands, the new cargo loading apron shall be provided.

3. Time of Implementation

3-1 Prospective timing of project start 1984/85, 1995/96

3-2 Time required for project completion 4 years, 2 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 104.0

1989 – 2000: 104.5

4-2 Annual Expenditure from 1988 to 2000: 2.67

after 2000: 5.35

Item	Year	UNIT	1983-1988	1989-2000	REMARK
Apron		spot	3:B-747	2:B-747	Cargo
Cargo Terminal BLDG.		m ²	26,350	34,700	

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of apron berths is the prerequisite. The required number of apron berths are planned based upon the forecasted peak hour movement has the apron occupancy time of cargo aircrafts. The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts.

1. Name of Project: Night Stay Apron Project at Karachi Airport

2. Description

As the air traffic demands grow, the number of the required aircraft increases rapidly. Accordingly, the night stay apron is to be prepared at this airport as well as Pax loading apron.

3. Time of Implementation

3-1 Prospective timing of project start 1986/87, 1988/89

3-2 Time required for project completion 2 year, 10 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 28.4

1989 – 2000: 120.6

4-2 Annual Expenditure from 1988 to 2000: 0.73

after 2000: 3.82

Item	Year	UNIT	1983-1988	1989-2000	REMARK
Apron		spot	5:T-jet 3:F-27	10:B-747 3:T-jet	Night stay

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the expansion of apron berths is the prerequisite. The required number of night stay apron berths are planned based upon the forecasted number of aircrafts. The development of additional apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts.

1. Name of Project: Existing Apron Project at Karachi Airport

2. Description

The existing apron is relatively old rigid pavement and several areas near the edge of the apron opposite the international terminal show failure.

Therefore, the existing apron is desired to repave in long term planning.

3. Time of Implementation

3-1 Prospective timing of project start 1984/85

3-2 Time required for project completion 4 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 -- 1988: 212.5

1989 -- 2000: NIL

4-2 Annual Expenditure from 1988 to 2000: 5.44

after 2000: NIL

Item	Year	UNIT	1983-1988	1989-2000	REMARK
Apron		spot	4:B-747 2:T-jet 2:F-27		PAX loading
			7:T-jet		Night stay

5. Preliminary Evaluation

On the premise that the airport is to meet the forecasted demand, the retention of apron berths is the prerequisite. The required number of apron berths are planned based upon the forecasted peak-hour movement and the apron occupancy time of aircrafts. The rehabilitation of existing apron berths needs to be implemented without delay to maintain the safe and smooth movement of aircrafts.

1. Name of Project: International Pax Terminal Bldg. and Car Parking Project at Karachi Airport

2. Description

In order to accommodate the growing international demands, and develop the terminal area as a main gateway for international traffic, the terminal facilities for international use (Pax Terminal Bldg. and Car parking) shall be constructed from the same reason as the domestic terminal building.

3. Time of Implementation

3-1 Prospective timing of project start 1983/84, 1988/89

3-2 Time required for project completion 5 years, 10 years

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: 539.7

1989 – 2000: 290.6

4-2 Annual Expenditure from 1988 to 2000: 11.32

after 2000: 17.76

Item	Year	UNIT	1983-1988	1989-2000	REMARK
Car parking		m ²	40,660	27,070	
PAX Terminal BLDG		m ²	53,210	34,450	
VIP BLDG		m ²	2,500	2,500	
Control tower		set	1		
Administration office		set	1		
POL		m ²	20,800	6,500	

5. Preliminary Evaluation

In order to cater for the forecasted demand, the expansion of terminal facilities including the passenger terminal building and car parking. The facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement. In consideration of the important role of Karachi International Airport, such terminal facilities of the required capacity need to be developed without much delay.

1. **Name of Project:** Domestic Pax Terminal Bldg. and Car Parking Project at Karachi Airport

2. **Description**

The two existing passenger terminal buildings handle respectively the both domestic and international passengers from it's history.

Since this division of function has not a little problem and consequently cause inconvenient for passengers and airlines, the domestic terminal building is desired to be newly built in long term planning.

3. **Time of Implementation**

3-1 **Prospective timing of project start** 1985/86, 1988/89

3-2 **Time required for project completion** 3 years, 10 years

4. **Cost of Project (Rupees in million)**

4-1 **Initial Cost** 1983 – 1988: 129.9

1989 – 2000: 82.0

4-2 **Annual Expenditure** from 1988 to 2000: 2.57

after 2000: 4.42

Item	Year	UNIT	1983-1988	1989-2000	REMARK
Car parking		m ²	27,550	18,480	
PAX Terminal BLDG		m ²	14,760	9,900	

5. **Preliminary Evaluation**

In order to cater for the forecasted demand, the expansion of terminal facilities including the passenger terminal building and car parking is prerequisite. The facility requirement is obtained based upon the number of peak hour passengers and the unit space requirement. In consideration of the important role of Karachi Airport in the Pakistan's air transport, such terminal facilities of the required facilities need to be developed without much delay.

1. Name of Project: Ormara Airport Project

2. Description

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1995

3-2 Time required for project completion 1 year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: NIL

1989 – 2000: 14.2

4-2 Annual Expenditure from 1988 to 2000: NIL

after 2000: NIL

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL Work	Pavement Work	Runway	m		2,750	Overlay
		Taxiway	m		290	Overlay

5. Preliminary Evaluation

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project: Bannu Airport Project

2. Description

The runway and taxiway are to be overlaid for good pavement condition.

3. Time of Implementation

3-1 Prospective timing of project start 1995

3-2 Time required for project completion 1 year

4. Cost of Project (Rupees in million)

4-1 Initial Cost 1983 – 1988: NIL

1989 – 2000: 11.5

4-2 Annual Expenditure from 1988 to 2000: NIL

after 2000: NIL

Item		Year	UNIT	1983-1988	1989-2000	REMARK
CIVIL Work	Pavement Work	Runway	m		1,830	Overlay
		Taxiway	m		275	Overlay

5. Preliminary Evaluation

The overlay of runway and taxiway is indispensable to maintain the safe aircraft movements from an engineering point of view.

1. Name of Project

Regional air navigation systems and related building plan for Pakistan

2. Description of Project

Regional Buildings and airport facility rooms are newly constructed at Karachi, Islamabad and Lahore for regional air traffic services. Those include buildings for Flight Information Center, Air Traffic Control Center, Search and Rescue Coordination Center, etc.

Training facilities and centralized maintenance center are proposed at Karachi for familiarization to the highly sophisticated equipment and for satisfactory maintenance.

Remotely controlled VHF A/G communications facilities are planned for en-route air traffic control.

En-route nav aids (VOR/DME/NDB) are planned for modernization of en-route guidance in Pakistan territory.

3. Time of Implementation 5 years (1983/84 – 1987/88)

4 years (1988/89 – 1991/92)

4. Cost of Project (Rupees in million)	(1983/84 – 1987/88)	Rs. 340.3
	(1988/89 – 1991/92)	Rs. 275.7
		<u>Rs. 616.0</u>

	1983/84 – 1987/88	1988/89 – 1991/92
Regional Building		
Karachi	Newly Provided	—
Islamabad	Newly Provided	—
Lahore	Newly Provided	—
Airport Facilities Rooms	Newly Provided	Extended
Training Equipment	Newly Provided	Replaced
Maintenance Depot and Workshop	Newly Provided	—
Flight calibration facility	Newly Provided	—
En route Nav aids	Replaced or newly Provided	Additionally Provided
Amir Chah (CVOR/DME)		
Cape Monz (NDB)		
Chor (NDB)		
Malakand (DVOR/DME)		
Kalat (DVOR/DME)		

Gilgit (DVOR/MDE)	Replaced or newly provided	Additionally Provided
Sheikhupura (DVOR/DME)		
Skardu (DVOR/DME)		
Remotely controlled VHF A/G communications		

5. Preliminary Evaluation

The major components of project are the development of A/G communication systems for enroute traffic control and enroute navigation systems. The project aims at bringing these systems in Pakistan to the international standard. Consequently, the air routes can be securely established and the systems become more reliable even in bad weather conditions.

The other components of project include the development of regional building, training equipments and maintenance depot. As the more complicated systems are introduced in Pakistan, it becomes more important to properly operate and maintain them. These project components are the requirement to keep the efficient supporting activities for such operation and maintenance. And the project timing is set so as to correspond to the implementation timing of related system development.

1. **Name of Project: ARSR/SSR en-route radar network plan**

2. **Description of Project**

En-route radar facilities and communications network are newly constructed for entire enroute radar control within Pakistan territory. Those include 3 remote ARSR/SSR radar sites in the vicinity of Karachi, Quetta and Lahore, radar microwave links, control consoles and related buildings.

Each ARSR/SSR will have a coverage of 200 NM radius, covering almost whole Pakistan territory.

3. **Time of Implementation**

5 years (1992/93 – 1996/97)

(This project should be implemented after the completion of ASR/SSR plan at major airports)

4. **Cost of Project (Rupees in million)**

1992/93 – 1996/97 Rs. 490.9

	1983/84 – 1987/88	1992/93 – 1996/97
ARSR/SSR Sites in the vicinity of Karachi, Lahore and Quetta	—	Newly constructed
Radar Microwave Link	—	Newly constructed
Buildings / Shelters	—	Newly constructed
Flight Data Processing System and control consoles	—	Newly installed

5. **Preliminary Evaluation**

This project aims at bringing the enroute radar facilities in Pakistan to the international standard. The benefits can be discussed basically for two aspects, namely the safety and efficiency of navigation.

Firstly, the separation of aircrafts can be secured more highly than ever. Therefore, the safety in the air routes particularly at the intersections of air routes can be preserved. Secondly, since the aircrafts can be separated securely in closer distances, the capacity of air routes will increase. As a result, more efficient schedules and air routes can be taken by the civil aircrafts.

1. Name of Project: Air Navigation Systems Plan for Karachi Int'l Airport

2. Description Project

Replacement of the existing ASR by a modern ASR/SSR is a top urgent to expedite safe and efficient aircraft operation at Karachi CTR.

Radio navigation aids and aeronautical lighting systems are replaced and/or newly provided during fiscal years 1983/84 – 1986/87 for complete precision approach category – I.

New ILS Cat-I and Lighting Cat-I are provided for extended B-runway for the planned wholly maintenance of the main runway.

Radio navigation aids and aeronautical lighting systems which will have been provided during fiscal years 1983/84 – 1986/87 will be upgraded to category - II.

3. Time of Implementation 4 years (1983/84 – 1986/87)

7 years (1989/90 – 1995/96)

4. Cost of Project (Rupees in million) 1983/84 – 1986/87 Rs. 182.5

1989/90 – 1995/96 Rs. 107.0

Rs. 289.5

Major Works (Karachi)

	1983/84 – 1986/87	1989/90 – 1995/96
Radio Nav aids		
ILS	–	Up graded to Cat.-II.
VOR/DME	Replaced	–
T-DME	–	Newly Provided
NDB	–	–
Other		
Communications		
COM.	Upgraded	–
Aeronautical Lights		
Approach Lighting	–	Upgraded to Cat.-II.
Runway Lighting	–	Upgraded to Cat.-II.
VASIS	–	–
Taxiway Lighting	–	–
Apron Flood Lights		Provided additionally

ATC			
Terminal ASR/SSR	Replaced		—
Meteorological system			
Runway Visual	—	Newly Provided	
Range Meter	—		—
For Subrunway			
ILS	Cat.-I Newly Provided		—
Approach Lighting	Cat.-I Newly Provided		—
VASIS	Cat.-I Newly Provided		—
Runway Lighting	Cat.-I Newly Provided		—
Taxiway Edge Lights	Cat.-I Newly Provided		—

5. Preliminary Evaluation

Karachi is by far the busiest and most important airport in Pakistan. Nevertheless, the present ASR was installed in 1965 and is now operated only on a test basis during morning hours suffering from maintenance problems. It is observed that most of the congestions in the Controlled Terminal Area shown in Table A-10 are due to the conflicting traffic during the absence of active ASR.

Upon replacement of ASR, therefore, much of the congestions are expected to be solved. Tables A-11 and A-12 present the results of cost benefit analysis on the assumption that 10% and 20% of the saved holding hours, respectively, are counted as the project benefit. Judging from the obtained internal rates of return, the project appears quite feasible in these cases. At the same time, the actual reduction of holding hours will without any doubt exceeds these percentages. It can be concluded that even an immediate implementation of the ASR/SSR project is justifiable.

Considering the importance of the Karachi Airport's role, the ILS and lighting systems for Precision Approach Category II are proposed to be eventually provided. As an intermediate step, Precision Approach Category I is to be reached during the 6th Five Year Plan period by replacing and newly providing the radio navigation aids and aeronautical lighting systems.

Table A-10 Annual Economic Holding Cost of the PIA Aircrafts at Karachi Airport (1981)

Type of Aircrafts	Holding Hours(Hrs)	Unit Cost(Rs/Hr)	Total Cost (Rs)
B747	103	89,969	9,226,807
DC10	180	66,704	12,006,720
A300	307	54,238	16,651,066
B707	148	35,540	5,259,920
B720	112	32,305	3,618,160
F27	100	5,657	565,700
Total	950	-	47,368,373

Source: PIA (Economic cost is calculated by Study Team)

**Table A-11 Stream of Economic Costs and Benefits
(Holding Hours: 10% Reduction)
Karachi Airport ASR/SSR Project**

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	32,301,000		32,301,000	
2	1984/85		2,442,900	2,442,900	15,347,230
3	1985/86		2,442,900	2,442,900	16,575,008
4	1986/87		2,442,900	2,442,900	17,901,007
5	1987/88		2,442,900	2,442,900	19,333,086
6	1988/89		2,442,900	2,442,900	20,229,740
7	1989/90		2,442,900	2,442,900	21,314,725
8	1990/91		2,442,900	2,442,900	22,380,461
9	1991/92		2,442,900	2,442,900	23,499,482
10	1992/93		2,442,900	2,442,900	24,674,455
11	1993/94	12,920,400	2,442,900	15,363,300	25,908,178
12	1994/95		2,442,900	2,442,900	27,203,585
13	1995/96		2,442,900	2,442,900	28,563,761
14	1996/97		2,442,900	2,442,900	29,991,948
15	1997/98		2,442,900	2,442,900	31,491,545
16	1998/99		2,442,900	2,442,900	33,066,121
17	1999/00		2,442,900	2,442,900	34,719,428
18	2000/01		2,442,900	2,442,900	36,455,398
19	2001/02		2,442,900	2,442,900	38,278,163
20	2002/03		2,442,900	2,442,900	40,192,071
21	2003/04		2,442,900	2,442,900	42,201,663

IRR= 47.53

Source: Study Team

**Table A-12 Stream of Economic Costs and Benefits
(Holding Hours: 20% Reduction)
Karachi Airport ASR/SSR Project**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	32,301,000		32,301,000	
2	1984/85		2,442,900	2,442,900	30,694,461
3	1985/86		2,442,900	2,442,900	33,150,015
4	1986/87		2,442,900	2,442,900	35,802,014
5	1987/88		2,442,900	2,442,900	38,666,173
6	1988/89		2,442,900	2,442,900	40,599,479
7	1989/90		2,442,900	2,442,900	42,629,449
8	1990/91		2,442,900	2,442,900	44,760,922
9	1991/92		2,442,900	2,442,900	46,988,963
10	1992/93		2,442,900	2,442,900	49,348,911
11	1993/94	12,920,400	2,442,900	15,363,300	51,816,356
12	1994/95		2,442,900	2,442,900	54,407,170
13	1995/96		2,442,900	2,442,900	57,127,522
14	1996/97		2,442,900	2,442,900	59,983,896
15	1997/98		2,442,900	2,442,900	62,983,091
16	1998/99		2,442,900	2,442,900	66,132,243
17	1999/00		2,442,900	2,442,900	69,438,855
18	2000/01		2,442,900	2,442,900	72,910,796
19	2001/02		2,442,900	2,442,900	76,556,326
20	2002/03		2,442,900	2,442,900	80,384,143
21	2003/04		2,442,900	2,442,900	84,403,326
IRR= 95.52					

Source: Study Team

1. Name of Project: Air Navigation Systems Plan for Lahore Int'l Airport

2. Description of Project

A terminal ASR/SSR is provided during fiscal years 1989/90 – 1995/96 for Lahore Control Zone (CTR).

The D-VOR/DME is replaced by a modern one during fiscal years 1984/85 – 1985/86.

Approach lighting system and runway lighting are upgraded to Cat.-I during fiscal years 1984/85 – 1985/86 so that precision approach category-I could be performed in conjunction with the existing ILS Cat.-I.

The ILS and aeronautical lighting systems Category-I are upgraded to Category-II during fiscal years 1989/90 – 1995/96.

3. Time of Implementation 2 years (1984/85 – 1985/86)

7 years (1989/90 – 1995/96)

4. Cost of Project (Rupees in million) 1984/85 – 1985/86 Rs. 35.2

1989/90 – 1995/96 Rs. 158.8

Rs. 194.0

Major Works (Lahore)

	1984/85 – 1985/86	1989/90 – 1995/96
Radio Nav aids		
ILS	–	Upgraded to Cat.-II
VOR/DME	Replaced	–
T-DME	Newly Provided	–
NDB	–	–
Others		
Communications		
COM.	Upgraded	–
Aeronautical Lights		
Approach Lighting	Upgraded to Cat.-I	Upgraded to Cat.-II
Runway Lighting	Upgraded to Cat.-I	Upgraded to Cat.-II
VASIS	3 Bar Provided	–
Taxiway Lighting	–	Newly Provided
Apron Flood Lights	Provided	Additional one Provided

ATC		
Terminal ASR/SSR	--	Newly Provided
Meteorological system		
Runway Visual Range Meter	--	Newly Provided

5. Preliminary Evaluation

Due to the fact that the Lahore Airport is situated very close to the Indian border and there are a number of overflying traffic, some opinions support the installation of radar. The peak day aircraft movements at Lahore are forecasted to be 39 in 1987/88 and 46 in 1999/2000. Under such a circumstance, the installation of radar will be justified at least in future, but the installation timing is remaining controversial.

Table A-13 indicates the present holding hours and economic cost of PIA aircrafts at the Lahore Airport. Then, Table A-14 shows the outcomes of cost benefit analysis for the cross-sectional assumption of holding hour reduction and installation timing (see Tables A-15 to A-16 for the examples of cost benefit stream). It can be interpreted from these figures that 70 to 80% of the reduction of holding hours are expected to economically pay off the cost.

It is understood anyhow that the air traffic congestions are much less serious at the Lahore Airport than Karachi or Islamabad. The installation of remote radar at Lahore seems better to be left for the 7th Five Year Plan period or after.

Considering the importance of the Lahore Airport's role, the ILS and lighting systems for Precision Approach Category II are proposed to be eventually provided. As an intermediate step, Precision Approach Category I is to be reached during the 6th Five Year Plan period by replacing and newly providing the radio navigation aids and aeronautical lighting systems.

Table A-13 Annual Economic Holding Cost of the PIA Aircrafts at Lahore Airport (1981)

Type of Aircrafts	Holding Hours(Hrs)	Unit Cost(Rs/Hr)	Total Cost(Rs)
B747	-	89,969	-
DC10	10	66,704	667,040
A300	64	54,238	3,471,232
B707	11	35,540	390,940
B720	7	32,305	226,135
F27	83	5,657	469,531
Total	175	-	5,224,878

Source: PIA (Economic cost is calculated by Study Team)

Table A-14 Economic Return (IRR) of Remote Radar Installation Project at Lahore Airport

Reduction of Holding Hours (%)	Installation Timing (Project Start) (%)			
	1983/84	1986/87	1988/89	1991/92
10	-	-	-	-
20	-	-	-	-
30	-	-	-	-
40	-	1.09	2.65	5.00
50	2.95	5.55	7.14	9.60
60	6.52	9.31	10.99	13.64
70	9.64	12.68	14.49	17.36
80	12.48	15.81	17.76	20.89
90	15.13	18.78	20.89	24.30
100	17.64	21.65	23.93	27.63

Source: Study Team

**Table A-15 Stream of Economic Costs and Benefits
(Holding Hours: 80% Reduction)
(Installation Timing: 1989/90)
Remote Radar Installation Project at Lahore
Airport**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1989/90	33,966,000		33,966,000	
2	1990/91		2,565,300	2,565,300	7,582,314
3	1991/92		2,565,300	2,565,300	7,885,607
4	1992/93		2,565,300	2,565,300	8,201,031
5	1993/94		2,565,300	2,565,300	8,529,072
6	1994/95		2,565,300	2,565,300	8,870,235
7	1995/96		2,565,300	2,565,300	9,225,044
8	1996/97		2,565,300	2,565,300	9,594,045
9	1997/98		2,565,300	2,565,300	9,977,806
10	1998/99		2,565,300	2,565,300	10,376,919
11	1999/00	13,586,400	2,565,300	16,151,700	10,791,995
12	2000/01		2,565,300	2,565,300	11,223,675
13	2001/02		2,565,300	2,565,300	11,672,621
14	2002/03		2,565,300	2,565,300	12,139,525
15	2003/04		2,565,300	2,565,300	12,625,106
16	2004/05		2,565,300	2,565,300	13,130,108
17	2005/06		2,565,300	2,565,300	13,655,312
18	2006/07		2,565,300	2,565,300	14,201,527
19	2007/08		2,565,300	2,565,300	14,769,587
20	2008/09		2,565,300	2,565,300	15,360,370
21	2009/10		2,565,300	2,565,300	15,974,784

IRR= 17.76

Source: Study Team

Table A-16 Stream of Economic Costs and Benefits
(Holding Hours: 80% Reduction)
(Installation Timing: 1992/93)
Remote Radar Installation Project at Lahore
Airport

		(Rs)			
Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1992/93	33,966,000		33,966,000	
2	1993/94		2,565,300	2,565,300	8,529,072
3	1994/95		2,565,300	2,565,300	8,870,235
4	1995/96		2,565,300	2,565,300	9,225,044
5	1996/97		2,565,300	2,565,300	9,594,045
6	1997/98		2,565,300	2,565,300	9,977,807
7	1998/99		2,565,300	2,565,300	10,376,919
8	1999/00		2,565,300	2,565,300	10,791,995
9	2000/01		2,565,300	2,565,300	11,223,674
10	2001/02		2,565,300	2,565,300	11,672,622
11	2002/03	13,586,400	2,565,300	16,151,700	12,139,526
12	2003/04		2,565,300	2,565,300	12,625,107
13	2004/05		2,565,300	2,565,300	13,130,111
14	2005/06		2,565,300	2,565,300	13,655,314
15	2006/07		2,565,300	2,565,300	14,201,526
16	2007/08		2,565,300	2,565,300	14,769,585
17	2008/09		2,565,300	2,565,300	15,360,368
18	2009/10		2,565,300	2,565,300	15,974,786
19	2010/11		2,565,300	2,565,300	16,613,776
20	2011/12		2,565,300	2,565,300	17,278,326
21	2012/13		2,565,300	2,565,300	17,969,459
IRR=		20.89			

Source: Study Team

1. Name of Project: Air Navigation Systems Plan for Islamabad International Airport

2. Description of Project

A terminal ASR/SSR is planned during fiscal years 1983/84 – 1985/86 for Islamabad Control Zone (CTR).

Radio navigation aids and aeronautical lighting systems which allow precision approach category-I operations are maintained as they are, but obsolescent equipment are replaced by modern ones.

Radio navigation aids and aeronautical lighting system category-I are upgraded to category-II during fiscal years of 1989/90 – 1995/96.

3. Time of Implementation 3 years (1983/84 – 1985/86)
7 years (1989/90 – 1995/96)

4. Cost of Project (Rupees in million) 1983/84 – 1985/86 Rs. 145.9
1989/90 – 1995/96 Rs. 87.9
Rs. 233.8

Major Works (Islamabad)

	1983/84 – 1985/86	1989/90 – 1995/96
Radio Nav aids		
ILS	–	Upgraded to Cat. II
VOR/DME	Replaced	–
T-DME	Newly Provided	–
NDB	Replaced	–
Others		
Communications		
COM.	Upgraded	–
Aeronautical Lights		
Approach Lighting	–	Upgraded to Cat. II
Runway Lighting	–	Ditto
VASIS	Newly Provided	–
Taxiway Lighting	Ditto	–
Apron Flood Lights	Ditto	–

ATC		
Terminal ASR/SSR	Newly Provided	—
Meteorological system		
Runway Visual Range Meter	—	Newly Provided

5. Preliminary Evaluation

The Islamabad Airport is estimated to meet the peak day aircraft movements of 34 in 1987/88 and 47 in 1999/2000. In comparison with those of the Karachi Airport which are 150 in 1987/88 and 197 in 1999/2000, the congestion seems less serious. Nevertheless, Islamabad is the nation's capital and receives a number of international flights and VIP flights as well as many PAF flights. Therefore, the necessity of radar is agreeable at least in future, and the controversial is the installation timing.

Table A-17 indicates the present holding hours and economic cost of PIA aircrafts at the Islamabad Airport. This is attributable partly to the absence of radar and also partly to the absence of parallel taxiway which is occupied by the landed aircrafts for taxiing back. Table A-18 shows the outcomes of cost benefit analysis for the assumption sets of holding hour reduction and installation timing (see Tables A-19 to A-22 for the examples of cost benefit stream). Since it can be accepted that the opportunity value of capital in the transport sector is somewhere near the middle of 10 and 15%, those cases which have higher economic returns than the one with 30% holding hour reduction and installed in 1988/89 appear to be feasible.

In actual, discussion has been held between the concerned Pakistani officers and Study Team that nearly half of the holding hours is the least expectation for reduction due to the more skillful separation of aircrafts enabled by the radar. Taking into consideration such further benefits as the holding hour reduction of other Pakistani and foreign aircrafts and the prestige of the capital city airport, the installation project of remote radar at the Islamabad Airport is justifiable during the 6th Five Year Plan period.

Considering the importance of the Islamabad Airport's role, the ILS and lighting systems for Precision Approach Category II are proposed to be eventually provided. As an intermediate step, Precision Approach Category I is to be reached during the 6th Five Year Plan period by replacing and newly providing the radio navigation aids and aeronautical lighting systems.

**Table A-17 Annual Economic Holding Cost of the PIA Aircrafts
at Islamabad Airport (1981)**

Type of Aircrafts	Holding Hours(Hrs)	Unit Cost(Rs/Hr)	Total Cost (Rs)
B747	30	89,969	2,699,070
DC10	90	66,704	6,003,360
A300	15	54,238	813,570
B707	25	35,540	888,500
B720	15	32,305	484,575
F27	160	5,657	905,120
Total	335	-	11,794,195

Source: PIA (Economic cost is calculated by Study Team)

**Table A-18 Economic Return (IRR) of Remote Radar Installation
Project at Islamabad Airport**

Reduction of Holding Hours (%)	Installation Timing (Project Start)			
	1983/84	1986/87	1988/89	1991/92
10	-	-	-	-
20	0.95	3.50	5.07	7.46
30	8.96	11.93	13.71	16.53
40	15.20	18.87	20.98	24.40
50	20.73	25.23	27.74	31.84
60	25.91	31.34	34.27	39.10
70	30.88	37.32	40.70	46.27
80	35.73	43.23	47.07	53.40
90	40.50	49.10	53.40	60.50
100	45.21	54.96	59.72	67.59

Source: Study Team

**Table A-19 Stream of Economic Costs and Benefits
(Holding Hours: 40% Reduction)
(Installation Timing: 1983/84)
Remote Radar Installation Project
at Islamabad Airport**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1983/84	33,966,000		33,966,000	
2	1984/85		2,565,300	2,565,300	6,109,428
3	1985/86		2,565,300	2,565,300	6,659,276
4	1986/87		2,565,300	2,565,300	7,258,611
5	1987/88		2,565,300	2,565,300	7,911,885
6	1988/89		2,565,300	2,565,300	8,228,360
7	1989/90		2,565,300	2,565,300	8,557,495
8	1990/91		2,565,300	2,565,300	8,899,794
9	1991/92		2,565,300	2,565,300	9,255,786
10	1992/93		2,565,300	2,565,300	9,626,017
11	1993/94	13,586,400	2,565,300	16,151,700	10,011,057
12	1994/95		2,565,300	2,565,300	10,411,499
13	1995/96		2,565,300	2,565,300	10,827,959
14	1996/97		2,565,300	2,565,300	11,261,077
15	1997/98		2,565,300	2,565,300	11,711,520
16	1998/99		2,565,300	2,565,300	12,179,980
17	1999/00		2,565,300	2,565,300	12,667,178
18	2000/01		2,565,300	2,565,300	13,173,865
19	2001/02		2,565,300	2,565,300	13,700,818
20	2002/03		2,565,300	2,565,300	14,248,850
21	2003/04		2,565,300	2,565,300	14,818,807

IRR=15.20

Source: Study Team

**Table A-20 Stream of Economic Costs and Benefits
(Holding Hours: 40% Reduction)
(Installation Timing: 1986/87)
Remote Radar Installation Project
at Islamabad Airport**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1986/87	33,966,000		33,966,000	
2	1987/88		2,565,300	2,565,300	7,911,885
3	1988/89		2,565,300	2,565,300	8,228,360
4	1989/90		2,565,300	2,565,300	8,557,495
5	1990/91		2,565,300	2,565,300	8,899,794
6	1991/92		2,565,300	2,565,300	9,255,786
7	1992/93		2,565,300	2,565,300	9,626,017
8	1993/94		2,565,300	2,565,300	10,011,057
9	1994/95		2,565,300	2,565,300	10,411,499
10	1995/96		2,565,300	2,565,300	10,827,959
11	1996/97	13,586,400	2,565,300	16,151,700	11,261,077
12	1997/98		2,565,300	2,565,300	11,711,520
13	1998/99		2,565,300	2,565,300	12,179,980
14	1999/00		2,565,300	2,565,300	12,667,178
15	2000/01		2,565,300	2,565,300	13,173,865
16	2001/02		2,565,300	2,565,300	13,700,818
17	2002/03		2,565,300	2,565,300	14,248,850
18	2003/04		2,565,300	2,565,300	14,818,807
19	2004/05		2,565,300	2,565,300	15,411,558
20	2005/06		2,565,300	2,565,300	16,028,020
21	2006/07		2,565,300	2,565,300	16,669,140

IRR= 18.86

Source: Study Team

**Table A-21 Stream of Economic Costs and Benefits
(Holding Hours: 40% Reduction)
(Installation Timing: 1988/89)
Remote Radar Installation Project
at Islamabad Airport**

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1988/89	33,966,000		33,966,000	
2	1989/90		2,565,300	2,565,300	8,557,495
3	1990/91		2,565,300	2,565,300	8,899,794
4	1991/92		2,565,300	2,565,300	9,255,786
5	1992/93		2,565,300	2,565,300	9,626,016
6	1993/94		2,565,300	2,565,300	10,011,057
7	1994/95		2,565,300	2,565,300	10,411,499
8	1995/96		2,565,300	2,565,300	10,827,958
9	1996/97		2,565,300	2,565,300	11,261,076
10	1997/98		2,565,300	2,565,300	11,711,520
11	1998/99	13,586,400	2,565,300	16,151,700	12,179,980
12	1999/00		2,565,300	2,565,300	12,667,179
13	2000/01		2,565,300	2,565,300	13,173,866
14	2001/02		2,565,300	2,565,300	13,700,819
15	2002/03		2,565,300	2,565,300	14,248,851
16	2003/04		2,565,300	2,565,300	14,818,804
17	2004/05		2,565,300	2,565,300	15,411,555
18	2005/06		2,565,300	2,565,300	16,028,020
19	2006/07		2,565,300	2,565,300	16,669,140
20	2007/08		2,565,300	2,565,300	17,335,905
21	2008/09		2,565,300	2,565,300	18,029,340

IRR= 20.98

Source: Study Team

Table A-22 Stream of Economic Costs and Benefits
(Holding Hours: 40% Reduction)
(Installation Timing: 1991/92)
Remote Radar Installation Project
at Islamabad Airport

(Rs)

Year		Cost			Benefit
		Construction Cost	Maintenance & Operating Cost	Total	
1	1991/92	33,966,000		33,966,000	
2	1992/93		2,565,300	2,565,300	9,626,017
3	1993/94		2,565,300	2,565,300	10,011,057
4	1994/95		2,565,300	2,565,300	10,411,500
5	1995/96		2,565,300	2,565,300	10,827,959
6	1996/97		2,565,300	2,565,300	11,261,078
7	1997/98		2,565,300	2,565,300	11,711,520
8	1998/99		2,565,300	2,565,300	12,179,980
9	1999/00		2,565,300	2,565,300	12,667,179
10	2000/01		2,565,300	2,565,300	13,173,866
11	2001/02	13,586,400	2,565,300	16,151,700	13,700,821
12	2002/03		2,565,300	2,565,300	14,248,853
13	2003/04		2,565,300	2,565,300	14,818,807
14	2004/05		2,565,300	2,565,300	15,411,557
15	2005/06		2,565,300	2,565,300	16,028,019
16	2006/07		2,565,300	2,565,300	16,669,138
17	2007/08		2,565,300	2,565,300	17,335,903
18	2008/09		2,565,300	2,565,300	18,029,342
19	2009/10		2,565,300	2,565,300	18,750,515
20	2010/11		2,565,300	2,565,300	19,500,535
21	2011/12		2,565,300	2,565,300	20,280,555

IRR= 24.40

Source: Study Team

1. Name of Project:

Air Navigation Systems Plan in Minor Airports, Fiscal Years 1983/84 – 1987/88

2. Description of Project

Radio navigation aids and aeronautical lights are newly planned for minor airports during fiscal years 1983/84 – 1987/88 as tabulated.

3. Time of Implementation 5 years (1983/84 – 1987/88)

4. Cost of Project (Rupees in million) 1983/84 – 1987/88 Rs. 210.7

Major Works (Fiscal: 1983/84 - 1987/88)

"1" : Planned (New/Replacement)

Airport	AIR NAVIGATION PLAN										
	ASR	ILS	VOR/ DME	T-DME	NDB	ALS	RWYL	VASIS	COM.	TWYL	Others
Peshawar			1					1	1	1	
D. I. Khan			1								
Faisalabad				1	1	1	1	1	1	1	
Multan			1		1	1	1	1	1	1	
Hyderabad					1						
Nawabshah			1	1	1	1	1	1	1	1	
Sukkur					1		1	1			
Quetta						1	1	1	1	1	
Turbat			1				1	1			
Gwadar			1				1	1			
Jiwani			1		1			1			
Sui					1						
Moenjodaro							1	1			
Pasni							1	1			
New Airport					1			1			

5. Preliminary Evaluation

This project deals with the airports other than the major three airports. As the basic concept of developing the navigation systems at these airports for the 6th Five Year Plan period, Precision Approach Category I is applied for those with turbo jet operations and Non-precision IFR Approach for those without turbo jet operations.

The project is expected to develop the ILS, lighting and other related systems in line with this concept.

1. Name of Project:

Air Navigation Systems Plan in Minor Airport, Fiscal Years 1988/89 – 1993/94

2. Description of Project

Radio navigation aids and aeronautical lights are newly planned during fiscal years 1988/89 – 1993/94 as tabulated.

Obsolescent equipment which will have been installed during fiscal years 1983/84 – 1987/88 will be replaced by new ones.

3. Time of Implementation 6 years (1988/89 – 1993/94)

4. Cost of Project (Rupees in million) 1988/89 – 1993/94 Rs. 107.5

Major Works (Fiscal: 1988/89 - 1993/94)

AIRPORT	AIR NAVIGATION PLAN										
	ASR	ILS	VOR/DME	T-DME	NDB	ALS	RWYL	VASIS	COM	TWYL	REP.
Peshawar											1
D. I. Khan			1 (DME)					1			1
Faisalabad			DME 1								1
Multan											1
Nawabshah										1	1
Quetta		MLS 1									1

“1”, Planned

“REP.” indicate replacement of equipment which will have been installed during fiscal years 1983/84 - 1987/88.

5. Preliminary Evaluation

The major portions of this project will be devoted to the replacement of navigation system equipments at the airports other than the major three which are expected to be overaged by then. These can be understood as the indispensable portions of the project.

The project also includes the development of additional navigation systems at such airports as D. I. Khan, Faisalabad, Nawabshah and Quetta. These systems are not considered such urgently required as to be developed during the 6th Five Year Plan period, but are desired to be installed relatively early after the 6th Five Year Plan period to accomplish the higher reliability as the traffic increases.

1. **Name of Project:**
Air Navigation Systems Plan in Minor Airport, Fiscal Years 1994/95 – 2000/2001
2. **Description of Project**
Radio navigation aids and aeronautical lights are newly planned for the minor airports and/or new local airports during fiscal years 1994/95 – 2000/2001.
3. **Time of Implementation** 6 years (1994/95 – 2000/2001)
4. **Cost of Project (Rupes in million)** 1994/95 – 2000/2001 Rs. 66.9

Major Works (Fiscal: 1994/95 - 2000/2001)

AIRPORT	AIR NAVIGATION PLAN										
	ASR	ILS	VOR/DME	DME	NDB	ALS	RWYL	VASIS	COM.	TWYL	Others
Saidu Sharif				1				1			
Chitral				1				1			
Hyderabad							1	1		1	
Moenjodaro					1			1			1
Sukkur											1
Panjgar					1			1			
Turbat											1
Pasni					1						1
Gwadar											1
Jiwani			DME 1								1
Sui								1			1

"1": Planned

5. Preliminary Evaluation

This project aims, first of all, at developing such additional navigation systems as DME, NDB, VASIS and lighting at the existing local airports to maintain more reliable services of aircrafts as the traffic increase. Secondly, the project provides the basic requirement of navigation systems at new local airports.

These systems have relatively low priorities, but are recommended to be achieved by the year 2000. As a consequence, Nonprecision IFR Approach will become possible at the local airports.

