PART IV PRELIMINARY STUDY OF STOL AIRPORTS

CHAPTER 21 IMPLEMENTATION SCHEDULE AND COST ESTIMATES

PART IV PRELIMINARY STUDY OF STOL AIRPORTS

CHAPTER 21 IMPLEMENTATION SCHEDULE AND COST ESTIMATES

21.1 General

In this chapter, implementation schedule and cost estimates based on the master plan of STOL airports are explained.

The object airports of study are:

- Jomsom Airport
- Simikot Airport
- Lukla Airport
- Mugu Airport
- Syangboche Airport

21.2 Implementation Schedule and Cost Estimates

The construction schedule and project cost for each airport development is indicated in Tables 21.2.1 - 10. This cost has been estimated primarily for economic analysis which will be evaluated considering the national economy.

This cost includes soil investigation and topographical survey, construction supervision, engineering services, and physical contingencies.

Table 21.2.1 Construction Schedule
for Jomsom Airport

ITEM	1990	1991	1992	1993
Soil Investigation and Topo Survey	———			
Basic Design	———			
Detailed Design and Tender documentation		———		
Construction			———	———
(Construction Supervision)			———	———
Land Acquisition		———		

Table 21.2.2 Cost Estimates
for Jomsom Airport

(Unit=US$1,000)

Item	Nepal Portion	Foreign Portion	Total
A. Land Acquisition Cost	51		51
B. Construction Cost	2,495	11	2,506
C. Engineering Services Cost	17	338	355
A+B+C	2,563	349	2,912
Contingency (approx. 10%)	256	35	291
Total of Project Cost	2,819	384	3,203

Exchange rate US$1.00=NRs25.00
Cost estimates based on 1988 price

Table 21.2.3 Construction Schedule for Simikot Airport

ITEM	1990	1991	1992	1993
Soil Investigation and Topo Survey	———			
Basic Design	———			
Detailed Design and Tender documentation		———		
Construction			———	
(Construction Supervision)			———	
Land Acquisition		———		

Table 21.2.4 Cost Estimates for Simikot Airport

(Unit=US$1,000)

Item	Nepal Portion	Foreign Portion	Total
A. Land Acquisition Cost	77		77
B. Construction Cost	1,970	9	1,979
C. Engineering Services Cost	17	267	284
A+B+C	2,064	276	2,340
Contingency (approx. 10%)	206	28	234
Total of Project Cost	2,270	304	2,574

Exchange rate US$1.00=NRs25.00
Cost estimates based on 1988 price

Table 21.2.5 Construction Schedule
for Lukla Airport

ITEM	1990	1991	1992	1993
Soil Investigation and Topo Survey	——			
Basic Design	——			
Detailed Design and Tender documentation		——		
Construction			——	
(Construction Supervision)			——	
Land Acquisition		——		

Table 21.2.6 Cost Estimates
for Lukla Airport

(Unit=US$1,000)

Item	Nepal Portion	Foreign Portion	Total
A. Land Acquisition Cost	50		50
B. Construction Cost	1,467	9	1,476
C. Engineering Services Cost	16	199	215
A+B+C	1,533	208	1,741
Contingency (approx. 10%)	153	21	174
Total of Project Cost	1,686	229	1,915

Exchange rate US$1.00=NRs25.00
Cost estimates based on 1988 price

Table 21.2.7 Construction Schedule
for Mugu Airport

ITEM	1990	1991	1992	1993
Soil Investigation and Topo Survey	———			
Basic Design	———			
Detailed Design and Tender documentation		———		
Construction				
(Construction Supervision)				
Land Acquisition				

Table 21.2.8 Cost Estimates
for Mugu Airport

(Unit=US$1,000)

Item	Nepal Portion	Foreign Portion	Total
1. Civil Works	3,610	9	3,619
2. Architectural Works	176		176
3. Air Navigation Systems	18	337	355
Total of Constuction Cost	3,804	346	4,150
Soil Investigation & Topographical Survey	16		16
Engineering Services Cost		561	561
Sub Total	3,820	907	4,727
Contingency (approx. 10%)	382	91	473
Total of Project Cost	4,202	998	5,200

Exchange rate US$1.00=NRs25.00
Cost estimates based on 1988 price

Table 21.2.9 Construction Schedule
for Syangboche Airpot

ITEM	1990	1991	1992	1993
Soil Investigation and Topo Survey	———			
Basic Design	———			
Detailed Design and Tender documentation		———		
Construction			———	———
(Construction Supervision)			———	———
Land Acquisition		———		

Table 21.2.10 Cost Estimates
for Syangboche Airport

(Unit=US$1,000)

Item	Nepal Portion	Foreign Portion	Total
1. Civil Works	1,883	9	1,892
2. Architectural Works	30		30
3. Air Navigation System	18	337	355
Total of Constuction Cost	1,931	346	2,277
Soil Investigation & Topographical Survey	23		23
Engineering Services Cost		307	307
Sub Total	1,954	653	2,607
Contingency (approx. 10%)	195	65	260
Total of Project Cost	2,149	718	2,867

Exchange rate US$1.00=NRs25.00
Cost estimates based on 1988 price

PART V PRELIMINARY STUDY OF NATIONWIDE NAVAIDS AND TELECOMMUNICATIONS NETWORK

CHAPTER 22 PRELIMINARY STUDY OF NATIONWIDE NAVAIDS AND TELECOMMUNICATIONS NETWORK

PART V PRELIMINARY STUDY OF NATIONWIDE NAVAIDS AND TELECOMMUNICATIONS NETWORK

CHAPTER 22 PRELIMINARY STUDY OF NATIONWIDE NAVAIDS AND TELECOMMUNICATIONS NETWORK

22.1 General

(1) En-route Navaids Network for Establishment of IFR Airways

As discussed in Chapter 5, only three international IFR airways between Kathmandu and India are established in Nepal. No IFR airways are established for domestic routes and not positive air traffic control but advisory information services are provided for VFR aircraft.

It is of urgent necessity to establish IFR airways for domestic flight routes between the major hub airports in order to strengthen the air safety and ensure the regularity of civil air transport for the increasing traffic in Phase I.

A new domestic IFR airways have been proposed in Section 5.6 and VOR/DME and NDB network is required for the composition and establishment of IFR airways.

(2) Domestic Fixed Telecommunication Network

As discussed in Chapter 3, there is no domestic fixed telecommunication network (AFTN). Since all the flight data transmission and ATS coordination are made by HF SSB transmitters from/to Kathmandu, there is a serious interference problem in the nation. In order to alleviate the concentration of the communications to Kathmandu, it is necessary to establish subcenters, viz., Nepalgunj in the west and Biratnagar in the east region and de-centralize the function of Kathmandu ACC.

For this purpose, a domestic AFTN circuit among hub airports or Kathmandu, Nepalgunj, Biratnagar and Pokhara have been planned.

22.2 Preliminary Study

All en-route navigational aids have been planned to be installed within airports in order to reduce the investment cost for installation of equipment and utilities supply and to ensure ease of maintenance.

(1) DVOR/DME Network

In order to serve for en-route air navigation up to Phase I, or year 2000, the existing two sets of DVOR/DME at Kathmandu and Nepalgunj Airports will be replaced and six (6) sets of new DVOR/DMEs will be installed at Bhairahawa, Biratnagar, Pokhara*, Tumlingtar, Janakpur and Simara* Airports.

Note: * The DVOR/DMEs which have been planned for airport use in Pokhara and Simara can be utilized for the network use.

Each replacing and new DVOR/DME will include the following:

a) Doppler VOR: dual equipment, 200 w
b) DME : dual equipment, 1 kw peak
c) Control and monitor equipment
d) Non-break DC power supply for two hours duration
e) Emergency generator
f) Low tension power supply system
g) Air-conditioned equipment building of concrete structures
h) Spare module, test equipment, training, etc.
i) Installation, adjustment and commissioning

(2) NDB for Hub Network

The existing eight (8) sets of NDB which are obsolete or incomplete and used for both airport and en-route navigation will be replaced at Kathmandu, Bhairahawa, Biratnagar, Nepalgunj, Pokhara, Bharatpur, Janakpur and Simara Airports in order to continue the existing airport use operation and to start en-route air navigation services for a hub network.

Each replacing NDB will include the following:

a) NDB of semi-conductor type, dual equipment: 50 - 100 w
b) 25 m high T type antenna with antenna mast
c) Emergency generator : 15 kva
d) Low tension power supply system
e) Air-conditioned equipment building of concrete structures
f) Spare module, test equipment, training, etc.
g) Installation, adjustment and commissioning
h) Control and monitoring equipment

(3) NDB for Spoke Network

In order to provide en-route air navigation for the spoke network, ten new sets of low power NDB will be required at the following airports: Baitadi, Bajhang, Bhojpur, Darchula, Doti, Mahendranagar, Ramechhap, Rolpa, Rumjatar and Taplejung.

NDBs which are installed at Dang, Rajbiraj and Bharatpur airports are old. Whether or not to replace them is now under consideration. NDB installed at Surkhet and Simara airports will be replaced under a French program by 1991.

Communication equipment at five STOL airports will be provided by a French program, but the airports where they are installed will be decided by DCA in the future.

The existing NDBs which have been implemented by French aid can continuously be used at Tumlingtar, Chandragadi, Lamidada, and Rukumkot Airports.

The low power NDB include the following equipments:

a) NDB of semi-conductor type, dual configuration: 25 w
b) Vertical antenna
c) Solar generator and batteries of 12 hours duration
d) Spare module, test equipment, training, etc.
e) Installation, adjustment and commissioning
f) Control and monitoring equipment

The outline of the above plans in items (1), (2), and (3) is summarized in Table 22.2.1.

Table 22.2.1 Outline of En-Route Navaids Plan

"O" indicates that the facility is existing
"X" indicates that the facility is required

Name of airport on which en-route (and airport) use Navaids should be installed	Facility Existing at present	Facility to be continuously used	Facility to be replaced	Facility to be newly installed	Facility planned to be implemented by French Program
(VOR/DME NETWORK)					
Kathmandu	O		X		
Bhairahawa				X	
Biratnagar				X	
Nepalgunj	O		X		
Pokhara				X	
Tumlingtar				X	
Janakpur				X	
Simara				X	
(NDB FOR HUB NETWORK)					
Kathmandu	O		X		
Bhairahawa	O		X		
Biratnagar	O		X		
Nepalgunj	O		X		
Pokhara	O		X		
Bharatpur	O		X		
Janakpur	O		X		
Simara	O		X		

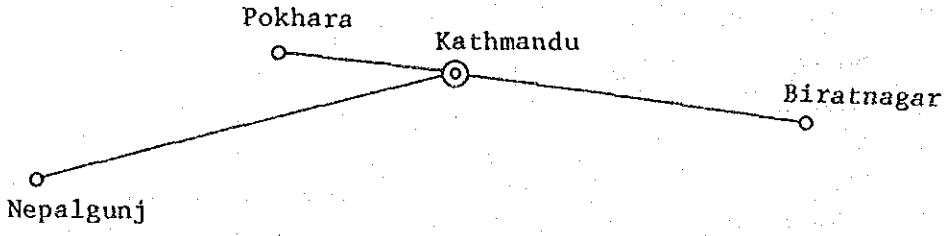
Table 22.2.1 Continued

Name of airport on which en-route (and airport) use Navaids should be installed	Facility Existing at present	Facility to be continuously used	Facility to be replaced	Facility to be newly installed	Facility planned to be implemented by French Program
(NDB FOR SPOKE NETWORK)					
Tumlingtar	O	O			
Baitadi				X	
Bajhang				X	
Bhojpur				X	
Chandragadi	O	O			
Darchula				X	
Doti				X	
Lamidada	O	O			
Mahendranagar					X
Ramechhap				X	
Rolpa					X
Rukumkot	O	O			
Rumjatar					X
Surkhet	O	O	X		
Taplejung					X

(4) Telecommunications Network

A domestic AFTN and ATS direct speech circuits are planned in the hub airports in order to improve the domestic fixed telecommunications.

Kathmandu Airport will be linked with Nepalgunj, Biratnagar and Pokhara Airports by a leased telephone line and domestic flight data will be transmitted among those airports. The domestic data will be distributed from those airports to the local airports in their vicinity by HF SSB radio.



In order to compose the domestic AFTN, one telephone line should be leased from Nepal Telecommunication Corporation. A small AFTN exchange will be installed in Kathmandu Airport and branched teletypewriters will be installed in Nepalgunj, Biratnagar and Pokhara Airports.

22.3 Implementation Schedule and Cost Estimates

(1) Implementation Schedule

The earliest implementation schedule is expected as shown in Table 22.3.1.

Table 22.3.1 Project Implementation Schedule

Item \ Fiscal Year	1989	1990	1991	1992	1993	1994	1995
Project Preparation	▬	▬					
Basic Design		▬	▬				
Detail Design and Tender			▬	▬			
Installation and Adjustment				▬	▬		
Commissioning					○		

(2) Cost Estimate

The project costs necessary to implement the navaids and telecommunications network in Phase I have been preliminarily estimated in Table 22.3.2.

The project costs include those for civil and building works, procurement of equipment/spare modules and parts/test equipment/maintenance tools, transportation, installation, adjustment and test, commissioning, training, and necessary engineering services.

Table 22.3.2 Estimated Project Cost for Phase I Development (Nationwide Nav. and Telecom. Network)

Exchange rate: US$1.00=NRs25
Cost estimates based on 1988 price

Unit=US$1,000

Item	Nepal Portion	Foreign Portion	Total
1. En-route Nav. Network	720	13,690	14,410
-DVOR/DME Network	470	8,950	9,420
-NDB for Hub Network	180	3,370	3,550
-NDB for Spoke Network	70	1,370	1,440
2. Domestic Telecom. Network	30	650	680
Sub Total	750	14,340	15,090
Engineering	-	1,510	1,510
Total of Project Cost	750	15,850	16,600

PART VI PROJECT EVALUATION

CHAPTER 23 ECONOMIC AND FINANCIAL ANALYSES

PART VI PROJECT EVALUATION

CHAPTER 23 ECONOMIC AND FINANCIAL ANALYSES

23.1 General

23.1.1 Objectives

The objectives of economic and financial analyses described in this chapter are to evaluate the economic and financial viability of the Phase I development of the proposed priority projects.

Based on an economic analysis, projects will be appraised from the viewpoint of the estimated contribution of the projects to the national and regional economy in which the projects are carried out. A financial analysis will evaluate the financial outcome of projects from the viewpoint of an enterprise or entity that implements the projects.

23.1.2 Premises for Analysis

(1) Evaluation period

TIA:	25 years from 1989
Other Airports:	25 years from 1990

(2) Life time of investment

The average life time is assumed to be 40 years for all the assets. At the end of evaluation period, the residual value is transferred to benefit side.

(3) Standard conversion factor

The SCF is supposed to be 0.88 with reference to the F/S reports for other airport projects in Nepal.

(4) Exchange rate

US$1.00 = NRs25.00 (average in August to October, 1988)

23.1.3 Cost and Benefit

The costs and benefits considered in the analysis are shown in Table 23.1.1. These costs and benefits are the differences between "with" and "without" project case. As for the detailed description and calculation of the costs and benefits, refer to Appendix 23.1.3.

23.1.4 Qualitative Benefit

The benefits in Table 23.1.1 are all quantitative benefits. But there are some other important benefits which cannot be measured quantitatively, such as:

(1) increase in the safety of passengers

(2) improvement of punctuality of aircraft operation

(3) increase in the comfortability of passengers

(4) improvement of environmental conditions

Although these benefits cannot be considered in cost-benefit analysis, they are, in some cases, just the main target of project.

Therefore, the IRR in Table 23.2.1 is the result of analysis without leading actors and it is not a decisive factor but a reference material for the project evaluation.

Table 23.1.1 The Costs and Benefits Considered in the Analysis

ITEM	TIA		POKHARA		JOMSON		SIMIKOT		LUKLA		MUGU		SYANGBOCHE	
	ECO.	FIN.	ECO.	FIN.	ECO.	FIN.	ECO.	FIN.	ECO.	FIN.	ECO.	FIN.	ECO.	FIN.
PROJECT COST														
1.INVESTMENT	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2.MAINT.& ADMI.COST	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PROJECT BENEFIT														
1.AIRCRAFT CHARGE REVENUE														
LANDING CHARGE	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PARKING CHARGE	○	○	○	○	○	○	○	○	○	○	○	○	○	○
FACILITY CHARGE	○	○	○	○	○	○	○	○	○	○	○	○	○	○
NAV. AID CHARGE	○	○	○	○	—	—	—	—	—	—	—	—	—	—
2.SAVING IN MAINTENANCE COST														
AIRPORT MAINTENANCE	○	○	○	○	○	○	○	○	○	○	—	—	—	—
AIRCRAFT MAINTENANCE	—	—	—	—	○	—	○	—	○	—	—	—	—	—
3.AIRPORT SERVICE CHARGE	○	○	○	○	○	○	○	○	○	○	○	○	○	○
4.CARGO CHARGE	○	○	—	—	—	—	—	—	—	—	—	—	—	—
5.FUEL ROYALITY	○	○	○	○	○	○	○	○	○	○	○	○	○	○
6.OPERATING PROFIT OF RNAC	○	—	○	—	○	—	○	—	○	—	○	—	○	—
7.VALUE ADDED BY TOURIST	○	—	○	—	—	—	—	—	○	—	○	—	○	—
8.VALUE ADDED BY EXPORT CARGO	○	—	—	—	—	—	—	—	—	—	—	—	—	—
9.INCOME OF UNSKILLED LABOR	○	—	○	—	○	—	○	—	○	—	○	—	○	—
10.CONSUMER SURPLUS OF AIR TRAFFIC	○	—	○	—	○	—	○	—	○	—	○	—	○	—

○ = Considered
— = Not Considered

ECO.= ECONOMIC
FIN.= FINANCIAL

23.2 Result of Analysis

The results of analysis are shown in Table 23.2.1 and 23.2.2. The cash flows of TIA are shown in Tables 23.2.3 to 23.2.6. The cash flows for other airports are shown in Appendix 23.2.

As shown in Table 23.2.1, all the airports, except TIA, do not show positive FIRR.

In Nepal, the opportunity cost of capital is supposed to be about 12%. Therefore the EIRR above 12% may justify the project economically. As shown in Table 23.2.1, TIA, Lukla, and Jomsom show acceptable EIRR.

B/C ratio and NPV are shown in Table 23.2.2. Assuming the opportunity cost of capital to be 12%, TIA, Lukla and Jomsom show the acceptable vallue respectively.

Table 23.2.1 Internal Rate of Return
(Base Case)

Airport	FIRR	EIRR
TIA	3.0%	19.7%
Pokhara	0%	2.1%
Jomsom	0%	13.1%
Simikot	0%	9.6%
Lukla	0%	19.0%
Mugu	0%	1.3%
Syangboche	0%	5.0%

Table 23.2.2 B/C Ratio and NPV Assuming the Opportunity Cost of Capital at 12% (Base Case)

Airport	B/C Ratio in Economic Value	NPV in Economic Value (1000 Rs)
TIA	1.68	2,375,200
Pokhara	0.38	-477,105
Jomsom	1.10	5,663
Simikot	0.82	-8,581
Lukla	1.66	23,087
Mugu	0.59	-39,789
Syangboche	0.51	-21,470

Note: Project bears totally the cost of construction and maintenance.

Table 23.2.3 Economic Cash Flow for TIA (Unit:Rs.1000)

YEAR	INVEST-MENT	MA-INTENANCE AND AD-MINISTRA-TION COST	TOTAL COST	BENEFIT	RESIDUAL VALUE	TOTAL BENEFIT	TOTAL COST IN PRES-ENT VALUE	TOTAL BENEFIT IN PRES-ENT VALUE	NET PRES-ENT VALUE
1989	5500	0	5500	0	5500	0	5500	0	-5500
1990	111475	0	111475	0	116838	0	93145	0	-98645
1991	833275	0	833275	8573	947188	8573	581772	5985	-674431
1992	1245820	0	1245820	8573	2169260	8573	726781	5001	-1396210
1993	621775	38391	660166	224032	2736130	224032	321797	109204	-1608800
1994	1384580	63986	1448560	388836	4050260	388836	589993	158371	-2040430
1995	11400	90476	101876	578858	3956600	578858	34671	196999	-1878100
1996	0	130543	130543	900276	3851250	900276	37122	256006	-1659210
1997	0	131849	131849	968079	3745910	968079	31328	230021	-1460520
1998	0	133167	133167	1043970	3640560	1043970	26438	207265	-1279690
1999	0	134499	134499	1113140	3535220	1113140	22312	184658	-1117350
2000	0	135844	135844	1195410	3429870	1195410	18830	165699	-970478
2001	0	137202	137202	1288250	3324520	1288250	15891	149205	-837163
2002	0	138574	138574	1372360	3219180	1372360	13411	132811	-717762
2003	0	139960	139960	1456940	3113830	1456940	11318	117812	-611268
2004	115225	141360	256585	1541440	3123710	1541440	17337	104150	-524454
2005	0	142773	142773	1644110	3015490	1644110	8060	92820	-439694
2006	0	144201	144201	1761750	2907260	1761750	6802	83107	-363389
2007	75100	145643	220743	1866580	2874130	1866580	8701	73574	-298516
2008	0	147099	147099	1972230	2764030	1972230	4845	64956	-238405
2009	0	148570	148570	2078100	2653930	2078100	4089	57188	-185306
2010	0	150056	150056	2184970	2543820	2184970	3450	50242	-138514
2011	0	151557	151557	2292760	2433720	2292760	2912	44052	-97374
2012	0	153072	153072	2401130	2323610	2401130	2457	38548	-61283
2013	0	154603	154603	2510490	2213510	4724000	2074	63369	12
TOTAL							2591030	2591050	

EB/EC= 1 EIRR= .19679

Table 23.2.4 Economic Benefit for TIA (Unit:Rs.1000)

	AIRCRAFT CHARGE REVENUE	AIRPORT SERVICE CHARGE REVENUE	CARGO CHARGE REVENUE	FUEL ROYALTY REVENUE	SAVING IN MA-INTENANCE COST	OPERATING PROFIT OF RNAC	VALUE ADDED BY TOURIST	VALUE ADDED BY EXPORT CARGO	INCOME OF UNSKILLED LABOR	CONSUMER SURPLUS OF AIR TRAFFIC	TOTAL
1989	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	8573	0	8573
1992	0	0	0	0	0	0	0	0	8573	0	8573
1993	15643	41904	3780	249	3423	27062	17581	97990	8573	7828	224032
1994	28969	72010	6750	425	5706	46313	31898	174981	8573	13212	388836
1995	43358	107554	10458	633	8068	69186	48310	271104	0	20187	578858
1996	65942	163262	16380	959	11641	105015	74365	431361	0	31351	900276
1997	69944	172890	17820	1014	11757	111226	80100	469283	0	34044	968079
1998	73947	182504	19260	1069	11875	117403	85984	515130	0	36799	1043970
1999	77949	192133	20700	1124	11994	123612	92281	553645	0	39700	1113140
2000	81236	202447	22560	1183	12113	130440	99153	603392	0	42885	1195410
2001	84524	212761	24420	1242	12235	137275	106353	663189	0	46250	1288250
2002	87812	223075	26280	1301	12357	144103	114042	713702	0	49688	1372360
2003	91099	233390	28140	1360	12481	150938	121946	764215	0	53372	1456940
2004	94387	243404	30000	1418	12605	157598	130222	814728	0	57082	1541440
2005	100197	255203	32280	1484	12731	165378	138410	876647	0	61776	1644110
2006	106007	267001	34560	1551	12859	173165	146971	952787	0	66850	1761750
2007	111817	278800	36840	1618	12987	180943	155922	1015640	0	72009	1866580
2008	117628	290598	39120	1684	13117	188730	165277	1078500	0	77577	1972230
2009	123438	302247	41400	1750	13248	196425	175053	1141360	0	83178	2078100
2010	129248	314045	43680	1817	13381	204202	185267	1204220	0	89109	2184970
2011	135059	325844	45960	1884	13515	211989	195937	1267070	0	95495	2292760
2012	140869	337643	48240	1950	13650	219766	207079	1329930	0	101999	2401130
2013	146679	349441	50520	2017	13786	227552	218715	1392790	0	108991	2510490

Table 23.2.5 Financial Cash Flow for TIA (Unit:Rs.1000)

YEAR	INVEST-MENT	MA-INTENANCE AND AD-MINISTRA-TION COST	TOTAL COST	REVENUE	RESIDUAL VALUE	TOTAL REVENUE	TOTAL COST IN PRES-ENT VALUE	TOTAL REVENUE IN PRES-ENT VALUE	NET PRES-ENT VALUE
1989	5650	0	5650	0	5650	0	5650	0	-5650
1990	121125	0	121125	0	126634	0	117652	0	-123302
1991	864050	0	864050	0	987514	0	815210	0	-938511
1992	1263550	0	1263550	0	2226290	0	1157950	0	-2096460
1993	635050	41051	676101	65466	2804980	65466	601828	58275	-2640010
1994	1403500	68419	1471920	114637	4136250	114637	1272650	99118	-3813550
1995	11850	96744	108594	171171	4040780	171171	91201	143754	-3760990
1996	0	139588	139588	259771	3933160	259771	113869	211908	-3662950
1997	0	140984	140984	275029	3825540	275029	111710	217922	-3556740
1998	0	142394	142394	290273	3717920	290273	109592	223406	-3442930
1999	0	143818	143818	305534	3610300	305534	107514	228408	-3322030
2000	0	145256	145256	321191	3502680	321191	105475	233228	-3194280
2001	0	146708	146708	336850	3395060	336850	103475	237585	-3060170
2002	0	148175	148175	352510	3287440	352510	101514	241501	-2920180
2003	0	149657	149657	368171	3179820	368171	99589	244998	-2774770
2004	116250	151154	267404	383532	3188450	383532	172841	247902	-2699710
2005	0	152665	152665	403631	3077930	403631	95848	253413	-2542150
2006	0	154192	154192	423731	2967400	423731	94031	258404	-2377780
2007	76500	155734	232234	443833	2933370	443833	137562	262902	-2252440
2008	0	157291	157291	463936	2820940	463936	90499	266930	-2076000
2009	0	158864	158864	483890	2708500	483890	88783	270428	-1894360
2010	0	160453	160453	503996	2596060	503996	87100	273588	-1707870
2011	0	162057	162057	524104	2483620	524104	85448	276345	-1516970
2012	0	163678	163678	544213	2371180	544213	83828	278720	-1322080
2013	0	165314	165314	564324	2258750	2823070	82239	1404390	65
TOTAL							5933050	5933120	

FB/FC= 1.00001 FIRR= .02952

Table 23.2.6 Financial Benefit for TIA

(Unit:Rs.1000)

	AIRCRAFT CHARGE REVENUE	AIRPORT SERVICE CHARGE REVENUE	CARGO CHARGE REVENUE	FUEL ROYALTY REVENUE	SAVING IN MA-INTENANCE COST	TOTAL
1989	0	0	0	0	0	0
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	15643	41904	3780	249	3890	65466
1994	28969	72010	6750	425	6484	114637
1995	43358	107554	10458	633	9168	171171
1996	65942	163262	16380	959	13228	259771
1997	69944	172890	17820	1014	13360	275029
1998	73947	182504	19260	1069	13494	290273
1999	77949	192133	20700	1124	13629	305534
2000	81236	202447	22560	1183	13765	321191
2001	84524	212761	24420	1242	13903	336850
2002	87812	223075	26280	1301	14042	352510
2003	91099	233390	28140	1360	14182	368171
2004	94387	243404	30000	1418	14324	383532
2005	100197	255203	32280	1484	14467	403631
2006	106007	267001	34560	1551	14612	423731
2007	111817	278800	36840	1618	14758	443833
2008	117628	290598	39120	1684	14906	463936
2009	123438	302247	41400	1750	15055	483890
2010	129248	314045	43680	1817	15205	503996
2011	135059	325844	45960	1884	15358	524104
2012	140869	337643	48240	1950	15511	544213
2013	146679	349441	50520	2017	15666	564324

23.3 Estimated Profit and Loss Statement

Estimated profit and loss statement, which considers maintenance cost only is shown in Table 23.3.1, 23.3.2 and in the Appendix 23.3. The percentage of maintenance (or operating) cost which the project can bear is as follows:

TIA	100%
Pokhara	20%
Jomsom	85%
Simikot	30%
Lukla	100%
Mugu	5%
Syangboche	65%

As shown by the figures above-mentioned, only TIA and Lukla airport projects can bear the whole maintenance cost. The remaining five projects are not self-sustainable financially.

But when all the seven airports are consolidated into one financial entity as shown in Table 23.3.2, the entity can make a considerable net profit.

Table 23.3.1 Estimated Profit and Loss Statement for TIA

(Unit:Rs.1000)

YEAR	OPERATING REVENUE	INTEREST RECEI-VABLE	TOTAL REVENUE	LOAN INTEREST	OPERATING COST	DEPRE-CIATION	INTEREST PAYABLE	TAX	TOTAL EXPENSE	NET PROFIT	NET DEFICIT
1989	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0
1993	65466	0	65466	0	41051	0	0	0	41051	24415	0
1994	114637	2930	117567	0	68419	0	0	2442	70861	46706	0
1995	171171	8535	179706	0	96744	0	0	4671	101415	78291	0
1996	259771	17929	277700	0	139588	0	0	7829	147417	130283	0
1997	275029	33563	308592	0	140984	0	0	13028	154012	154580	0
1998	290273	52113	342386	0	142394	0	0	15458	157852	184534	0
1999	305534	74257	379791	0	143818	0	0	18453	162271	217520	0
2000	321191	100360	421551	0	145256	0	0	21752	167008	254543	0
2001	336850	130905	467755	0	146708	0	0	25454	172163	295592	0
2002	352510	166376	518886	0	148175	0	0	29559	177735	341151	0
2003	368171	207314	575485	0	149657	0	0	34115	183772	391713	0
2004	383532	254320	637852	0	151154	0	0	39171	190325	447526	0
2005	403631	308023	711654	0	152665	0	0	44753	197418	514236	0
2006	423731	369731	793462	0	154192	0	0	51424	205616	587846	0
2007	443833	440273	884106	0	155734	0	0	58785	214519	669587	0
2008	463936	520623	984559	0	157291	0	0	66959	224250	760309	0
2009	483890	611860	1095750	0	158864	0	0	76031	234895	860855	0
2010	503996	715163	1219160	0	160453	0	0	86086	246538	972620	0
2011	524104	831877	1355980	0	162057	0	0	97262	259319	1096660	0
2012	544213	963477	1507690	0	163678	0	0	109666	273344	1234350	0
2013	564324	1111600	1675920	0	165315	0	0	123435	288749	1387170	0

Table 23.3.2 Estimated Profit and Loss Statement for all the Seven Airports

(Unit:Rs.1000)

YEAR	OPERATING REVENUE	INTEREST RECEI-VABLE	TOTAL REVENUE	LOAN INTEREST	OPERATING COST	DEPRE-CIATION	INTEREST PAYABLE	TAX	TOTAL EXPENSE	NET PROFIT	NET DEFICIT
1989	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0
1993	65466	0	65466	0	41051	0	0	0	41051	24415	0
1994	116727	2930	119657	0	71794	0	0	2442	74236	45421	0
1995	176709	8380	185089	0	116353	0	0	4542	120895	64194	0
1996	265468	16084	281552	0	159393	0	0	6419	165812	115739	0
1997	280885	29972	310857	0	160987	0	0	11574	172561	138297	0
1998	296352	46568	342920	0	162597	0	0	13830	176426	166494	0
1999	311773	66547	378320	0	164223	0	0	16649	180872	197448	0
2000	327652	90241	417893	0	165865	0	0	19745	185610	232283	0
2001	343528	118115	461643	0	167523	0	0	23228	190752	270891	0
2002	359423	150622	510045	0	169199	0	0	27089	196288	313757	0
2003	375301	188273	563574	0	170891	0	0	31376	202266	361308	0
2004	390898	231630	622528	0	172600	0	0	36131	208730	413797	0
2005	411250	281286	692536	0	174326	0	0	41380	215705	476830	0
2006	431557	338505	770062	0	176069	0	0	47683	223752	546310	0
2007	451839	404062	855901	0	177830	0	0	54631	232461	623441	0
2008	472204	478875	951079	0	179608	0	0	62344	241952	709127	0
2009	492317	563971	1056290	0	181404	0	0	70913	252317	803971	0
2010	512668	660447	1173120	0	183218	0	0	80397	263615	909500	0
2011	532965	769587	1302550	0	185050	0	0	90950	276000	1026550	0
2012	553233	892773	1446010	0	186901	0	0	102655	289556	1156450	0
2013	573590	1031550	1605140	0	188770	0	0	115645	304415	1300720	0

23.4 Sensitivity Analysis

A sensitivity analysis is also made to provide a basis for probabilistic judgement on the feasibility of the projects. The analysis has been carried out in the following cases:

Case I: Construction cost increases, or traffic demand increases or decrease.

Case II: Some portion of construction cost and maintenance cost is exempted so as to make EIRR and FIRR more than the opportunity cost of capital.

Table 23.4.1 shows the result of Case I. Increase and decrease of traffic demand and construction cost show no considerable change in EIRR and FIRR.

Table 23.4.2 shows the EIRR and FIRR for Case II. In the base case, Mugu Airport project shows a small value for EIRR. But, if 80% of the construction cost is exempted from the project, then the EIRR shows 13.4%. For the Mugu area, the airport is only one access mode. Therefore, regardless of EIRR, an airport is inevitable for the area from the viewpoint of local welfare, and 80% exemption of the construction cost may be justified.

For other three airports of Pokhara, Simikot and Syangboche, EIRR of which are less than 10%, exemption of 30 to 70% of construction cost also improves EIRR to more than 13%.

Table 23.4.1 Sensitivity Analysis (Case I)
(Internal rate of return assuming 10% increase in construction cost and 10% increase/decrease in traffic demand)

(Unit: %)

Airport	Base Case	Case I			
		Traffic 10% up	Traffic 10% down	Cost 10% up	Traffic 10% down and Cost 10% up
FIRR					
TIA	3.0	3.8	2.0	2.2	1.6
EIRR					
TIA	20	21	18	18	17
Lukla	19	20	18	18	16
Jomsom	13	14	12	12	11
Simikot	10	11	9	9	8

Note: Project bears totally the cost of construction and maintenance.

Table 23.4.2 Sensitivity Analysis (Case II)
(Internal rate of return when project bears X% of construction cost and Y% of maintenance cost)

(Unit: %)

Airport	Base Case	Case II	X	Y
FIRR				
TIA	3.0	13.7	25.0	100
Pokhara	0.0	13.1	1.5	10
Jomsom	0.0	12.4	5.0	10
Simikot	0.0	13.5	1.7	10
Lukla	0.0	13.2	11.0	100
Mugu	0.0	12.8	0.7	1
Syangboche	0.0	13.1	3.8	10
EIRR				
Pokhara	2.1	13.5	30	100
Simikot	9.6	13.8	70	100
Mugu	1.3	13.4	20	100
Syangboche	5.0	13.1	40	100

23.5 Project Evaluation

Among all the projects, TIA, Lukla and Jomsom Airport development projects may be justified by the acceptable EIRR value more than 12%.

Pokhara, Simikot, and Syangboche Airport development projects may be only justified when 30 to 70% of construction cost is exempted.

For Mugu Airport project, exemption of more than 80% of construction cost is required for the justification of the project.

The FIRR of each project is very low in Base Case because financial benefits are relatively small in comparison with economic benefits.

The above-mentioned evaluation is not made in consideration of all aspects of the projects, because there is some qualitative benefit besides the quantitative benefit which is considered in the above evaluation. This qualitative benefit is similar to that of hospitals and schools, and is important for the evaluation of the projects which aim to improve the public welfare in remote areas as well as the improvement of aircraft safety.

Accordingly, these projects are considered to be implemented from the viewpoint not only of the national economy but also of the local society.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION AND RECOMMENDATIONS

The over-all development of air transport system in Nepal has been studied and the economic and financial feasibility on the priority plans have been examined.

According to the study for Identification of Priority Projects, the following nine projects were selected from 44 airports and related facilities as priority projects. Project costs and the economic internal rate of return (EIRR) have been estimated as shown in Table 1.

Table 1 Project Cost and Evaluation

Project	Project Cost (US$1,000)	EIRR (%)
Kathmandu (Phase I)	174,200	19.7
New Pokhara (Phase I)	39,700	2.1
Jomsom	3,200	13.1
Simikot	2,600	9.6
Lukla	1,900	19.0
Mugu	5,200	1.3
Syangboche	2,900	5.0
En-route Navaids Network and Nationwide Aeronautical Telecom. Network	16,600	-

Needless to say, attention to the other airport projects such as Dolpa, Jumla, Phaplu, and Sanfebagar airports should be also paid.

Development of Nepalgunj airport, which is not selected as a key airport in this study because the master plan was already completed in 1988, is also important as a hub airport for the air transport network in Mid and Far Western Development Region.

Among these airport projects, the following projects are recommended to be implemented immediately in consideration of importance and urgency.

(1) Tribhuvan International Airport Project

a) Construction of the new domestic terminal building	: US$14,100,000
b) Expansion of passenger apron	: US$ 7,600,000
c) Installation of air navigation system	: US$16,800,000

(2) New Pokhara Airport Project : US$39,700,000

(3) STOL Airports Project

a) Jomsom Airport development	: US$ 3,200,000
b) Lukla Airport development	: US$ 1,900,000
c) Simikot Airport development	: US$ 2,600,000
d) Syangboche Airport development	: US$ 2,900,000

With these projects, the function and capacity of the existing facilities can be remarkably improved and the demand of passenger and aircraft in future will be satisfactorily accommodated. Furthermore, safety and punctuality of aircraft operations will be promoted.

In addition to the direct effect of the growth of international and domestic trade, indirect effects such as a contribution to the public welfare in remote districts and the promotion of the tourism sector are expected.

It is advisable to organize a suitable committee and begin the following preparatory and required coordination work:

- The project should be presented and discussed with the related organizations in HMG/N in order to make up a consensus for project implementation. It should be listed with the National Development Projects and given suitable priority.

- Since the existing domestic terminal building and passenger loading apron at TIA have been saturated even for the present demand, they should be constructed prior to other works.

- Preparations including the request for financial assistance, etc., should be initiated at the earliest possible date so that engineering services including basic design, detailed design, preparation of tender documents, assistance in evaluation of the tenders, etc., can be carried out and completed by the end of 1990.

- Construction work should be begun at the beginning of 1991 so that these facilities can become operational by the beginning of 1992.

- Land acquisition and compensation for the Ring road diversion preceding construction of the cargo terminal, maintenance terminal, etc. should be started as soon as possible.

- As for the other projects mentioned before, similar preparation should be done based on the priority according to the national administrative guidance.

- For TIA, to harmonize the airport with the area surrounding the airport, height restriction should be enforced in order to ensure the required obstacle limitation surfaces. A land use plan in the airport vicinity where aircraft noise will exceed the allowance should be implemented.

Master plans of some of the airports and related facilities should be reviewed in the future, because air traffic demand, (especially cargo volume), land acquisition, and the future plans of the Royal Enclosure and Military base cannot be predicted.