CHAPTER 6

CONSTRUCTION SCHEDULE AND COST ESTIMATE

CHAPTER 6 CONSTRUCTION SCHEDULE AND COST ESTIMATE

6-1 General

Construction schedule and cost estimate are made based on the study results of the preceding chapters as well as of the data and information collected in the field survey.

6-2 Construction Conditions

6-2-1 Site Condition

The Lusaka International Airport is located about 20 km northeast of Lusaka, capital of the landlocked country, and has a well developed access road. The surface routes available for transporting imported materials and equipment, i.e. the northern route from Tanzania and the southern routes from South Africa and Zimbabwe, are also adequately developed, causing no problem in this regard either. The Airport has ample room on its vast premises and, therefore, no problem is foreseen in storing and stockpiling the construction materials and equipment, as well as in installing the asphalt plants, etc. on the site as required for the improvement work.

The operating hours of the Airport according to the AIP are from 04:00 to 22:00 in Greenwich mean time, or between 06:00 and 24:00 in local time. In view of this situation, construction

works of the airfield facilities that might interfere with the operation of the Airport will have to be executed during the night hours between 01:00 and 06:00.

Regarding the meteorological conditions of the Airport, the work during the rainy seasons requires special care, but judging from the overall volume of the improvement work, will cause little problem that might significantly affect the construction schedule.

6-2-2 Construction Materials

(1) Aggregate (Crushed Stone and Sand)

There is quarry with an adequate supply capacity of crushed stone in Chawama area in the southeastern part of Lusaka city. However, the quality of the Chawama crushed stone as a surface course material of bituminous concrete pavement is not adequate, and the material for this purpose has to be procured from Kitwe. Sand can be obtained in adequate supply both in quantity and quality from the Kafue River that flows about 80 km south of Lusaka city.

(2) Cement

Cement is 100% locally procured as it is produced in Zambia based on the British Standards in such abundant supply that it is exported to neighbouring countries.

(3) Bitumen

Bitumen of the required quality and quantity is to be imported.

(4) Building Materials

All building materials need to be imported with the exception of a few locally produced items such as bricks, concrete blocks, some wooden products, etc.

(5) Equipment and Instruments

All equipment, instruments and materials for air navigation facilities, as well as such special passenger terminal equipment as passenger loading bridges, metal detectors, etc. are to be imported.

6-2-3 Labour

Considering the recent rise in the rates of unemployment and concentration of the population into Lusaka, there is no problem in the local procurement of unskilled labour in terms of quantity. As for the quality of labour no particular problem is anticipated with the unskilled labour to be locally procured in view of the fact that Zambia has recently experienced construction projects comparable in scale to the present Project.

Regarding such skilled labour as for installation of air navigation facilities and some special passenger terminal equipment and instruments, it is not locally procurable and has, therefore, to be sought from outside of Zambia.

6-3 Construction Schedule

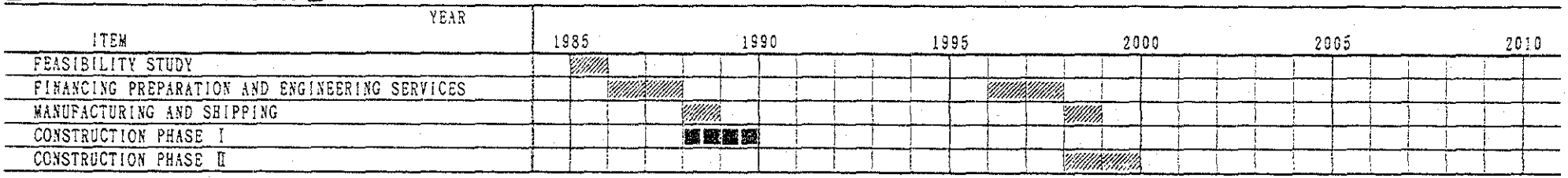
The construction schedule is developed with due regard to the following:

1) Timing and availability of funds for the Project, and time period required for the pre-construction engineering services of the improvement work;
2) Time required for manufacture and transport of equipment and instruments to be imported;
3) Approximate volume of work and expected work performance per day;
4) Procurement method and availability of major construction materials; and
5) Relative timing and inter-lacing of execution of the component work items to optimize overall work efficiency.

Engineering design and construction of the Phase I Development for the design year 2000 is scheduled to commence around 1987 for completion in time for the opening of the new facilities in 1990. Phase II design and construction for the

design year of 2010 is scheduled to commence around 1997 for completion by 2000. Details of the construction schedules for Phase I and Phase II are shown in Figs. 6-1 and 6-2 respectively.

☐ PROJECT DEVELOPMENT SCHEDULE ☐



☐ PHASE I DESIGN AND CONSTRUCTION SCHEDULE ☐

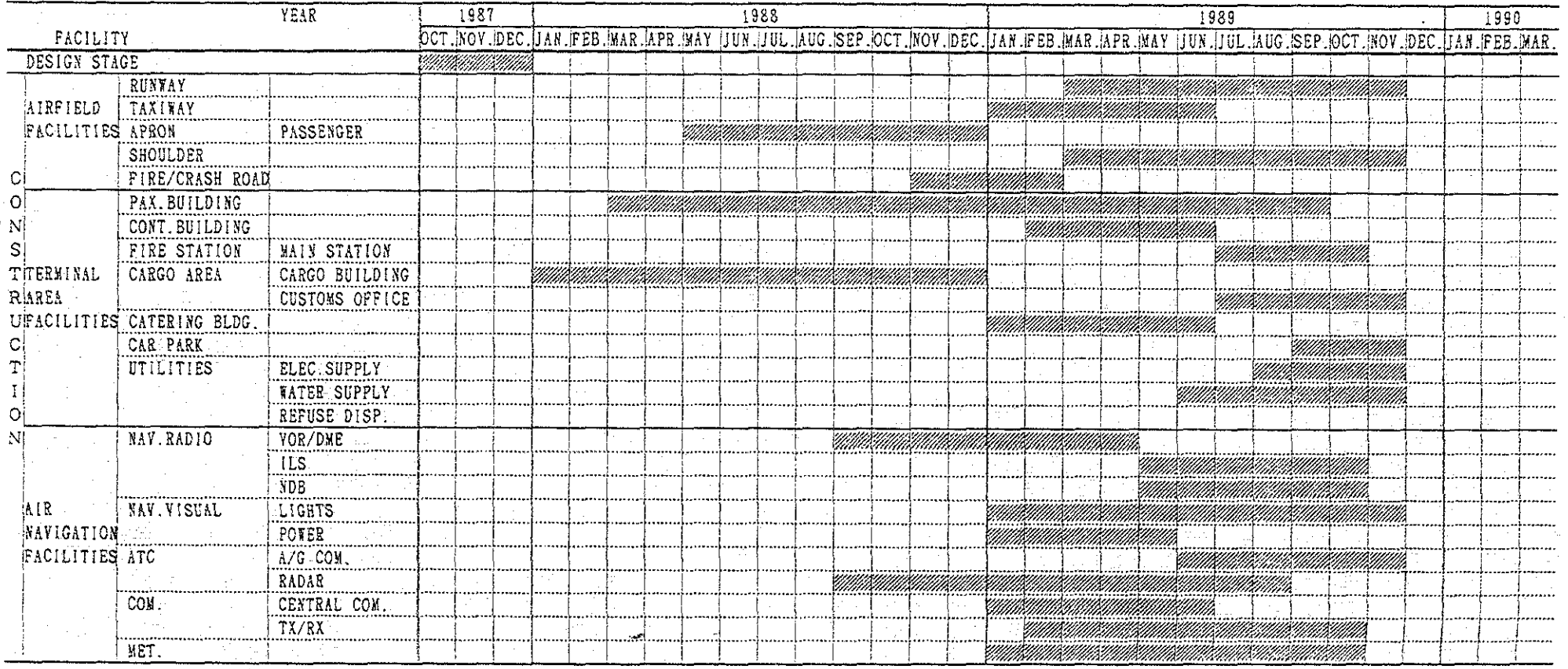
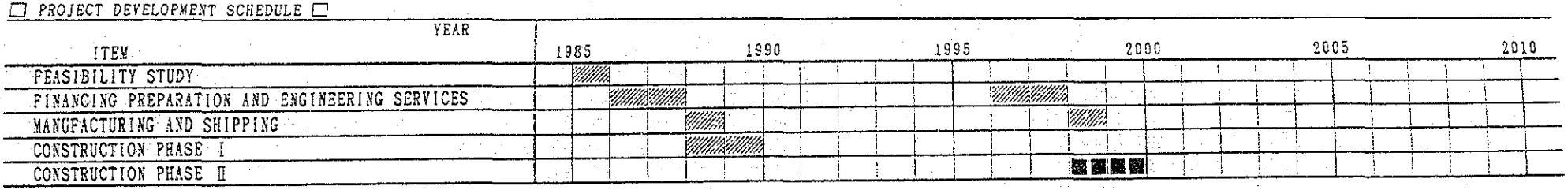


Fig. 6-1 Project Development Schedule (Phase I)

☐ *PROJECT DEVELOPMENT SCHEDULE* ☐



☐ PHASE II DESIGN AND CONSTRUCTION SCHEDULE ☐

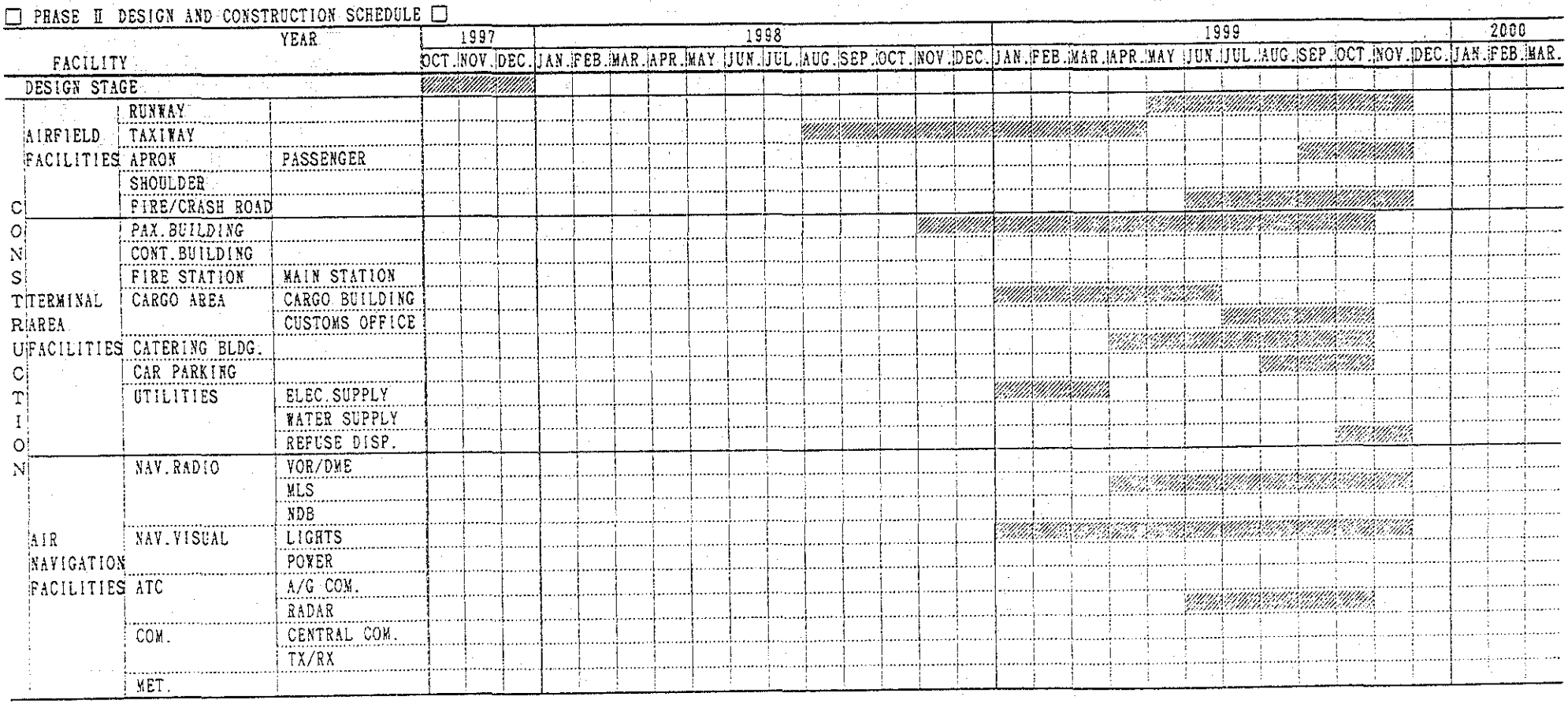


Fig. 6-2 Project Development Schedule (Phase II)

6-4 Cost Estimate

Construction cost by development phase was estimated as tabulated in Table 6-1, and the breakdown by year of the construction cost based on the construction schedules as per Figs. 6-1 and 6-2 is shown in Table 6-2.

The present cost estimate is based on the following conditions:

1) Unit prices used in the cost estimate are based on the data collected by the JICA Study Team in March 1985;
2) Foreign portion of the construction cost includes the following items:
   a) Purchase cost of construction equipment,
   b) Cost of imported materials such as bitumen, steel, glass, etc.,
   c) Foreign remittance portion of overhead and profit of the foreign contractor,
   d) Wage of foreign labour, and
   e) Fuel and lubricant cost of the construction machinery;
3) Local portion of the construction cost includes the following items:
   a) Operation cost of the construction equipment other than fuel and lubricant,
   b) Construction materials procured in Zambia such as cement, aggregate and wooden material, etc.,

c) Local portion of the foreign and local contractors' overhead cost and profits, and

d) Wages of local labour;

4) Physical contingency for variance in quantity of construction is estimated at 5% of the sum of the cost of items 1 through 5 as shown in Table 6-1; and

5) Conversion between US dollar, Kwacha and Yen is based on the exchange rates as of March 1985 of US$1.00 = K2.36 = ¥257.

Table 6-1 Construction Cost Estimate

(In 1985 thousand Kwacha)

Cost Item	Phase I Design Year 2000			Phase II Design Year 2010			Overall		
	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total
1. Airfield Facilities	6,265	13,618	19,883	4,219	10,509	14,728	10,484	24,127	34,611
2. Terminal Area Facilities	23,978	9,465	33,443	22,140	9,818	31,958	46,118	19,283	65,401
3. Air Navigation Facilities	34,332	3,223	37,555	10,270	660	10,930	44,602	3,883	48,485
4. Subtotal	64,575	26,306	90,881	36,629	20,987	57,616	101,204	47,293	148,497
5. Engineering Services	5,971	2,209	8,180	3,350	1,835	5,185	9,321	4,044	13,365
6. Physical Contingency	3,527	1,426	4,953	1,999	1,141	3,140	5,526	2,567	8,093
7. Grand Total	74,073	29,941	104,014	41,978	23,963	65,941	116,051	53,904	169,955

Table 6-2 Annual Breakdown of Estimated Construction Cost

(In 1985 thousand Kwacha)

Construction Phase		Year of Implementation	Foreign Portion	Local Portion	Total
Phase I	Design year 2000	1987	4,389	1,623	6,012
		1988	14,427	7,876	22,303
		1989	55,257	20,442	75,699
Phase II	Design year 2010	1997	2,462	1,349	3,811
		1998	2,368	2,874	5,242
		1999	37,148	19,740	56,888
Total			116,051	53,904	169,955

CHAPTER 7

ECONOMIC ANALYSIS

CHAPTER 7 ECONOMIC ANALYSIS

7-1 General

The purpose of the economic analysis is to make a comprehensive evaluation of the economic worth brought about in the Republic of Zambia by the implementation of the Lusaka International Airport Development Project.

The economic evaluation is generally made in terms of the economic internal rate of return (EIRR) or the net present value (NPV) of the project derived from the cost-benefit analysis made from the viewpoint of the national economy. It is a general practice to make cost-benefit analysis on the "with and without principle", that is to say, comparing the case where the project is implemented with the case where the project is not implemented. In such an analysis, whatever positive values identified on a comparative basis as being saved or gained on account of the implementation of the project are defined as the benefits of the project. On the other hand, any negative values accruing from the implementation of the project, again on a comparative basis, are defined as the costs of the project.

In the present study, the "without project" situation is termed the Base Case as defined below.

7-2 Assumptions

7-2-1 The Base Case

The Base Case, which is defined as the "without project" case of the present study, is one in which the existing Lusaka International Airport is to continue operating at the present facility level with minimum investments being made just enough for maintaining the present level of service throughout the project life. The minimum investments here are defined to be identical to those first mentioned in the 3rd paragraph of Section 5-1-1 in Chapter 5 hereinabove as being needed for the "urgent improvement of a few limited facilities . . . for soonest possible execution", and which are itemized under the column "Minimum Requirements" in Table 5-3. In the Base Case the air traffic at the Lusaka International Airport is assumed to reach the saturation point in 1985 and to remain unchanged thereafter throughout the project life.

If the Project, both Phase I and Phase II, is implemented, it can accommodate the forecast air transport demand up to the year 2010 beyond the 1985 saturation point in the Base Case, while if Phase I only is implemented, then it will only be able to meet the demand up to the year 2000. Fig. 7-1 presents the above situation in a graphic form.

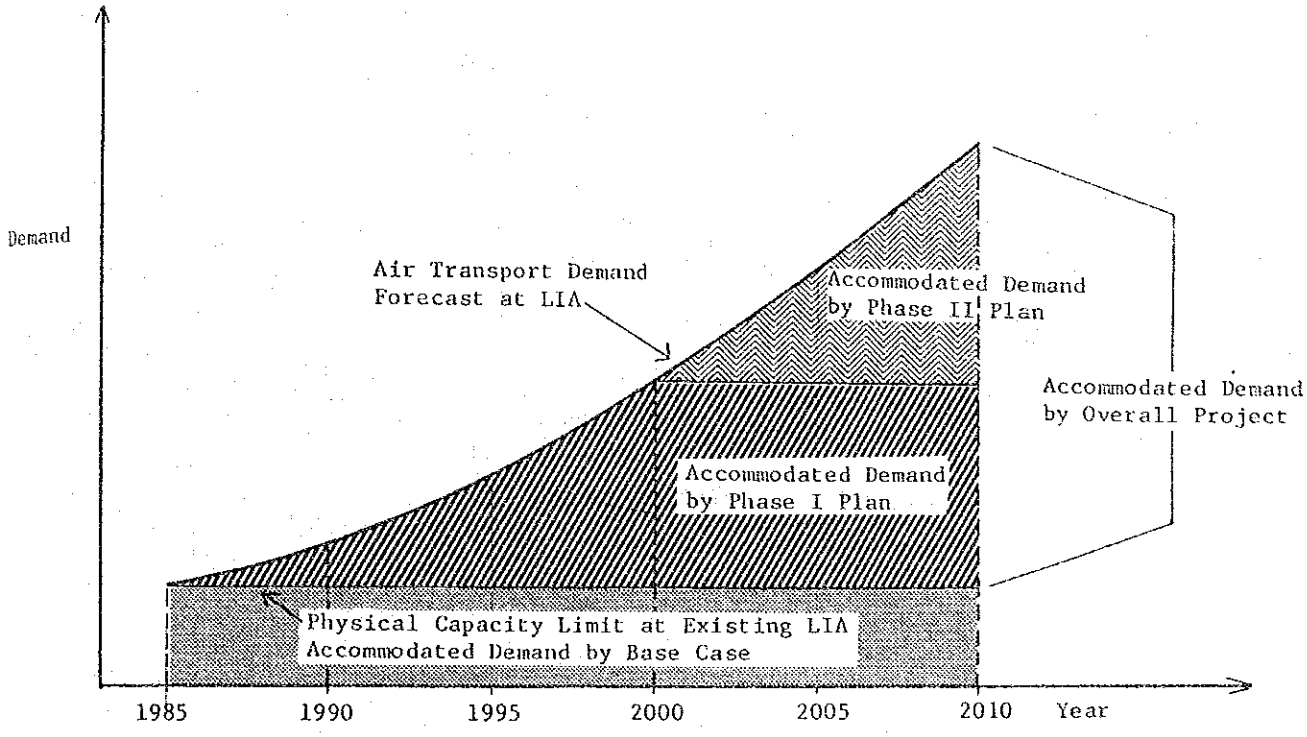


Fig. 7-1 Base Case and Overflowing Demand

7-2-2 Project Life

The project life is assumed to be 20 years following the opening in 1990 of the Phase I facilities, and the costs and benefits of the Project and those of the Base Case, which are both calculated in Kwacha on the basis of the actual prices prevailing in 1985, are measured for the said project life of 1990 - 2010.

7-2-3 Shadow Pricing

Application of shadow prices is generally desirable in the cost-benefit analysis of development projects in developing countries where market mechanisms are often distorted by various factors. However, in the case of Zambian economy the Government strictly controls foreign exchange and labour markets under a somewhat socialistic economic policy, and therefore, shadow pricing is considered inappropriate and consequently not applied in the present study.

7-3 Estimate of Economic Costs

7-3-1 Investment Costs

It is a usual practice in cost-benefit analysis to regard indirect taxes and Customs duties as transfers to the Government from the viewpoint of the national economy.

The construction costs estimated in Chapter 6 hereinabove are based on the market prices, but Customs duties are deducted from the cost of the imported goods in the foreign portion according to "Chapter 100 for Goods for Special Uses" in the "CHAPTER 662 OF THE LAWS OF ZAMBIA: Customs and Excise," which specifies that "goods for the exclusive use of the Government are duty-free subject to certain conditions."

The indirect taxes are deducted from the cost of domestic goods in the local portion at a uniform rate of 15%, which is a weighted average calculated on the basis of the following rates stipulated in the "CHAPTER 662 OF THE LAWS OF ZAMBIA: Customs and Excise":

- Portland cement	Free
- Road and paving setts, curbs and flagstones, of natural stone	15%
- Wood blocks, strips, etc., planed, tongued or grooved etc. but not further manufactured	15%
- Articles of plastering material	15 - 30%
- Articles of cement or of concrete, e.g. bricks, tiles, sanitary ware, etc.	10 - 30%

The economic costs per annum of the investment for the Project and for the Base Case are shown in Table 7-1. The cost of the Base Case net of indirect taxes is estimated based on the facility plan presented in Chapter 5 hereinabove.

Table 7-1 Annual Disbursement of Economic Cost of Investment

(In 1985 thousand Kwacha)

	Base Case		Project Phase I			Project Phase II		
	1st Year	2nd year	1987	1988	1989	1997	1998	1999
Airfield	97	-	-	5,080	13,062	-	2,676	10,704
Terminal	1,047	-	-	11,261	21,858	-	1,887	29,543
Nav-aids	-	18,554	-	3,742	33,688	-	-	10,913
Subtoal	1,144	18,554	-	20,083	68,608	-	4,563	51,160
Engineering	1,230	528	5,726	548	1,906	3,630	129	1,426
Contingency	121	955	286	1,062	3,605	181	250	2,709
TOTAL	2,495	20,037	6,012	21,690	74,119	3,811	4,942	55,295

7-3-2 Maintenance and Operation Costs

Estimates of the economic costs of the annual maintenance and operation of the Project and the Base Case for the assumed project life of 20 years are made in the following manner.

(1) Maintenance Cost of Newly Invested Facilities

1) Airfield Facilities

Estimated at 2% of the investment costs both for the Base Case and the Project case, provided that in the Base Case it includes the cost of a 3-cm thick runway overlay needed in 1997 amounting to 4,324 thousand Kwacha.

2) Terminal Area Facilities

Estimated at 3% of the investment costs.

3) Air Navigation Facilities

Estimated at 5% of the investment cost.

(2) Maintenance and Operation Cost of Airport

This subsection concerns the running cost, i.e. the cost of both maintenance and operation of the entire facilities of the Airport, except for the maintenance cost of the newly invested facilities dealt with in (1) hereinabove. It is estimated that the running cost except for the wages of the Airport personnel would increase by 10%, amonting to 866 thousand Kwacha in 1985, while no increase is estimated in the total

wages of 1,470 thousand Kwacha for 1985, taking into account the recent declining trend in the number of employees at the Airport.

In the Base Case, the above 1985 figures are assumed to remain unchanged each year throughout the project life. In the Project case, the wages are assumed to increase according to the number of employees estimated in Chapter 9 hereinafter, with the wage rate remaining unchanged at an average per employee of 2,500 Kwacha in 1985. The wages are estimated to amount to 1,700 thousand Kwacha for 680 employees in 1990, and 1,825 thousand Kwacha for 730 employees in 2000.

The 1984 record of the maintenance and operation costs of the existing facilities of the Lusaka International Airport incurred upon each of the responsible departments are summarized in Table 7-2.

Table 7-2 Maintenance and Operation Cost of Existing Facilities of Lusaka International Airport

(In 1984 thousand Kwacha)

	Running Costs other than Wages	Wages	Total
Civil Aviation Department	589	1,146	1,735
Roads Department	180	123	303
Buildings Department	18	201	219
Total	787	1,470	2,257

Source: Departments concerned of Zambian Government

(3) General Expenses

The general expenses are estimated at 10% of the sum of the maintenance cost for newly invested facilities discussed in (1) hereinabove and the maintenance and operation cost of the Airport discussed in (2) hereinabove.

Table 7-3 shows the economic costs of the annual maintenance and operation of the Project and the Base Case.

Table 7-3 Economic Costs of Annual Maintenance and Operation

(In 1985 thousand Kwacha)

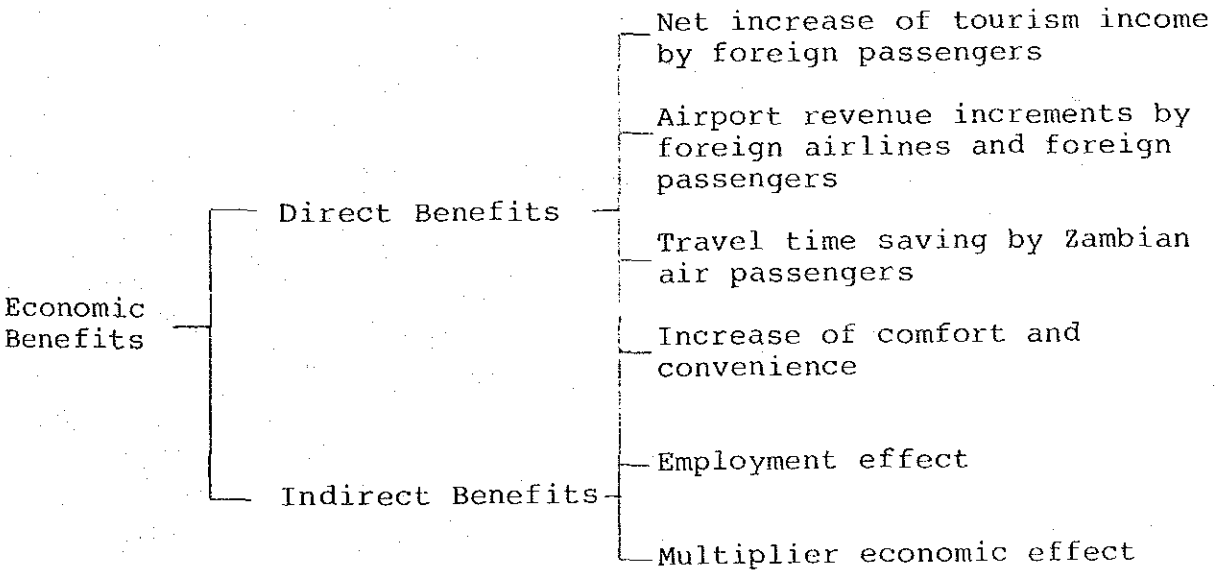
Item	Base Case			Project	
	1990-1996	1997	1998-2010	1990-1999	2000-2010
(1) Maintenance of New Facilities					
Airfield	2	4,326	77	363	631
Terminal Area	31	31	31	994	1,937
Air Navigation	928	928	928	1,872	2,418
Subtotal	961	5,285	1,036	3,229	4,986
(2) Running Cost*					
Non-wage Cost	866	866	866	866	866
Wages	1,470	1,470	1,470	1,700	1,825
Subtotal	2,336	2,336	2,336	2,566	2,691
(3) General	330	762	337	580	768
Grand Total	3,627	8,383	3,709	6,375	8,445

* Excluding maintenance of the newly invested facilities accounted for in Section 7-3-2·(1).

7-4 Estimate of Economic Benefits

7-4-1 Classification of Economic Benefits

The economic benefits considered attributable to the Project from the viewpoint of the national economy of Zambia comprise the direct (primary) benefits and the indirect (secondary) benefits, each of which consisting of the tangible benefits and the intangible benefits as shown below.



7-4-2 Direct Benefits

(1) Net Increase of Tourism Income

As discussed in Section 7-2-1 the international air passenger transport demand at Lusaka International Airport will overflow in the Base Case after 1985, and such overflowing international air passengers would either be forced to give up their trip, or seek other - namely surface - means of transport for their intended trip. In the present study, the ratio of the occurrence of the above two alternative cases are assumed as shown in Table 7-4, by judgement of the study team on the probable choice of international air passengers for each of the 5 regions by purpose of trip.

Table 7-4 Assumed Choice of Overflowing International Air Passengers

(%)

Region	Nationality	Choice*	Purpose of Trip		
			Tourism	Business	Private
Africa (S)	Zambian	A	100	50	50
		B	0	50	50
	Foreigner	A	100	50	50
		B	0	50	50
Africa (L)	Zambian	A	100	50	50
		B	0	50	50
	Foreigner	A	100	50	50
		B	0	50	50
Europe	Zambian	A	100	100	50
		B	0	0	50
	Foreigner	A	100	100	50
		B	0	0	50
America	Zambian	A	100	100	50
		B	0	0	50
	Foreigner	A	100	100	50
		B	0	0	50
Asia	Zambian	A	100	100	50
		B	0	0	50
	Foreigner	A	100	100	50
		B	0	0	50

* Notes: A: Give up trip
B: Switch to surface transport

As stated in Section 7-2-1, those overflowing international air passengers who would give up their trip in the Base Case can be accommodated by the Airport if the Project is implemented. The average tourism expenditures by region, according to the market research conducted by Zambia National Tourist Board in 1983, are as shown in Table 7-5. The weighted average per capita expenditure by region shown in the same table in 1985 price is calculated based on the distribution ratio of tourists by region according to the tourists statistics, with assumed increase rate of 20%, equal to that of the consumer prices.

Table 7-5 Per Capita Tourism Expenditure by Region

(In 1985 Kwacha)

Region	Survey in 1983		Estimates in 1985 Price	Ratio	Weighted Average
	Subregion	Expenditure			
Africa(S)	all	250	300	1.0	300
Africa(L)	Kenya	500	600	0.4	960
	South Africa	1,000	1,200	0.6	
Europe	all	1,000	1,200	1.0	1,200
America	all	1,500	1,800	1.0	1,800
Asia	Japan	1,500	1,800	0.1	810
	Oceania	1,000	1,200	0.4	
	Rest of Asia	250	300	0.5	

According to the Third National Development Plan, the total investment cost in the transport, communications and tourism sectors together is estimated at K1,083 million for the combined Second and Third National Development period of 1972-1983 as shown in Table 7-6.

Table 7-6 National Investments on Transport, Communications and Tourism

(K million)

National Plan	Transport and Communication	Tourism	Total
Second	350	33	383
Third	650*	50	700
Total	1,000	83	1,083

* Excluding the on-going roads projects.

Since the estimated K170 million total construction cost of the Project, both Phase I and Phase II inclusive, is roughly equivalent to 15% of the above-mentioned investment cost of K1,083 million, 15% of the gross tourism expenditure made by the overflowing expatriate international air passengers who would have given up their trip under the Base Case is assumed to

be the economic benefits attributable to the Project, which is enjoyed by the Zambian economy as net foreign exchange earning increments.

On the basis of the above considerations, the net increase of the tourism income attributable to the implementation of the Project is estimated as shown in Table 7-7.

Table 7-7 Incremental Net Tourism Income

YEAR	AFRICA(S) Number ('000)	AFRICA(S) Tourism Income ('000K)	AFRICA(L) Number ('000)	AFRICA(L) Tourism Income ('000K)	EUROPE Number ('000)	EUROPE Tourism Income ('000K)	AMERICA Number ('000)	AMERICA Tourism Income ('000K)	ASIA Number ('000)	ASIA Tourism Income ('000K)	GROSS Tourism Income (A)	Net Addition to GNP Tourism Income (A) X 15%
1990	1.95	584	4.34	4,163	15.53	15,526	3.08	4,626	3.14	2,547	27,446	4,117
1991	2.42	726	5.39	5,172	19.26	19,260	3.80	5,707	3.91	3,164	34,029	5,104
1992	2.92	876	6.51	6,245	23.23	23,229	4.57	6,854	4.72	3,820	41,024	6,154
1993	3.45	1,036	7.69	7,386	27.45	27,446	5.38	8,071	5.58	4,518	48,457	7,269
1994	4.02	1,206	8.96	8,599	31.93	31,929	6.24	9,362	6.49	5,259	56,356	8,453
1995	4.62	1,387	10.30	9,889	36.69	36,694	7.15	10,732	7.47	6,048	64,750	9,713
1996	5.26	1,579	11.72	11,251	41.79	41,788	8.09	12,142	8.50	6,885	73,646	11,047
1997	5.94	1,783	13.23	12,698	47.20	47,205	9.09	13,636	9.60	7,776	83,098	12,465
1998	6.67	2,001	14.83	14,235	52.96	52,964	10.15	15,219	10.77	8,722	93,141	13,971
1999	7.44	2,231	16.53	15,870	59.09	59,086	11.26	16,895	12.01	9,729	103,811	15,572
2000	8.26	2,477	18.34	17,607	65.60	65,596	12.45	18,670	13.33	10,799	115,149	17,272
2001	8.92	2,675	19.80	19,010	70.78	70,781	13.48	20,221	14.40	11,662	124,349	18,652
2002	9.61	2,882	21.33	20,481	76.21	76,210	14.56	21,847	15.51	12,567	133,987	20,098
2003	10.33	3,100	22.94	22,021	81.90	81,897	15.70	23,553	16.68	13,515	144,085	21,613
2004	11.09	3,328	24.62	23,635	87.85	87,853	16.89	25,342	17.91	14,508	154,666	23,200
2005	11.89	3,567	26.38	25,326	94.09	94,091	18.15	27,219	19.20	15,549	165,752	24,863
2006	12.71	3,812	28.22	27,091	100.68	100,678	19.41	29,109	20.54	16,640	177,330	26,599
2007	13.56	4,069	30.15	28,941	107.58	107,579	20.73	31,088	21.95	17,783	189,459	28,419
2008	14.46	4,338	32.17	30,879	114.81	114,809	22.11	33,159	23.43	18,980	202,165	30,325
2009	15.40	4,619	34.28	32,909	122.38	122,384	23.55	35,328	24.98	20,235	215,476	32,321
2010	16.38	4,914	36.50	35,036	130.32	130,321	25.07	37,599	26.61	21,550	229,420	34,413
TOTAL		53,191		378,442		1,407,328		406,378		232,257	2,477,596	371,639

(2) Airport Revenue Increments

As discussed in Section 7-2-1 the future aircraft movements are expected to overflow after 1985 when the Airport's capacity would reach the saturation point. Assuming that 50% of all aircraft movements will continue to be of foreign airlines as it is today, the incremental airport revenues that would be paid by foreign airlines if the Project is implemented, are considered to be the economic benefits of the Project in terms of foreign exchange earnings, along with the expected increase in international passenger service charges. The incremental airport revenues are estimated on the basis of the Aviation (Aerodromes Fees) Notice, 1984 as follows:

1) Landing Charges

Day landing charges are levied on international flights (fixed wing aircraft) based on the maximum permissible take-off weight with minimum charge of K30.00 as follows:

Aircraft weight (tonnes)		Day charge per tonne or part thereof (K)
First	25	8
Next	75	10
Over	100	12

2) Lighting Charges

25% of the day landing charges are levied for all night landings or take-offs.

3) Parking Charges

Parking charges are levied on the basis of the maximum permissible take-off weight with minimum charge of K15.00 as follows:

Aircraft weight (tonnes)		Parking rates per tonne or part thereof per hour or part thereof, with first 3 hours free (K)
First	25	0.6
Next	75	0.4
Over	100	0.2

4) Passenger Service Charge

Passenger service charge of K20.00 is levied per embarking passenger on international flights according to the Government Notice of January 1985.

On the basis of the current airport charges at Lusaka International Airport, estimation is made on incremental airport revenues accruing from the foreign passengers and foreign aircraft movements accommodated by the Project, with the results as shown in Table 7-8.

Table 7-8 Airport Revenue Increments

(In 1985 thousand Kwacha)

YEAR	Landing Charge	Lighting Charge	Parking Charge	Passenger Service Charge	Total Revenue
1990	850	63	9	930	1,852
1991	1,052	78	11	1,154	2,295
1992	1,253	97	13	1,392	2,756
1993	1,455	113	16	1,645	3,228
1994	1,656	132	18	1,914	3,721
1995	1,855	149	21	2,200	4,225
1996	2,130	175	24	2,503	4,832
1997	2,405	199	27	2,826	5,457
1998	2,680	223	30	3,169	6,101
1999	2,955	248	34	3,533	6,769
2000	3,229	274	37	3,920	7,460
2001	3,506	302	40	4,233	8,081
2002	3,783	329	44	4,560	8,716
2003	4,060	356	47	4,904	9,368
2004	4,337	385	51	5,263	10,036
2005	4,609	411	54	5,640	10,714
2006	4,966	449	59	6,033	11,507
2007	5,323	483	63	6,444	12,314
2008	5,680	521	68	6,875	13,144
2009	6,037	558	72	7,327	13,994
2010	6,392	594	77	7,800	14,863
TOTAL	70,215	6,138	815	84,265	161,433

(3) Travel Time Saving

As stated in Subsection (1) above, the overflowing Zambian international air passengers who would make their trips would have to switch to surface transport modes such as railways or roads in order to reach their destinations or neighbouring international airports for transfer. Such travel time lost by Zambians would be saved by the implementation of the Project, comprising economic benefits to the Zambian economy attributable to the Project. Theoretically speaking, such benefits could be estimated in monetary terms by using the concept of time value. However, such benefits are rather difficult to be quantified and are not counted in the present study. The same applies to the domestic air passengers who would overflow in the Base Case.

(4) Increase of Comfort and Convenience

The service level of the terminal area facilities will particularly be much improved by the implementation of the Project as compared with that of the Base Case. Air passengers will derive increased comfort and convenience from the improved facilities in the passenger terminal building. For example, waiting time will be largely reduced in the Customs, Immigration and Health Control procedures, as well as at the check-in counters. The Project will also reduce the average handling time of air cargo, at the same time reducing possible occurrence of damage or decay of air cargo, by

the renewal of the air cargo terminal building. These advantages may well be termed direct benefits enjoyed by the airport users, but are not counted in the present study because of the difficulty in their quantification.

7-4-3 Indirect Benefits

(1) Employment Effect

The Lusaka International Airport Development Project is expected to contribute to increasing the national income of Zambia by providing increased employment opportunities both during and after the construction of the facilities. These benefits are quantifiable, but have been treated as indirect benefits as is generally practiced, and consequently no calculation thereof is made in the present study.

(2) Multiplier Economic Effect

The Project will cause multiplier effects on the Zambian economy as a whole through increased procurement of goods and services related to the construction and maintenance of the facilities. These effects could be quantitatively identified through the input-output analysis, which, however, is considered outside the scope of the present study.

7-5 Economic Evaluation

7-5-1 Results of Economic Cost-Benefit Analysis

Cost-benefit analysis is made on the basis of the cash flow of the economic costs and the direct tangible economic benefits obtained through comparison between the Base Case and the Project case as discussed above. In the Base Case, for the purpose of comparison with the Project case, the construction is assumed to commence in 1988, with investments being completed in 1989. In addition to comparing the Base Case with the Project, complete with Phase I and Phase II inclusive, a comparison is also made between the Base Case and a case where only Phase I of the Project is implemented, assuming that the Airport, after completion of the Phase I facilities, would continue operating beyond the design year 2000 through and up to 2010, continuing to accommodate only the forecast demand for 2000, and incurring only the maintenance and operation cost each year.

The economic internal rate of return (EIRR) is 12.5% for the entire Project as shown in Table 7-9, and 13.5% for the Phase I of the Project as shown in Table 7-10. On account of these figures it is concluded that the Project is economically feasible from the viewpoint of the national economy of Zambia where the social discount rate is understood to be 12%. If the intangible benefits are taken into consideration, then the Project will show a much

better EIRR figure. It is also noteworthy that the implementation of the Project could contribute to the country in terms of foreign exchange earnings which are scarce in Zambia.

7-5-2 Sensitivity Analysis

Sensitivity analysis is made of the EIRR value for certain fluctuations of the key factors of the economic costs and the direct tangible economic benefits, with the results as shown below.

	Phase I & II	Phase I only
1) 10% decrease in demand	11.0%	12.1%
2) 20% decrease in demand	9.7%	10.6%
3) 10% increase in demand	13.9%	14.9%
4) 10% increase in costs	11.1%	12.3%
5) 20% increase in costs	9.9%	11.2%
6) 10% decrease in costs	14.0%	15.0%
7) 10% decrease in demand and 10% increase in costs	9.6%	10.9%
8) 20% decrease in demand and 20% increase in costs	6.8%	8.4%

Table 7-9 Cash Flow of Economic Cost and Benefits

(The Entire Project)

(In 1985 thousand Kwacha)

YEAR	Economic Cost of Phase 1 & 2(A) Invest Cost	Mainte Operat Cost	Economic Cost of Base Case (B) Replace-ment Cost	Mainte Operat Cost	Incre-mental Cost (C=A-B)	Net Addition to GNP of Incremental T-Income	Economic Benefits Incremental Total Airport Revenue	Benefits (D)	Net Benefits (E=D-C)	Discounted Cash Flow at 10%	at 12%
1987	6,012	0	0	0	6,012	0	0	0	-6,012	-4,969	-4,793
1988	21,690	0	2,495	0	19,195	0	0	0	-19,195	-14,421	-13,663
1989	74,119	0	20,037	0	54,082	0	0	0	-54,082	-36,939	-34,370
1990	0	6,375	0	3,627	2,748	4,117	1,852	5,969	3,221	2,000	1,828
1991	0	6,375	0	3,627	2,748	5,104	2,295	7,399	4,651	2,626	2,357
1992	0	6,375	0	3,627	2,748	6,154	2,756	8,909	6,161	3,162	2,787
1993	0	6,375	0	3,627	2,748	7,269	3,228	10,497	7,749	3,615	3,130
1994	0	6,375	0	3,627	2,748	8,453	3,721	12,175	9,427	3,998	3,399
1995	0	6,375	0	3,627	2,748	9,713	4,225	13,937	11,189	4,314	3,603
1996	0	6,375	0	3,627	2,748	11,047	4,832	15,879	13,131	4,602	3,779
1997	3,811	6,375	0	8,383	1,803	12,465	5,457	17,921	16,118	5,136	4,137
1998	4,942	6,375	0	3,709	7,608	13,971	6,101	20,072	12,464	3,611	2,857
1999	55,295	6,375	0	3,709	57,961	15,572	6,769	22,341	-35,620	-9,380	-7,289
2000	0	8,445	0	3,709	4,736	17,272	7,460	24,732	19,996	4,787	3,653
2001	0	8,445	0	3,709	4,736	18,652	8,081	26,733	21,997	4,787	3,568
2002	0	8,445	0	3,709	4,736	20,098	8,716	28,814	24,078	4,764	3,507
2003	0	8,445	0	3,709	4,736	21,613	9,368	30,980	26,244	4,720	3,413
2004	0	8,445	0	3,709	4,736	23,200	10,036	33,236	28,500	4,660	3,309
2005	0	8,445	0	3,709	4,736	24,863	10,714	35,577	30,841	4,584	3,197
2006	0	8,445	0	3,709	4,736	26,599	11,507	38,106	33,370	4,509	3,089
2007	0	8,445	0	3,709	4,736	28,419	12,314	40,733	35,997	4,422	2,975
2008	0	8,445	0	3,709	4,736	30,325	13,144	43,469	38,733	4,326	2,858
2009	0	8,445	0	3,709	4,736	32,321	13,994	46,316	41,580	4,221	2,739
2010	0	8,445	0	3,709	4,736	34,413	14,863	49,276	44,540	4,111	2,620
TOTAL	165,869	156,645	22,532	81,989	217,993	371,639	161,433	533,072	315,079	17,246	2,706

EIRR = 12.402041334

Table 7-10 Cash Flow of Economic Cost and Benefits

(Phase I of the Project)

(In 1985 thousand Kwacha)

YEAR	Economic Cost of Phase 1 (A) Invest Cost	Mainte Operat Cost	Economic Cost of Base Case (B) Replace-ment Cost	Mainte Operat Cost	Incre-mental Cost (C=A-B)	Net Addition to GNP of Incremental T-Income	Economic Benefits Incremental Airport Revenue	Total Benefits (D)	Net Benefits (E=D-C)	Discounted Cash Flow at 10%	at 12%
1987	6,012	0	0	0	6,012	0	0	0	-6,012	-4,969	-4,793
1988	21,690	0	2,495	0	19,195	0	0	0	-19,195	-14,421	-13,663
1989	74,119	0	20,037	0	54,082	0	0	0	-54,082	-36,939	-34,370
1990	0	6,375	0	3,627	2,748	4,117	1,852	5,969	3,221	2,000	1,828
1991	0	6,375	0	3,627	2,748	5,104	2,295	7,399	4,651	2,626	2,357
1992	0	6,375	0	3,627	2,748	6,154	2,756	8,909	6,161	3,162	2,787
1993	0	6,375	0	3,627	2,748	7,269	3,228	10,497	7,749	3,615	3,130
1994	0	6,375	0	3,627	2,748	8,453	3,721	12,175	9,427	3,998	3,399
1995	0	6,375	0	3,627	2,748	9,713	4,225	13,937	11,189	4,314	3,603
1996	0	6,375	0	3,627	2,748	11,047	4,832	15,879	13,131	4,602	3,775
1997	0	6,375	0	8,383	-2,008	12,465	5,457	17,921	19,929	6,350	5,115
1998	0	6,375	0	3,709	2,666	13,971	6,101	20,072	17,406	5,042	3,989
1999	0	6,375	0	3,709	2,666	15,572	6,769	22,341	19,675	5,181	4,026
2000	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	5,282	4,031
2001	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	4,802	3,599
2002	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	4,366	3,214
2003	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	3,969	2,869
2004	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	3,608	2,562
2005	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	3,280	2,288
2006	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	2,982	2,042
2007	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	2,711	1,824
2008	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	2,464	1,628
2009	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	2,240	1,454
2010	0	6,375	0	3,709	2,666	17,272	7,460	24,732	22,066	2,037	1,298
TOTAL	101,821	133,875	22,532	81,989	131,175	283,860	123,294	407,154	275,979	22,302	7,992

EIRR = 13.5469616396