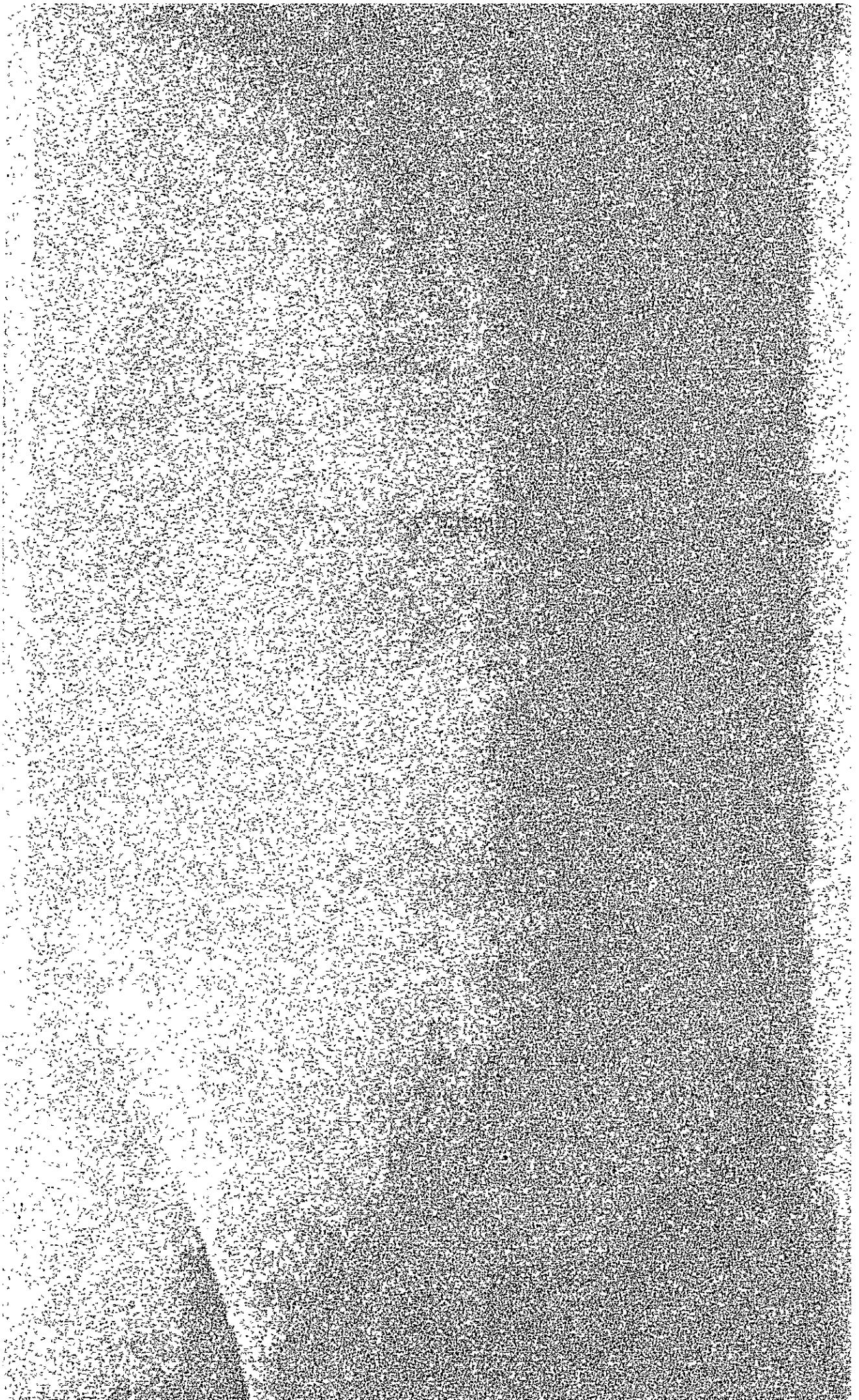


CHAPTER 7



CHAPTER 7 CONSTRUCTION SCHEDULE AND COST ESTIMATE

7.1 Construction Conditions

7.1.1 Soil and Rainfall Intensity

Available data of the previous study and the results of soil tests carried out as mentioned in Chapter 5 indicate that the soil of the new airport construction site is of a red, highly plastic silty clay with in site densities varying from 850 kg/m^3 to $1,150 \text{ kg/m}^3$ and natural moisture contents between 37% and 41%. The maximum dry densities were found to be between $1,475 \text{ kg/m}^3$ and $1,435 \text{ kg/m}^3$, and the optimum moisture contents between 29% and 31%. The percent-swell-and-shrinkage is estimated to be as low as 0.5, which indicates an extraordinarily high compressibility of the soil. It is recommended that an experimental banking be made in the detailed design stage.

The rainfall intensity of the CPS area could not be precisely analyzed because of the insufficiency of detailed rainfall records, and is estimated to be 70 mm/hour for the purpose of this study on the basis of the related data supplied by the Direccion de Meteorologia.

7.1.2 Construction Material

1) Sand and stone

Extensive deposits of basalt are found around CPS, which would make excellent aggregate when crushed. Both fine and coarse sands suitable for construction can be dredged from the Rio Parana and from the Rio Acaray.

2) Cement, asphalt and steel material

Since majority of cement, asphalt and steel materials used in heavy construction projects in Paraguay are generally being imported, these materials to be used for the construction of the new airport are also assumed to be imported.

7.2 Civil Works

7.2.1 Grading

1) Determination of formation level

Search was made by electronic computer for an optimum formation level of the new airport that would give closest possible balance between cuts and fills and minimized total quantity of earthworks. Calculation of the optimum formation level was made by unit area of 50-meter grids drawn throughout the entire area of the proposed airport premises.

The quantities of required earthwork resulting from the determined formation level are as shown in Table 7.1.

The longitudinal section and the standard cross section of the runway are shown in Appendix 7-1.

Table 7.1 EARTHWORK QUANTITIES

Excavation	
Stripping	131,000 m ³
Excavation	2,976,000 m ³
Embankment	1,488,000 m ³

2) Earthmoving quantities by hauling distance

Excavation work is classified into the following three categories by type of construction equipment to be used depending on the hauling distance of earth.

Table 7.2 CLASSIFICATION OF EXCAVATION WORK BY EQUIPMENT

	Work Category	Hauling Distance	Equipment Used
Short Distance Work	(1)	Less than 50 m	Bulldozer
Medium Distance Work	(2)	50 m or more and less than 1,000 m	Motor Scraper
Long Distance Work	(3)	1,000 m or more	Shovel-Tipper

The total earthmoving volume was classified into the above three categories so as to minimize the hauling distance, with the results as summarized in Table 7.3. The distribution diagram of earthworks is shown in Appendix 7-2.

Table 7.3 EARTHMOVING QUANTITIES BY DISTANCE

Works	Quantity ('000 m ³)	Average Hauling Distance (m)
Stripping	131	1,000
Earthmoving (1)	148	40
Earthmoving (2)	1,438	700
Earthmoving (3)	1,391	1,700

3) Method of earthwork

The earth of the site to be excavated consists mostly of silty clay which will easily turn muddy once wetted and disturbed. The results of the soil

tests indicate that it is recommendable to use bulldozer or tire-roller for compaction of the embankment. Special care should be taken not to give excessive compaction to the soil when it has high water content. Scheduling of earthwork must, therefore, be worked out duly taking this condition into account. Loose surface of the embankment work shall be compacted and smoothed out without delay to prevent penetration of the rain water.

7.2.2 Pavement

1) Pavement structure

Comparative analyses were made of the characteristics of the two types of pavement presently being applied on airports in general, namely the asphalt concrete pavement and the cement concrete pavement, with the results as shown in Table 7.4.

As a result of this comparison, the asphalt concrete pavement has been adopted on account of economy and ease of construction, maintenance and repair for all pavement surfaces of the proposed new airport, except for the passenger loading apron where cement concrete is preferable because of its better ability to resist the expected recessing, oil leakage and twisting force.

Table 7.4 COMPARISON BETWEEN ASPHALT CONCRETE PAVEMENT AND CEMENT CONCRETE PAVEMENT

	Asphalt	Cement
THICKNESS	Thick	Thin
LOAD BEARING CHARACTERISTICS	Surface may be rutted depending on load	Can accommodate variety of loads without rutting
JOINT	Not needed	Needed between panels to absorb effects of temperature variation
WEATHERING	Surface tends to harden and lose cohesion rather soon	Weathering does not much affect the bearing strength
COST	About 6000G/m ² (CBR = 7%)	About 8700G/m ² (K ₇₅ = 4.5kg/cm ³)
CONSTRUCTION PERIOD	Rather short and suitable for surfacing of extensive area	Longer
MAINTENANCE AND REPAIR	Easier because spot repair is possible	Difficult, because it involves breaking up of concrete slabs, and long curing period

2) Pavement thickness

The thickness of the pavement was determined based on the following design factors.

Design load (critical aircraft)	B-747
Repetition of design load	5,000 times
CBR of subgrade	7%
K ₇₅ of subgrade of the passenger loading apron	4.5 kg/cm ³

The typical structure of the proposed airport pavement is shown in Appendix 7-3.

3) Pavement construction method

As already mentioned, care should be taken not to let the subgrade work exposed to rain. Therefore, as soon as the subgrading work is completed, the subbase shall be laid without delay. If and when the pavement work takes place during the rainy season, a prime coating shall be applied on top of the subgrade. If, on the other hand, the circumstances should not permit such prompt execution of the subbase work, the actual formation level of the subgrade shall be finished slightly higher than the design level in order to allow for removal of the moistened surplus earth on the subgrade surface by grader just before the subbase work is actually executed.

7.2.3 Airport Drainage System

1) Basic design consideration

The drainage system of the new airport is basically planned so as not to disturb the existing natural drainage in and around the airport site after completion of the airport construction. It consists of the two separate sub-systems, one each on either side of the runway centerline. The overall drainage system of the proposed new airport is shown in Fig. 7.1.

2) Estimated discharge

The following rational formula was used to estimate the design discharge to be accommodated by the new airport drainage system.

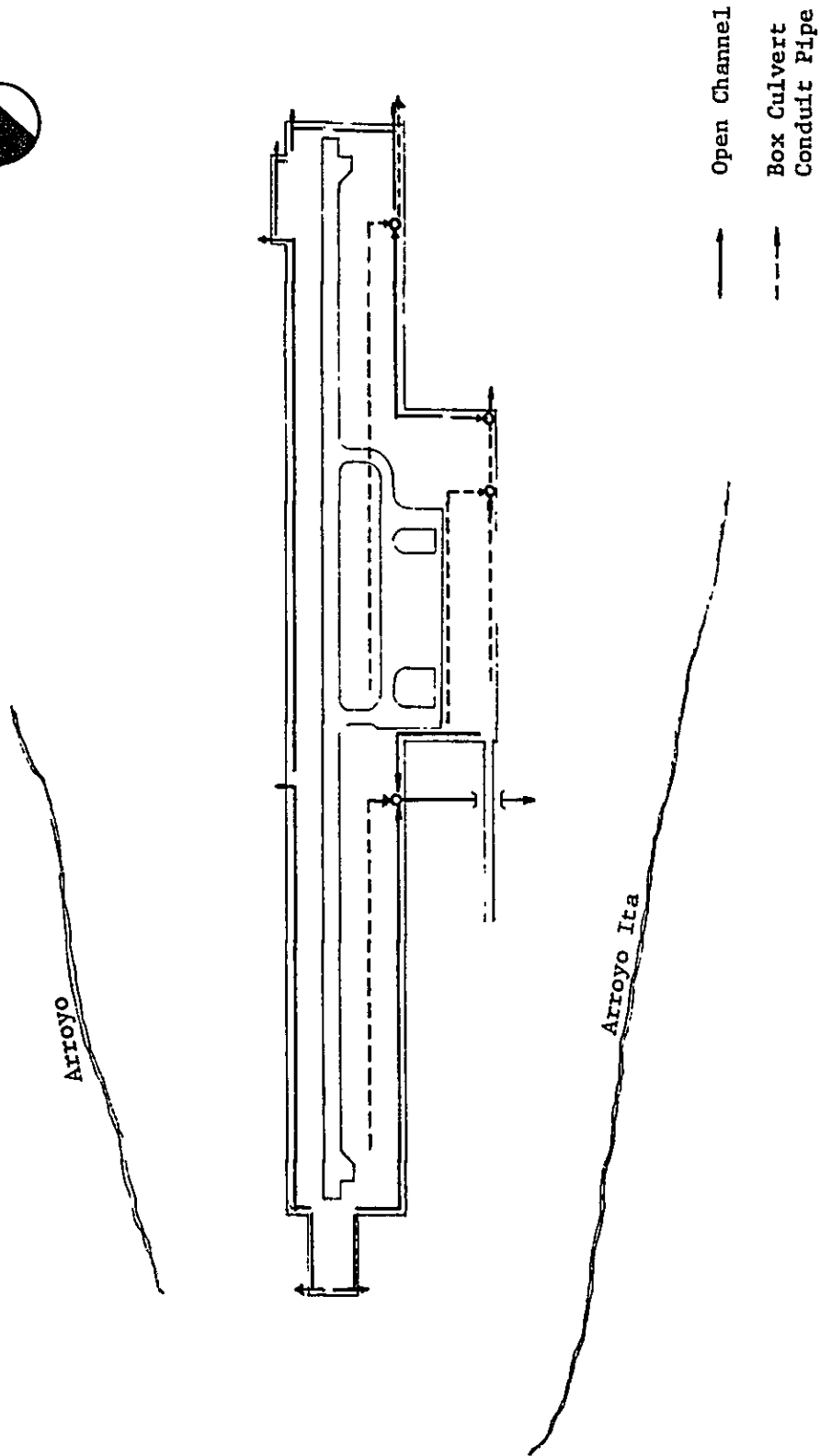


FIG. 7.1 DRAINAGE SYSTEM OF NEW CPS AIRPORT

$$Q = CiA/360$$

where,

Q :	design discharge (m ³ /sec.)	
C :	runoff coefficient by FAA criteria	
	for asphalt pavement	0.95
	for concrete pavement	0.95
	for sodding area	0.5
	for other areas	0.3
i :	rainfall intensity	70mm/hr.
A :	drainage area (ha)	

7.3 Building Works

7.3.1 Building Structure

All the buildings of the new airport will be of reinforced concrete structure.

7.3.2 Foundation of Buildings

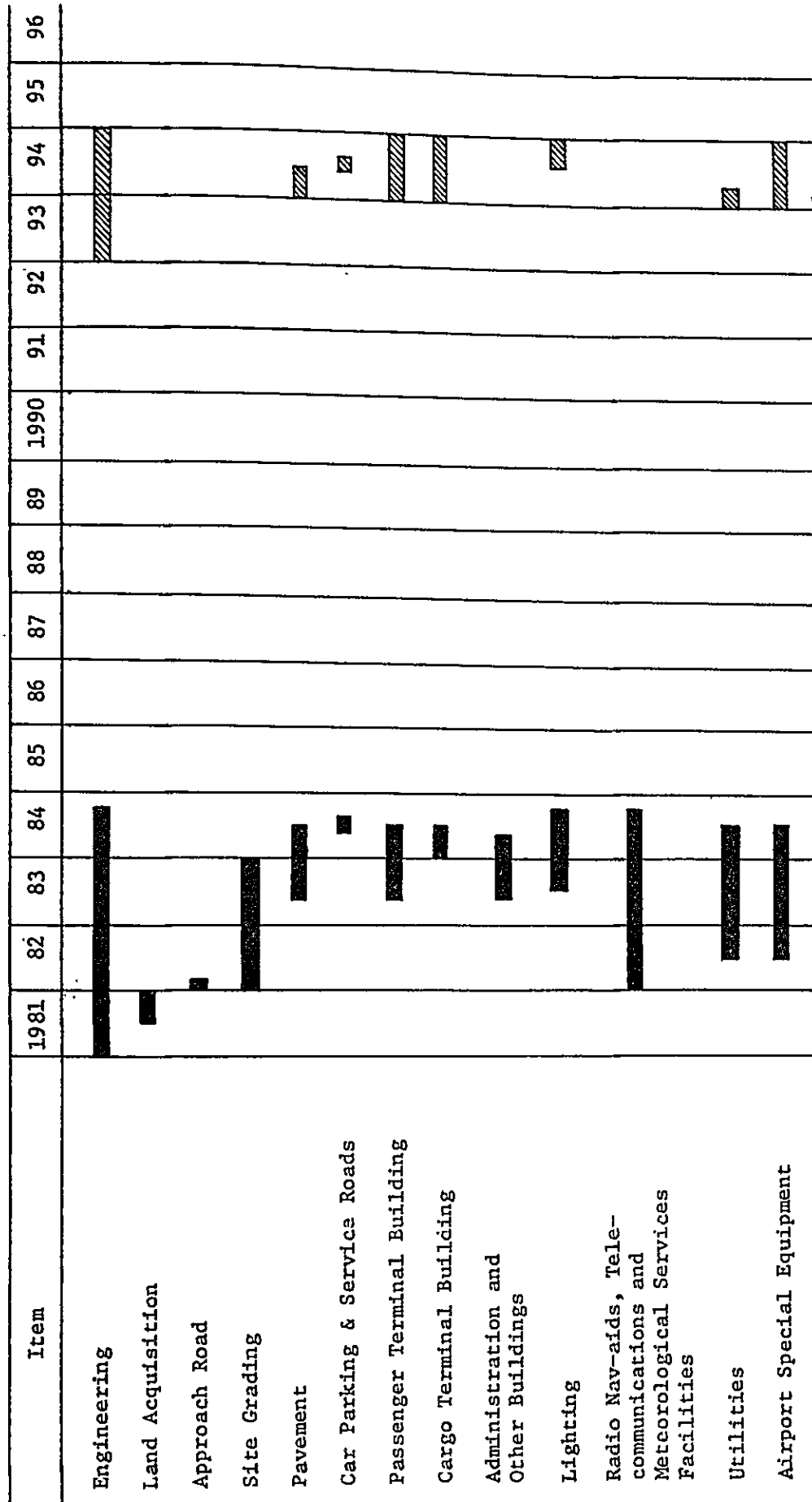
Judging from the results of the standard penetration tests an isolated spread foundation is considered suitable for the airport buildings.

7.4 Construction Schedule

Construction schedule of the new airport is planned as shown in Fig. 7.2, based on an assumption that the detailed design and land acquisition will have been completed by the end of 1981.

Fig. 7.2 CONSTRUCTION SCHEDULE OF NEW CPS AIRPORT

■ Stage I
 ▨ Stage II



7.5 Construction Cost Estimate

Construction cost of the new airport by development stage is estimated as tabulated in Table 7.5, and the breakdown by year of the construction cost based on the construction schedule as per Fig. 7.2 is shown in Table 7.6.

The present cost estimate is based on the following conditions.

- 1) Unit prices used in the cost estimate are mostly based on the data collected by the JICA survey team from May to June in 1979.
- 2) Foreign currency portion of the construction cost includes the following items:
 - a. Purchase cost of construction equipment without Customs duty.
 - b. Cost of imported materials such as cement, steel, asphalt and glass, without Customs duty.
 - c. Foreign remittance portion of the overhead and profit of foreign contractors and engineering firms.
 - d. Wages of foreign labor.
 - e. Fuel and lubricant of the construction equipment.



3) Local currency portion of the cost includes the following items:

- a. Operation cost of the construction equipment other than fuel and lubricant.
- b. Construction materials procured in Paraguay such as aggregate and wooden material.
- c. Land transport cost of materials and labor.
- d. Local portion of foreign and local contractors' overhead costs and profits.
- e. Wages of local labor.
- f. Land acquisition cost.

4) Engineering fee is estimated at 10% of the total cost of works.

5) Contingency is estimated at 10% of the sum of the total cost of works, engineering fee and the cost of land acquisition.

6) Conversion between one another of US Dollar, Guarani and Yen is based on the exchange rates as of June 1979 of US\$1.0 = G140 = ¥220.

Table 7.5 ESTIMATED CONSTRUCTION COST OF NEW CPS AIRPORT

(Unit: Thousand US\$)

Cost Item	Stage I			Stage II			Total		
	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total	Foreign Portion	Local Portion	Total
Civil Works	16,822	12,848	29,670	536	422	958	17,358	13,270	30,628
Building & Equipment	10,557	3,365	13,922	5,677	2,067	7,744	16,234	5,432	21,666
Lighting	3,039	347	3,386	132	4	136	3,171	351	3,522
Radio Nav-aid, Telecommunications & Meteorological Service Facilities	7,143	194	7,337	0	0	0	7,143	194	7,337
Utilities	8,280	1,375	9,655	113	152	265	8,393	1,527	9,920
Total of Works	45,841	18,129	63,970	6,458	2,645	9,103	52,299	20,774	73,073
Engineering	4,584	1,813	6,397	646	265	911	5,230	2,078	7,308
Land Acquisition	0	353	353	0	0	0	0	353	353
Contingency	5,043	2,030	7,073	710	291	1,001	5,753	2,321	8,074
Grand Total	55,468	22,325	77,793	7,814	3,201	11,015	63,282	25,526	88,808

Table 7.6 ESTIMATED ANNUAL CONSTRUCTION COST OF
NEW CPS AIRPORT

(Unit: Thousand US\$)

Year		Foreign Portion	Local Portion	Total
STAGE I	1981	2,521	1,386	3,907
	1982	6,837	1,415	8,252
	1983	26,323	6,712	33,035
	1984	19,787	12,812	32,599
	Sub-total	55,468	22,325	77,793
STAGE II	1993	356	145	501
	1994	7,458	3,056	10,514
	Sub-total	7,814	3,201	11,015
Total		63,282	25,526	88,808

Note: Since the above figures do not take account of any future cost inflation, the following table is presented to give an idea of the construction cost in a case where the cost rising trend of the last three years (1975-1978), namely 6.7% and 7.1% per annum for the local and foreign portions respectively, was assumed to continue through the year of completion of the Stage I construction.

ESTIMATED ANNUAL CONSTRUCTION COST OF NEW CPS AIRPORT
WITH COST INFLATION TAKEN INTO ACCOUNT

(Unit: Thousand US\$)

Year		Foreign Portion	Local Portion	Total
STAGE I	1981	2,858	1,560	4,418
	1982	8,257	1,691	9,921
	1983	33,878	8,519	42,397
	1984	27,146	17,273	44,419
	Total	72,139	29,043	101,182

CHAPTER 8



CHAPTER 8 FINANCIAL ANALYSIS

8.1 General

The purpose of the financial analysis is to examine the financial profitability of the New Airport Construction Project in CPS based on the assumption that the new airport administration will be a self-supporting financial entity. The evaluation was made in terms of the financial internal rate of return which resulted from the financial cost-benefit analysis based on the cash flow of the financial costs and the financial benefits.

8.2 Estimate of Financial Costs

8.2.1 Construction Cost

The annual construction cost of the Project shown in Table 7.6 of Chapter 7 which is based on the market prices as of 1979 was used as the financial cost of the construction in the present analysis.

8.2.2 Maintenance and Operation Cost

Estimates of the annual maintenance and operation costs of the proposed new airport are shown in Table 8.1. The calculation of these costs was made in the following manner.

- 1) Annual maintenance cost, including repair works and replacement cost of runway, taxiway, aprons, approach road and car parking: -

Estimated at 1% of their respective construction costs, each including the costs of pavement and drainage works but excluding the cost of grading works.

Table 8.1 ESTIMATE OF MAINTENANCE AND OPERATION COSTS OF NEW CPS AIRPORT

(In thousand US\$ as of 1979)

Year	Civil Works	Maintenance Costs				Sub-total	Wages	Others	Total
		Building and Utilities	Nav-aids Other Equipment						
1985	216.1	196.0	440.9		853.0	328.2	59.1	1,240.3	
1986	216.1	196.0	440.9		853.0	331.9	59.2	1,244.1	
1987	216.1	196.0	440.9		853.0	353.7	59.4	1,248.1	
1988	216.1	196.0	440.9		853.0	339.5	59.6	1,252.1	
1989	216.1	196.0	440.9		853.0	343.3	59.8	1,256.1	
1990	216.1	196.0	440.9		853.0	346.8	60.0	1,259.8	
1991	216.1	196.0	440.9		853.0	350.4	60.2	1,263.6	
1992	216.1	196.0	440.9		853.0	354.4	60.3	1,267.7	
1993	216.1	196.0	440.9		853.0	357.7	60.5	1,271.2	
1994	216.1	196.0	440.9		853.0	361.4	60.7	1,275.1	
1995	225.7	259.5	494.7		979.9	365.0	67.2	1,412.1	
1996	225.7	259.5	494.7		979.9	368.6	67.4	1,415.9	
1997	225.7	259.5	494.7		979.9	372.3	67.6	1,419.8	
1998	225.7	259.5	494.7		979.9	376.0	67.8	1,423.7	
1999	225.7	259.5	494.7		979.9	379.7	68.0	1,427.6	
2000	225.7	259.5	494.7		979.9	384.2	68.2	1,432.3	
2001	225.7	259.5	494.7		979.9	388.8	68.4	1,437.1	
2002	225.7	259.5	494.7		979.9	393.4	68.7	1,442.0	
2003	225.7	259.5	494.7		979.9	398.1	68.9	1,446.9	
2004	225.7	259.5	494.7		979.9	402.8	69.1	1,451.8	

- 2) Maintenance cost of the buildings and of the airport utilities, including repair works and replacement cost: -

Estimated at 1% of their respective construction costs.

- 3) Maintenance cost of the navigational aids, fire-fighting and rescue facilities and the special equipment, including the cost of replacement parts and their replenishments: -

Estimated at 5% of their respective construction costs.

- 4) Personnel cost: -

Estimated based on the present wage rates of ANAC and on the recommended manning program of the New CPS Airport Administration as shown in Table 10.1 of Chapter 10, with the results as shown in Table 8.2.

- 5) Other costs to be incurred in operation of the new airport: -

Estimated in a lump sum at 5% of the sum of the estimated annual maintenance cost and the annual personnel cost of the new airport.



Table 8.2 ESTIMATE OF ANNUAL PERSONNEL COST OF
NEW CPS AIRPORT ADMINISTRATION

	(In 1979 thousand US\$)				
	1985	1989	1994	1999	2004
Airport Director	6.6	6.6	6.6	6.6	6.6
Secretary	1.8	1.8	1.8	1.8	1.8
Chief of Operations Div.	5.7	5.7	5.7	5.7	5.7
Secretary	1.8	1.8	1.8	1.8	1.8
Air Traffic Control Sec.	48.9	48.9	48.9	48.9	48.9
Flight Operations Sec.	25.5	29.1	32.7	38.1	45.3
Meteorological Services Sec	18.3	18.3	18.3	18.3	18.3
Fire-Fighting & Rescue Sec.	57.9	57.9	57.9	57.9	57.9
Chief of Maintenance Div.	5.7	5.7	5.7	5.7	5.7
Secretary	1.8	1.8	1.8	1.8	1.8
Air Field Maintenance Sec.	27.5	27.5	27.5	27.5	27.5
Terminal Maintenance Sec.	49.9	54.2	61.5	67.2	75.9
Electrical & Mechanical Maintenance Sec.	37.5	37.5	37.5	37.5	37.5
Technical Procurement Sec.	9.3	11.1	12.9	14.7	16.5
Chief of Administration Div.	5.7	5.7	5.7	5.7	5.7
Secretary	1.8	1.8	1.8	1.8	1.8
Accounting Section	9.3	11.1	12.9	14.7	16.5
Personnel Section	7.5	9.3	11.1	12.9	14.7
Statistics Section	5.7	7.5	9.3	11.1	12.9
Total	328.2	343.3	361.4	379.7	402.8

8.3 Estimate of Financial Benefits

The financial benefits of the New CPS Airport Construction Project comprise entirely the airport revenues to be collected based on the current airport tariff structure of the Republic of Paraguay, which includes the following items.

- 1) Landing Charge
- 2) Parking Charge
- 3) Land Rental
- 4) Terminal Rental
- 5) Car Parking Charge
- 6) Airport Access Road Toll
- 7) Aviation Fuel Tax
- 8) Observation Deck Admission Fee
- 9) Passenger Service Charge
- 10) Cargo Handling Tax
- 11) Taxi Surcharge
- 12) Charge on Airline Employees Working at Airport

8.3.1 Landing Charges

The current landing charge by aircraft type is as shown in the following table. The number of aircraft movements was calculated in Chapter 4 and is tabulated in Table 8.3. Expected revenues from landing charges at the new airport calculated based on the above information are shown in Table 8.4.

	<u>All-up Weight</u> (ton)	<u>Charge per Landing</u> Guaranies (US Dollars)	
L-1011	195	26,300	(212)
B-707	152	23,900	(193)
B-727	77	15,600	(126)
DC9	49	11,000	(79)
DHC-7	19	5,700	(41)
General Aviation (Small Aircraft)	no more than 2	400	(2.9)

Table 8.3 FORECAST OF AIRCRAFT MOVEMENTS AT NEW CPS AIRPORT

Item	1985	1989	1994	1999	2004
International Passenger Flight					
L-1011 Class				300	300
B-707 Class	80	120	300		
B-727 Class	1,800	3,000	3,600	5,100	6,600
Domestic Passenger Flight					
DC-9 Class				1,080	1,620
DHC-7 Class	3,240	4,320	5,940	5,940	7,020
General Aviation	36,500	43,708	54,740	63,220	73,000
International Freighter					
				104	142

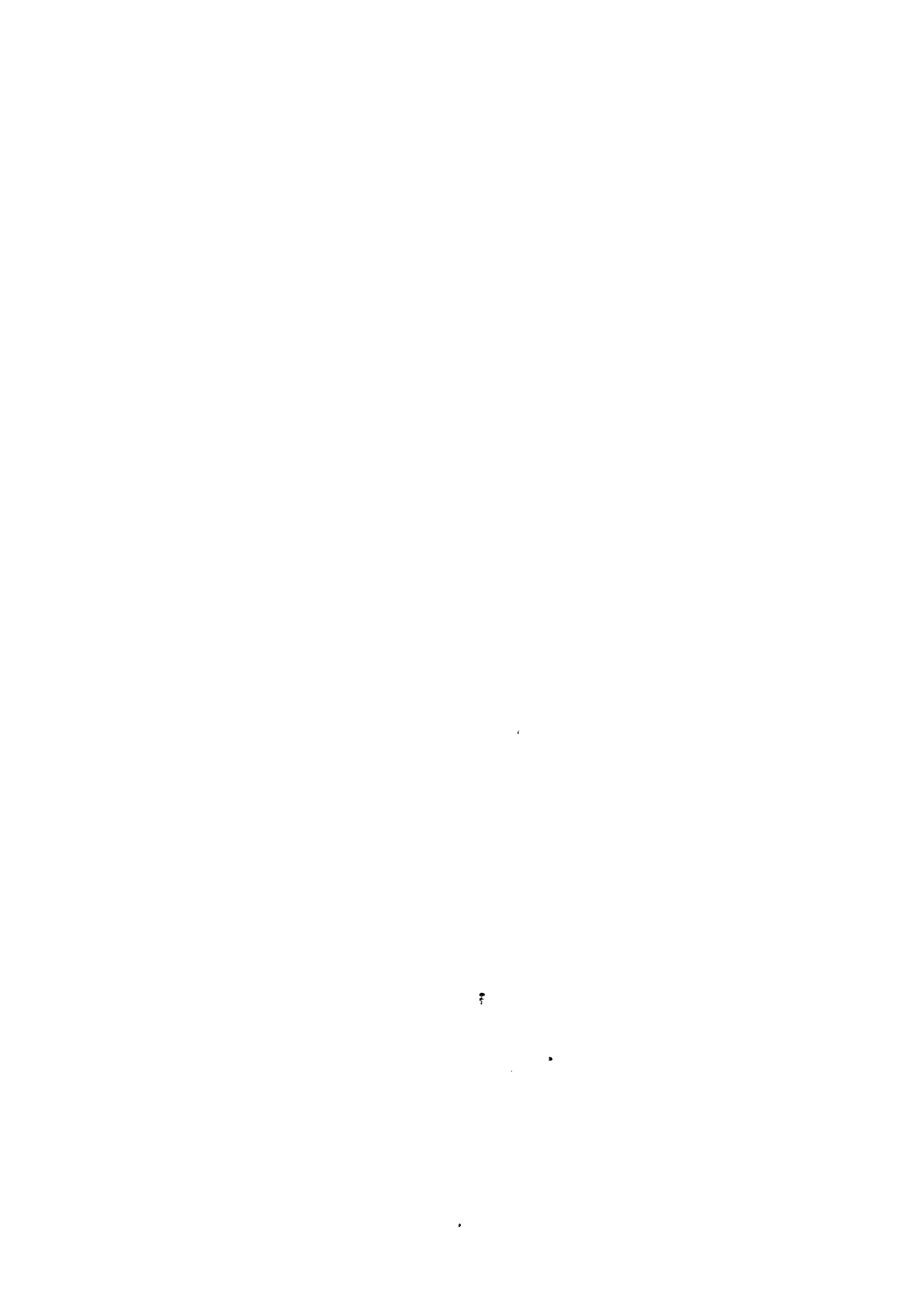
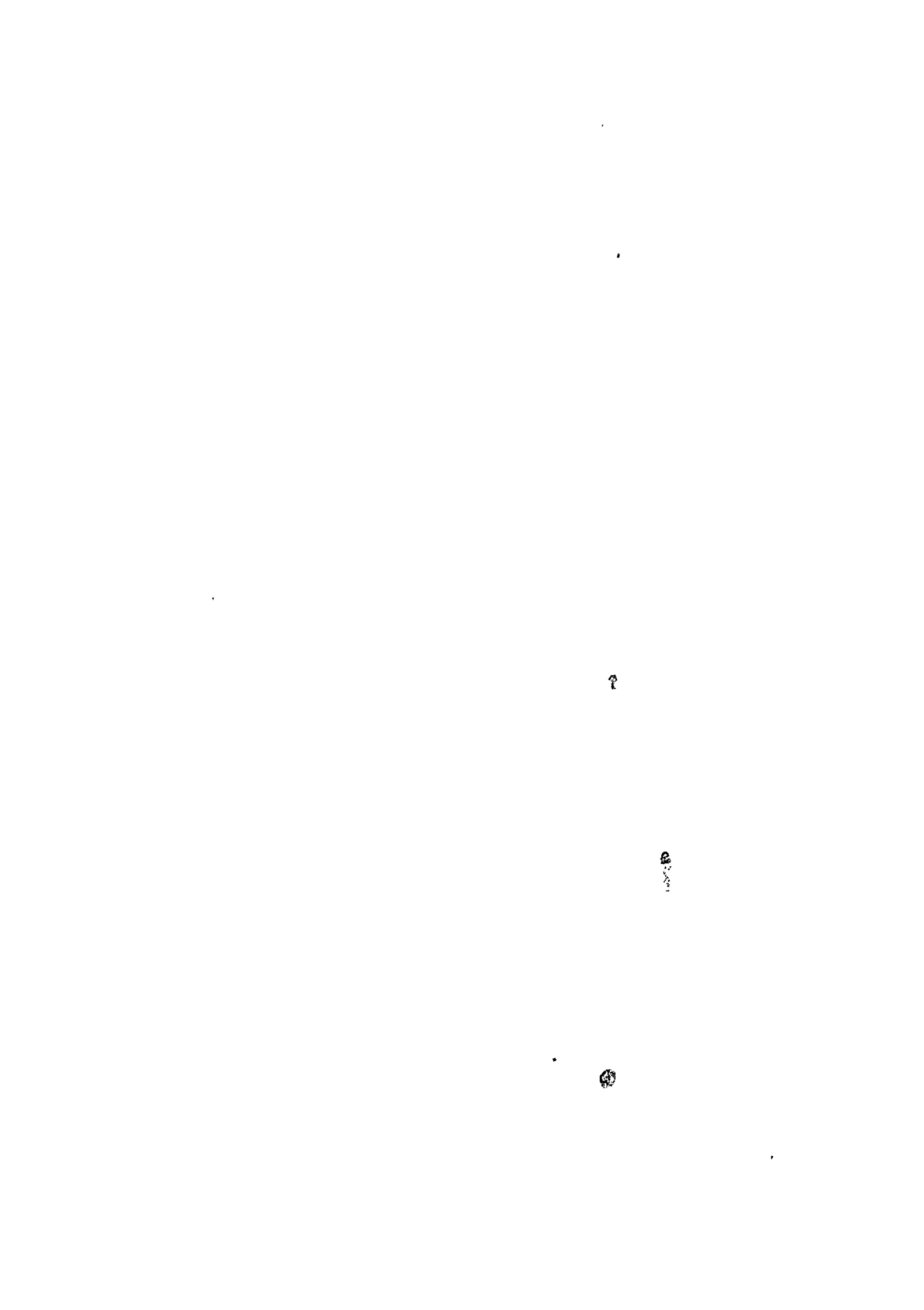


Table 8.4 ESTIMATE OF LANDING CHARGES
AT NEW CPS AIRPORT

(In thousand US\$)

Item	1985	1989	1994	1999	2004
International Service					
L-1011 Class				31.8 (150)	31.8 (150)
B-707 Class	7.7 (40)	11.6 (60)	29.0 (150)		
B-727 Class	113.4 (900)	189.0 (1,500)	226.8 (1,800)	321.3 (2,550)	415.8 (3,300)
B-707 - 320C				10.0	13.7
Domestic Service					
DC-9 Class				42.7 (540)	64.0 (810)
DHC-7 Class	66.4 (1,620)	88.6 (2,160)	121.8 (2,970)	121.8 (2,970)	143.9 (3,510)
General Aviation	52.9 (18,250)	63.4 (21,854)	79.4 (27,375)	91.7 (31,610)	105.9 (36,500)
Total	240.4	352.6	457.0	619.3	775.1

Note: Figures in parenthesis indicate the number of aircraft landings.



8.3.2 Aircraft parking charges

Parking charges are levied according to the all-up weight of aircraft remaining parked beyond an initial period of 6 hours, based on the following rates currently in force.

	<u>All-up Weight</u> ton	<u>Parking Charges/day</u>	
		Guaranies	(US Dollars)
L-1011	195	3,990	(32)
B-707	152	3,630	(29)
B-727	77	2,250	(18)
DC-9	49	1,400	(10)
DHC-7	19	750	(5)
General Aviation (Small Aircraft)	no more than 2	40	(0.3)

Estimated parking charges expected at the new airport are as shown in Table 8.5. The number of aircraft staying beyond the initial 6-hour period was calculated from the assumed flight schedule presented in Chapter 4.

Table 8.5 ESTIMATE OF PARKING CHARGES AT
NEW CPS AIRPORT

(In thousand US\$)

Aircraft Type	1985	1989	1994	1999	2004
L-1011				4.8 (150)	4.8 (150)
B-707	1.2 (40)	1.7 (60)	4.4 (150)		
B-727	5.4 (300)	5.4 (300)	5.4 (300)	5.4 (300)	5.4 (300)
DHC-7	4.1 (810)	4.1 (810)	4.1 (810)	4.1 (810)	4.1 (810)
General Aviation	5.5 (18,250)	6.6 (21,854)	8.2 (27,375)	9.5 (31,610)	11.1 (36,500)
Total	16.2	17.8	22.1	23.8	25.4

Note: Figures in parenthesis indicate the number of parking aircraft

8.3.3 Land rental

The land rental currently in force is as follows.

- ° Land areas used for aircraft fuel storage and supply facilities, and for cargo facilities - G50 (US\$0.4) per square meter per month
- ° Land area for aircraft maintenance - G25 (US\$0.2) per square meter per month

Calculation of this revenue expected at the new airport was based on the respective areas planned in Chapter 6, with the results as shown in Table 8.6.

Table 8.6 ESTIMATE OF LAND RENTAL
AT NEW CPS AIRPORT

(In thousand US\$ as of 1979)

	1985	1989	1994	1999	2004
Fuel Storage and Supply Area	39.8 (8,300)	39.8 (8,300)	39.8 (8,300)	55.7 (11,600)	55.7 (11,600)
Hangars, etc.	53.5 (22,291)	53.5 (22,291)	53.5 (22,291)	53.5 (22,291)	53.5 (22,291)
Total	93.3	93.3	93.3	109.2	109.2

Note: Figures in parenthesis indicate the chargeable land area in m².

8.3.4 Terminal rental

Terminal rental estimated for the new airport based on the current rate of G400 (US\$2.9) per square meter per month is shown in Table 8.7. The rentable floor areas are as follows.

	<u>Stage I</u>	<u>Stage II</u>
Airline offices	691 m ²	2,019 m ²
Shops	217	469
Restaurant & Coffee Shops	664	991
Bank·Post Office	49	91

Table 8.7 ESTIMATE OF TERMINAL RENTAL
AT NEW CPS AIRPORT

(In 1979 thousand US\$)

	1985	1989	1994	1999	2004
Office Space	24.0 (691)	24.0 (691)	24.0 (691)	70.3 (2019)	70.3 (2019)
Shops	7.6 (217)	7.6 (217)	7.6 (217)	16.3 (469)	16.3 (469)
Restaurants and Coffee Shops	23.1 (664)	23.1 (664)	23.1 (664)	34.5 (991)	34.5 (991)
Bank·Post Office	1.7 (49)	1.7 (49)	1.7 (49)	3.2 (91)	3.2 (91)
Total	56.4	56.4	56.4	124.3	124.3

Note: Figures in parenthesis indicate the rentable floor areas.

8.3.5 Car parking charges

The expected revenues accruing from car parking charges at the new airport calculated on the basis of the following current car parking charges and the number of parking cars estimated in Chapter 4 are shown in Table 8.8.

Charge per month: G600 (US\$4.3)

Charge per hour : G 30 (US\$0.2)

Table 8.8 ESTIMATE OF CAR PARKING CHARGES
AT NEW CPS AIRPORT

(IN 1979 thousand US\$)

	1985	1989	1994	1999	2004
Charges by Month*	16.0 (310)	19.3 (374)	24.4 (474)	31.0 (601)	39.3 (761)
Charges by Hour	4.0 (20,093)	5.7 (28,576)	8.8 (44,050)	12.7 (63,600)	16.9 (84,476)
Total	20.0	25.0	33.2	43.7	56.2

Note: Figures in parenthesis indicate the number of cars parked.

* Monthly charges are assumed to apply to airport employee commuter cars only.

8.3.6 Airport access road toll

The expected annual revenues accruing from tolls on airport access road estimated based on the traffic volumes calculated in Chapter 4 and the current rates shown below are tabulated in Table 8.9.

Private car	G 20 (US\$0.1)/vehicle
Taxi	G 50 (US\$0.4)/vehicle
Bus & Cargo Van	G100 (US\$0.7)/vehicle

Table 8.9 ESTIMATE OF ACCESS ROAD TOLLS
AT NEW CPS AIRPORT

(In thousand US\$)

	1985	1989	1994	1999	2004
Private Car	2.0 (20,093)	2.9 (28,576)	4.4 (44,050)	6.4 (63,600)	8.4 (84,476)
Taxi	6.9 (17,268)	9.5 (23,720)	14.1 (35,340)	19.6 (49,076)	26.4 (66,046)
Others	12.1 (17,326)	14.4 (20,525)	18.0 (25,690)	22.0 (31,457)	27.2 (38,816)
Total	21.0	26.8	36.5	48.0	62.0

Note: Figures in parenthesis indicate the number of vehicles involved.

8.3.7 Aviation fuel tax

Aviation fuel tax is currently levied on fuel supply companies at the unit price of 1.1 Guaranies (US\$0.008) for each gallon supplied. Assuming that all departing aircraft will be supplied with fuel at the new airport enough for one way trip to their immediate destination, expected total revenue accruing from this item of airport tariffs will be as shown in Table 8.10.

Table 8.10 ESTIMATE OF FUEL TAX
AT NEW CPS AIRPORT

(In thousand US\$)

	1985	1989	1994	1999	2004
Fuel Tax	23.1 (2,887.5)	38.1 (4,762.5)	53.5 (6,687.5)	76.2 (9,525)	93.7 (11,712.5)

Note: Figures in parenthesis indicate the amount of fuel supplied in thousand gallons.

8.3.8 Observation deck admission fee

The current admission fee to observation deck on top of the passenger terminal building is G10 (US\$0.07) per person. Based on the assumption made in Chapter 4 that an arriving or departing resident air passenger of international service will each bring 2 well-wishers to the airport, the total annual revenue accruing from this item was calculated as shown in Table 8.11.

Table 8.11 ESTIMATE OF OBSERVATION DECK
ADMISSION FEE AT NEW CPS AIRPORT

(In thousand US\$)

	1985	1989	1994	1999	2004
Observation Deck	5.6	8.0	12.3	17.2	23.7
Admission Fee	(80)	(114)	(176)	(245)	(338)

Note: Figures in parenthesis indicate the number of well-wishers involved in thousand persons.

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8.3.9 Passenger service charge

Each departing international passenger with destinations of Bolivia, Argentine, Brazil and Uruguay is currently charged a passenger service charge of G 450 (US\$3.2) and those with destinations other than the above countries are each charged G 500 (US\$3.4). Estimated total passenger service charge per annum at the New CPS Airport is shown in Table 8.12.

↓ Table 8.12 ESTIMATE OF PASSENGER SERVICE CHARGES
AT NEW CPS AIRPORT

(In thousand US\$)

	1985	1989	1994	1999	2004
Passenger Service Charge at US\$3.2/ person	170.5 (55.3)	237.1 (74.1)	356.2 (111.3)	502.1 (156.9)	666.2 (208.2)
Passenger Service Charge at US\$3.4/ person	54.7 (16.1)	77.9 (22.9)	119.7 (35.2)	172.0 (50.6)	231.2 (68.0)
Total	225.2	315.0	475.9	674.1	897.4

Note: Figures in parenthesis indicate the number of passengers involved in thousand persons.

8.3.10 Cargo handling tax

Cargo handling tax is currently levied on cargo handling companies at the following unit rates:

Import Cargo	G 200 (US\$1.4)/ton
Export Cargo	G 170 (US\$1.2)/ton
Transfer Cargo	G 200 (US\$1.4)/ton

Table 8.13 shows the estimated annual revenues of this category expected at the new airport.

Table 8.13 ESTIMATE OF CARGO HANDLING TAX AT
NEW CPS AIRPORT

(In 1979 thousand US\$)

	1985	1989	1994	1999	2004
Import Cargo	0.8 (550.3)	1.1 (806.4)	1.8 (1,272.8)	2.5 (1,797.8)	3.5 (2,501.7)
Export Cargo	0.3 (235.8)	0.4 (345.6)	0.7 (545.5)	0.8 (707.6)	1.3 (1,072.3)
Transfer Cargo	0.8 (570.3)	1.1 (805.3)	1.7 (1,202.1)	2.5 (1,775.7)	3.2 (2,263.8)
Total	1.9	2.6	4.2	5.8	8.0

Note: Figures in parenthesis indicate cargo tonnage handled.

8.3.11 Taxi surcharge

ANAC presently collects taxi operating license fee at a rate of 10% over the taxi fare on each trip to and from the airport. For the purpose of the present financial analysis, such surcharges were assumed to average G 270 (US\$1.9) per trip. Table 8.14 shows the total annual revenue accruing from this item at the New CPS Airport.

Table 8.14 TAXI SURCHARGE

(In 1979 thousand US\$)

	1985	1989	1994	1999	2004
Taxi Surcharge	65.6 (34,500)	90.1 (47,400)	134.3 (70,700)	186.6 (98,200)	251.0 (132,100)

Note: Figures in parenthesis indicate the number of taxi trips involved.

8.3.12 Charge on airline employees working at airport

ANAC currently collects the following charges from airlines on their employees working at the airport.

- ° G 100 (US\$0.7) per man-hour for daytime operation
- ° G 200 (US\$1.4) per man-hour for nighttime operation

Applying these rates to the number of airline employees working at the new airport estimated in Chapter 4 and summarized in Table 8.15, the annual revenues from this item was estimated as shown in Table 8.16.



Table 8.15 NUMBER OF AIRLINE PERSONNEL

	1994	2004
Daytime Operation	170	280
Nighttime Operation	85	140
Day-off	85	140

Table 8.16 ESTIMATE OF CHARGES ON AIRLINE EMPLOYEES WORKING AT NEW CPS AIRPORT

(In thousand US\$)

	1985	1989	1994	1999	2004
Daytime Operation	110.4 (157,680)	161.7 (230,997)	260.6 (372,300)	334.5 (477,802)	429.2 (613,200)
Nighttime Operation	110.4 (78,840)	161.7 (115,499)	260.6 (186,150)	334.5 (238,901)	429.2 (306,600)

Note: Figures in parenthesis indicate the man-hours involved.

8.4 Results of Financial Cost-Benefit Analysis

Table 8.17 shows the cash flow of financial costs and revenues of the project calculated based on the current airport tariff structure of ANAC.

As the figures in Table 8.18 indicate, the level of the landing fees and passenger service charges currently in force in Paraguay since 1974 are considerably lower than those of the neighboring countries, some being as low as one third of the 3-country average. It is, therefore, considered not quite practicable to base the financial evaluation of the Project on the cost-benefit analysis made with the financial costs calculated with the current tariff level.

The present JICA study has shown that if the airport tariffs of ANAC other than the taxi surcharge were to be raised at the rates and timing of the following two cases, the FIRRs of 3.8% and 5.6% respectively could be expected.

CASE 1 (FIRR=3.8%)

1985	Increase by 200% over the present level				
1989	"	33.3%	"	1985	"
1994	"	12.5%	"	1989	"
1999	"	11.1%	"	1994	"

CASE 2 (FIRR=5.6%)

1985	Increase by 200% over the present level				
1989	"	66.7%	"	1985	"
1994	"	10.0%	"	1989	"
1999	"	9.1%	"	1994	"

Table 8.17 CASH FLOW OF FINANCIAL COSTS & REVENUES OF NEW CPS AIRPORT DEVELOPMENT PROJECT

Year	Costs										Revenues										Operating Surplus	Cumulative Balance			
	Construction	Maintenance & Operation	Total	Land-ling Charge	Parking Charge	Land Rental	Terminal Rental	Car Parking Charge	Airport Access Road Toll	Aviation Fuel Tax	Balcony Admission Fee	Passenger Service Charge	Cargo Handling Tax	Taxi Surcharge	Charge on Air-line Employees	Total									
																	(In thousand US\$)								
1981	3,907.0	0	3,907.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3,907.0		
82	8,252.0	0	8,252.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-12,159.0	
83	33,035.0	0	33,035.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-45,194.0	
84	32,599.0	0	32,599.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-77,793.0	
85	0	1,240.3	1,240.3	240.4	16.2	93.3	56.4	20.0	21.0	23.1	5.6	225.2	1.9	65.6	220.8	989.5	220.8	220.8	220.8	220.8	220.8	220.8	220.8	-78,043.8	
86	0	1,244.1	1,244.1	264.6	16.6	93.3	56.4	21.1	22.3	26.2	6.1	244.9	2.1	71.0	242.9	1,067.5	242.9	242.9	242.9	242.9	242.9	242.9	242.9	-78,220.4	
87	0	1,248.1	1,248.1	291.1	17.0	93.3	56.4	22.4	23.7	29.7	6.7	266.4	2.2	76.9	267.2	1,153.0	267.2	267.2	267.2	267.2	267.2	267.2	267.2	-78,315.5	
88	0	1,252.1	1,252.1	320.4	17.4	93.3	56.4	23.6	25.2	33.6	7.3	289.7	2.4	83.2	294.0	1,246.5	294.0	294.0	294.0	294.0	294.0	294.0	294.0	-78,321.1	
89	0	1,256.1	1,256.1	352.6	17.8	93.3	56.4	25.0	26.8	38.1	8.0	315.0	2.6	90.1	323.4	1,349.1	323.4	323.4	323.4	323.4	323.4	323.4	323.4	-78,228.1	
1990	0	1,259.8	1,259.8	371.4	18.6	93.3	56.4	26.5	28.5	40.8	8.7	342.1	2.9	97.0	355.8	1,442.0	355.8	355.8	355.8	355.8	355.8	355.8	355.8	-78,045.9	
91	0	1,263.6	1,263.6	391.1	19.4	93.3	56.4	28.0	30.3	43.6	9.5	371.5	3.1	105.7	391.4	1,543.3	391.4	391.4	391.4	391.4	391.4	391.4	391.4	-77,766.2	
92	0	1,267.7	1,267.7	412.0	20.3	93.3	56.4	29.6	32.3	46.7	10.4	403.5	3.5	114.5	430.6	1,653.1	430.6	430.6	430.6	430.6	430.6	430.6	430.6	-77,380.8	
93	501.0	1,271.2	1,772.2	433.9	21.2	93.3	56.4	31.4	34.3	50.0	11.3	438.2	3.8	124.0	473.8	1,771.6	473.8	473.8	473.8	473.8	473.8	473.8	473.8	-77,381.4	
94	10,514.0	1,275.1	11,789.1	457.0	22.1	93.3	56.4	33.3	36.5	53.5	12.3	475.9	4.2	134.3	521.2	1,900.0	521.2	521.2	521.2	521.2	521.2	521.2	521.2	-87,270.5	
95	0	1,412.1	1,412.1	492.0	22.4	109.2	124.3	35.1	38.6	58.6	13.2	510.2	4.5	143.3	547.9	2,099.3	547.9	547.9	547.9	547.9	547.9	547.9	547.9	-86,586.3	
96	0	1,415.9	1,415.9	521.0	22.8	109.2	124.3	37.1	40.7	62.6	14.1	547.0	4.8	153.2	575.9	2,212.7	575.9	575.9	575.9	575.9	575.9	575.9	575.9	-85,789.5	
97	0	1,419.8	1,419.8	551.8	23.1	109.2	124.3	39.2	43.0	66.8	15.0	586.5	5.2	163.5	605.4	2,333.0	605.4	605.4	605.4	605.4	605.4	605.4	605.4	-84,876.3	
98	0	1,423.7	1,423.7	584.3	23.4	109.2	124.3	41.4	45.4	71.3	16.1	628.8	5.5	174.6	636.4	2,460.7	636.4	636.4	636.4	636.4	636.4	636.4	636.4	-83,839.3	
99	0	1,427.6	1,427.6	619.3	23.8	109.2	124.3	43.7	48.0	76.2	17.2	674.1	5.8	186.6	669.0	2,597.2	669.0	669.0	669.0	669.0	669.0	669.0	669.0	-82,669.7	
2000	0	1,432.3	1,432.3	647.7	24.1	109.2	124.3	46.0	50.5	79.4	18.3	713.8	6.2	197.9	703.2	2,720.6	703.2	703.2	703.2	703.2	703.2	703.2	703.2	-81,381.4	
01	0	1,437.1	1,437.1	677.4	24.4	109.2	124.3	48.3	53.2	82.8	19.6	755.8	6.6	210.0	739.1	2,850.7	739.1	739.1	739.1	739.1	739.1	739.1	739.1	-79,967.8	
02	0	1,442.0	1,442.0	708.6	24.7	109.2	124.3	50.8	56.0	86.3	20.8	800.4	7.0	222.9	776.9	2,987.9	776.9	776.9	776.9	776.9	776.9	776.9	776.9	-78,421.9	
03	0	1,446.9	1,446.9	741.1	25.1	109.2	124.3	53.3	58.9	89.9	22.2	847.5	7.5	236.5	816.7	3,132.2	816.7	816.7	816.7	816.7	816.7	816.7	816.7	-76,736.6	
04	0	1,451.8	1,451.8	775.1	25.4	109.2	124.3	56.2	62.0	93.7	23.7	897.4	8.0	251.0	858.4	3,284.4	858.4	858.4	858.4	858.4	858.4	858.4	858.4	-74,904.0	
Total	88,808.0	26,887.3	115,695.3	9,852.8	425.8	2,025.0	1,807.0	712.0	777.2	1,152.9	266.1	10,331.9	89.8	2,901.8	10,450.0	40,794.3	10,450.0	10,450.0	10,450.0	10,450.0	10,450.0	10,450.0	10,450.0	10,450.0	-74,904.0

Table 8.18 COMPARISON OF LANDING FEES AND PASSENGER SERVICE CHARGES

(In US\$)

	Landing Fee					Passenger Service Charge
	L-1011 (195 ton)	B-707 (152 ton)	B-727 (77 ton)	DC-9 (49 ton)	DHC-7 (19 ton)	
Argentina	975	684	281	179	59	5.3
Brazil	516	402	204	130	50	4.3
Bolivia	897	699	259	165	64	6.0
3-country Average	796	595	247	158	58	5.2
Paraguay	212	193	126	79	41	3.2

Source: International Air Transport Association,
International User Charges as of September 1979.



CHAPTER 9



CHAPTER 9 ECONOMIC ANALYSIS

9.1 General

The purpose of the economic analysis is to examine whether or not the New CPS Airport Construction Project is economically feasible from the viewpoint of the national economy of the Republic of Paraguay. The present analysis was made on the "with and without" principle.

By comparing the "with-project" case wherein the New CPS Airport Project is assumed to be implemented and the "without-project" case wherein the Project is not to be implemented, any economic values accruing to or saved by the state and/or the nationals of the Republic of Paraguay that are identified as attributable to the new airport construction were termed economic benefits of the Project, while any expenditures incurred were termed economic costs. Having identified such benefits and costs, an economic internal rate of return was calculated and used to evaluate the economic feasibility of the Project.

The existing CPS Airport with a 1,100 m long grass runway suffers from frequent occurrence of heavy fogs because of the nearby lake and Parana River, and its flight handling capacity is considered "negligible small". Consequently the "without-project" case in the present analysis is defined to be the case where the existing CPS Airport is non-existent.

The Project life is assumed at 20 years from the opening of the New CPS Airport, and the costs and benefits are both expressed in US Dollars in 1979 real terms.



9.2 Estimate of Economic Costs

9.2.1 Basic Concept

The economic costs used in the present analysis comprises those of construction, maintenance and operation of the new airport. The economic cost of construction comprises the construction cost calculated in Chapter 7 from which import duties were already excluded, minus indirect taxes imposed in Paraguay.

9.2.2 Construction Cost

In calculating the economic cost of construction, an average of 3% indirect tax was deducted from the cost of locally procured goods and services of the local currency portion calculated in Chapter 7.

As it appears that there is no excessive unemployment in the labor market in Paraguay and also because foreign exchange rates have been reasonably stable, neither the shadow wage rate nor the shadow exchange rate was applied in the calculation. The resultant economic costs of construction by currency and by item are summarized in Tables 9.1 and 9.2 for Stage I and Stage II respectively, while Table 9.3 shows the annual breakdown of the economic construction costs.

9.2.3 Maintenance and Operation Cost

Based on the economic construction cost calculated in the preceding subsection the economic cost of maintenance and operation of the new airport was calculated in the same methods as those employed in calculating the corresponding financial cost of maintenance and operation. Table 9.4 shows the resultant costs for each year of the project life.



Table 9.1 GROUPING OF ESTIMATED CONSTRUCTION COST IN ECONOMIC COST CALCULATION
(In 1979 thousand US\$)

Item	Foreign Portion				Local Portion				Grand Total
	Foreign Goods & Services	Labor		Total	Domestic Goods & Services	Labor		Total	
		Skilled	Unskilled			Skilled	Unskilled		
(1) Civil Works	15,842	980	0	16,822	9,003	2,945	700	12,648	29,470
(2) Building & Equipment	10,279	278	0	10,557	2,465	589	252	3,306	13,863
(3) Airfield Lighting	2,721	318	0	3,039	232	105	5	342	3,381
(4) Radio Nav-aids, Telecommunications & Meteorological Facilities	6,455	688	0	7,143	82	40	72	194	7,337
(5) Utilities	7,609	671	0	8,280	602	715	47	1,364	9,644
Sub-Total	42,906	2,935	0	45,841	12,382	4,394	1,076	17,854	63,693
(6) Engineering	-	-	-	4,584	-	-	-	1,785	6,369
(7) Land Acquisition	0	0	0	0	-	-	-	342	342
Sub-Total	-	-	-	50,425	12,382	4,394	1,076	19,979	70,404
(8) Contingency	-	-	-	5,043	-	-	-	1,998	7,041
Grand Total	42,906	2,935	-	55,468	12,382	4,394	1,076	21,977	77,445



Table 9.2 GROUPING OF ESTIMATED CONSTRUCTION COST IN ECONOMIC CALCULATION
STAGE - II

Item	(In 1979 thousand US\$)										
	Foreign Portion					Local Portion					Grand Total
	Foreign Goods & Services	Labor Skilled	Labor Unskilled	Total	Domestic Goods & Services	Labor Skilled	Labor Unskilled	Total			
(1) Civil Works	536	-	-	536	319	82	14	415	951		
(2) Building & Equipment	5,490	187	-	5,677	1,486	382	164	2,032	7,709		
(3) Airfield Lighting	115	17	-	132	1	3	-	4	136		
(4) Radio Nav-aids, Telecommunications & Meteorological Facilities	-	-	-	0	-	-	-	-	0		
(5) Utilities	113	-	-	113	76	59	15	150	263		
Sub-Total	6,254	204	-	6,458	1,882	526	193	2,601	9,059		
(6) Engineering	-	-	-	646	-	-	-	260	906		
(7) Land Acquisition	-	-	-	0	-	-	-	0	0		
Sub-Total	-	-	-	7,104	-	-	-	2,861	9,965		
(8) Contingency	-	-	-	710	-	-	-	286	996		
Grand Total	-	-	-	7,814	-	-	-	3,147	10,961		

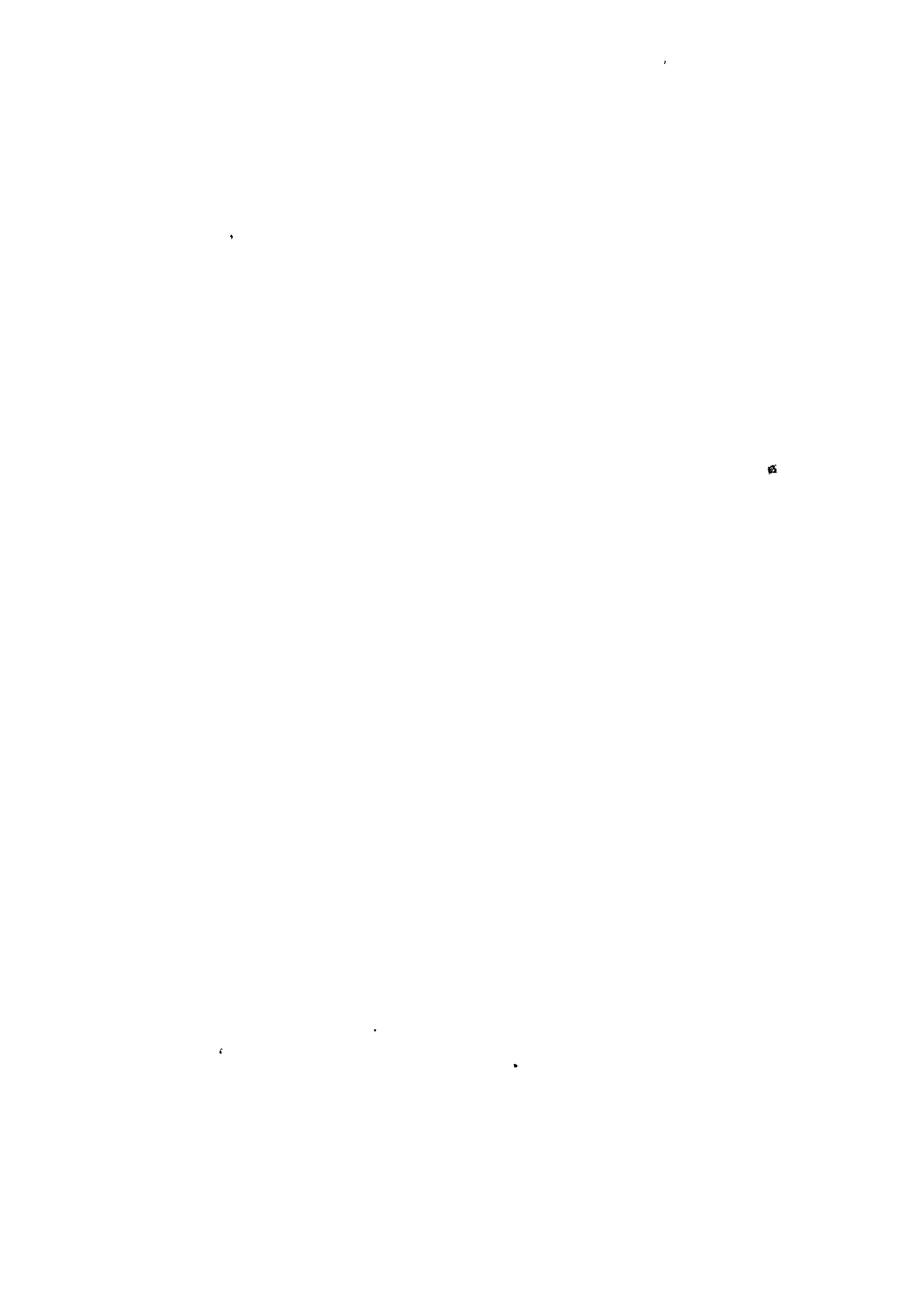


Table 9.3 ANNUAL BREAKDOWN OF ESTIMATED ECONOMIC COST
OF CONSTRUCTION AT NEW CPS AIRPORT

(In 1979 thousand US\$)

Year	Foreign Portion	Local Portion	Total
1981	2,521	1,359	3,880
1982	6,837	1,404	8,241
1983	26,323	6,623	32,946
1984	19,787	12,591	32,378
Sub-Total	55,468	21,977	77,445
1993	356	142	498
1994	7,458	3,005	10,463
Sub-Total	7,814	3,147	10,961
Total	63,282	25,124	88,406



Table 9-4 ESTIMATED MAINTENANCE AND OPERATION COSTS OF NEW CPS AIRPORT

Year	MAINTENANCE COSTS						Wage	Others	Total
	(in 1979 thousand US\$)					Sub Total			
	Civil Work	Building Utilities	Nav-aids, Lighting						
1985	205.5	195.4	440.6			841.5	382.2	58.5	1,228.2
'86	"	"	"			"	331.9	58.7	1,232.1
'87	"	"	"			"	335.7	58.9	1,236.1
'88	"	"	"			"	339.5	59.1	1,240.1
'89	"	"	"			"	343.3	59.2	1,244.0
'90	"	"	"			"	346.8	59.4	1,247.7
'91	"	"	"			"	350.4	59.6	1,251.5
'92	"	"	"			"	354.4	59.8	1,255.7
'93	"	"	"			"	357.7	60.0	1,259.2
'94	"	"	"			"	361.4	60.1	1,263.0
'95	215.0	258.5	494.4			967.9	365.0	60.3	1,393.2
'96	"	"	"			"	368.6	60.5	1,397.0
'97	"	"	"			"	372.3	60.7	1,400.9
'98	"	"	"			"	376.0	60.9	1,404.8
'99	"	"	"			"	379.7	61.1	1,408.7
2000	"	"	"			"	384.2	61.3	1,413.4
'01	"	"	"			"	388.8	61.5	1,418.2
'02	"	"	"			"	393.4	61.7	1,423.0
'03	"	"	"			"	398.1	62.0	1,428.0
'04	"	"	"			"	402.8	62.2	1,432.9
TOTAL	4,205.0	4,539.0	9,350.0			18,094.0	7,332.2	1,205.5	26,577.7

9.2.4 Total Economic Costs

The total economic cost of construction amounted to US\$88,406,000 and that of maintenance and operation to US\$26,577,700. Table 9.5 shows the summary of the economic cost of the New CPS Airport Construction Project totalling in US\$114,983,700.

9.3 Estimate of Economic Benefits

9.3.1 Basic Concept

In the present analysis the quantifiable economic benefits attributable to the New CPS Airport Construction Project were identified in the direct and indirect benefit categories as follows. The calculation, however, was made only on the 5 direct benefit items, with the indirect benefits having been accounted for only in qualitative terms.

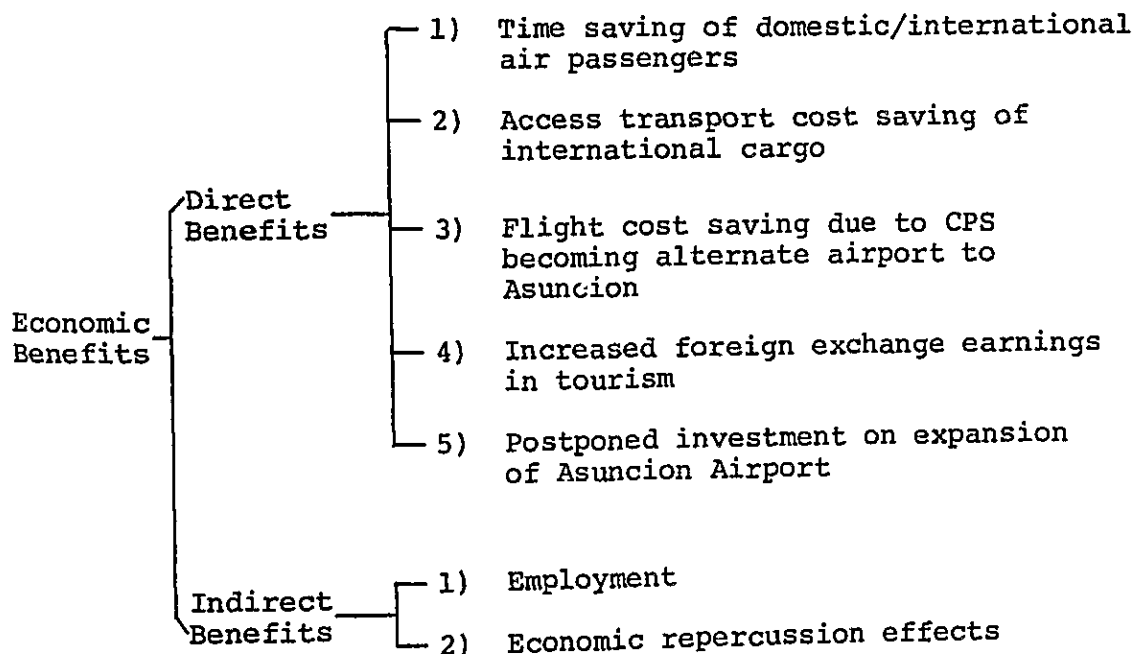


Table 9.5 ESTIMATED ECONOMIC COST OF NEW CPS AIRPORT

(In 1979 thousand US\$)

Year	Construction Cost	Maintenance & Operation Cost	Total
1981	3,880.0	0.0	3,880.0
1982	8,241.0	0.0	8,241.0
83	32,946.0	0.0	32,946.0
84	32,378.0	0.0	32,378.0
85	0.0	1,228.2	1,228.2
86	0.0	1,232.1	1,232.1
87	0.0	1,236.1	1,236.1
88	0.0	1,240.1	1,240.1
89	0.0	1,244.0	1,244.0
90	0.0	1,247.7	1,247.7
91	0.0	1,251.5	1,251.5
92	0.0	1,255.7	1,255.7
93	498.0	1,259.2	1,757.2
94	10,463.0	1,263.0	11,726.0
95	0.0	1,393.2	1,393.2
96	0.0	1,397.0	1,397.0
97	0.0	1,400.9	1,400.9
98	0.0	1,404.8	1,404.8
99	0.0	1,408.7	1,408.7
2000	0.0	1,413.4	1,413.4
01	0.0	1,418.2	1,418.2
02	0.0	1,423.0	1,423.0
03	0.0	1,428.0	1,428.0
04	0.0	1,432.9	1,432.9
Total	88,406.0	26,577.7	114,983.7

9.3.2 Direct Benefits

1) Saving in travel time and cost of domestic/ international air passengers

When the New CPS Airport is constructed, the air passengers with their origin/destination in the CPS airport territory as defined in Chapter 3 will enjoy a reduction in travel time by not having to go via Asuncion for their intended air trip. The travel time saved will mainly comprise the bus transportation time between Asuncion and CPS and the difference in the air travel time between a specific origin/destination and Asuncion or CPS. The benefit also includes the bus fare between Asuncion and CPS. Calculation of this benefit is made only for the resident air passengers with origin/destination in the CPS airport territory. The formula used in the calculation is presented below.

$$B_i = (W_i \cdot T_i + C_i) \cdot P_i$$

- where
- B_i : Annual total time saving value expected in the year "i".
 - W_i : Time value per resident air passenger.
 - T_i : Time saved between CPS Airport and origin/destination airport.
 - C_i : Cost saved between CPS Airport and origin/destination airport.
 - P_i : Forecast number of passengers involved in the year "i".

Time value of resident air passengers used in the calculation was assumed as follows by referring to the comparable figures of the Brian Report, and with the growth rate assumed at 4.2% per annum, equal to that of the national income per capita of Paraguay mentioned in "Plan Nacional de Desarrollo Economico y Social" for the period 1976-1981.

1985	US\$5.6
1994	US\$8.1
2004	US\$12.1

2) Saving in access transport cost of international cargo

With the construction of the New CPS Airport, consignors of export cargo originating from the CPS Airport territory will save the road transport cost between Asuncion and CPS.

The unit cost of this surface transport was assumed to remain unchanged throughout the project life at US\$14.3/ton based on the currently prevailing rate.

Time value of air cargo is hard to quantify and was, therefore, not taken into account in the present analysis. Airfreight charges from a given destination to Asuncion and to CPS were assumed to be equal, and consequently no difference was accounted for in the calculation.

3) Flight cost saving due to CPS becoming alternate airport to Asuncion

The New CPS Airport which is to be equipped with an instrument approach runway CAT-I can be expected to replace Buenos Aires, Saõ Paulo, or Rio de Janeiro airports as alternate airports to Asuncion.

The New CPS Airport is only 150 NM away from Asuncion Airport, while Buenos Aires, the closest of the above-mentioned 3 current alternative airports, is 570 NM away, and the saving in fuel load to fly the difference of 420 NM distance will bring considerable reduction in take-off weight of the relevant aircraft and hence the reduction in full consumption.

Weighted average of distances from Asuncion to the nearest points of departure on all international routes serving Asuncion was calculated to be approximately 700 NM with service frequency factors taken into account. A 180-seater aircraft flying this distance with the reduced fuel weight as mentioned above would yield a saving in fuel consumption of 675 liter per trip.

Calculation of the total benefit under this item was made on an assumption that half the total international flight movements are of the Paraguay airlines, using the unit price of US\$0.256/liter which is the average current price prevailing in Paraguay.

4) Increased foreign exchange earnings in tourism

When the New CPS Airport is constructed, the CPS region will enjoy increase in the number of foreign tourists because of the improved access the new airport will provide to such tourism resources as Iguaz Fall, Itaipu Dam, etc.

The consequent increase in foreign exchange earnings for the Republic was calculated on the following assumptions: namely that each incoming foreign passenger will spend an average of US\$91.00 per day in Paraguay in 1985 and that the amount will increase by US\$1.00 every year throughout the project life; that



the average length of stay of each foreign passenger in 1985 will be 3 days, this number increasing by 1 day every 5 years during the first half of the project life; and finally that 10% of the total international arriving air passengers will be nonresidents in 1985, this share increasing up to 50% by 1994 and remaining unchanged thereafter. The value-added ratio of the spendings by foreign air passengers in Paraguay was assumed at 50% throughout the 20-year project life.

5) Postponed investment on expansion of Asuncion Airport

If the new airport is not constructed the Asuncion Airport will have to accommodate majority of the air passengers with origin/destination in the CPS Airport territory, and the 1 million passenger handling capacity of the Asuncion Airport terminal is expected to reach a saturation point in 1991, calling for an investment for expansion in 1990. If, on the other hand, the New CPS Airport is constructed, the expansion can be postponed till 1994. Based on the unit prices used in Chapter 7 the total cost of the expansion of the international and domestic passenger terminal facilities to the maximum permissible capacity of 1.8 million passengers a year amounts to US\$12,600,000. Discounting this amount of investment assumed to take place in 1991 and 1994 respectively to the 1985 value using the social discount rate of 10%, the benefit was calculated to be approximately US\$2,250,000.

The direct economic benefits of the New CPS Airport Construction Project as calculated above over the Project life of 20 years between 1985 and 2004 are shown in Table 9.6.

Table 9.6 ESTIMATED ECONOMIC BENEFITS OF NEW CPS AIRPORT

(In 1979 thousand US\$)

Year	Benefits							Total Benefits
	Time Saving Benefits		Int'l Cargo Cost Saved	Fuel Cost Saved	Net Increase in Foreign Expenditure	ASU Airport's Investment Delay	Total	
	Domestic Passengers	Int'l Passengers						
1981	0	0	0	0	0	0	0	
1982	0	0	0	0	0	0	0	
1983	0	0	0	0	0	0	0	
1984	0	0	0	0	0	0	0	
1985	188.9	209.3	5.6	187.1	2,843.8	2,254.6	5,689.3	
1986	226.7	319.1	6.2	202.7	3,453.4	0	4,208.1	
1987	272.0	486.5	6.8	219.6	4,193.7	0	5,178.6	
1988	326.4	741.7	7.5	237.9	5,092.8	0	6,406.3	
1989	391.6	1,130.8	8.3	257.8	6,184.5	0	7,973.0	
1990	469.9	1,391.8	9.1	278.2	6,938.8	0	9,087.8	
1991	563.9	1,713.0	9.9	300.2	7,785.0	0	10,372.0	
1992	676.7	2,108.3	10.9	323.9	8,734.5	0	11,674.2	
1993	811.9	2,594.7	11.9	349.5	9,799.8	0	13,568.0	
1994	974.3	3,193.8	13.0	377.1	10,995.0	0	15,553.2	
1995	1,105.7	3,545.8	14.0	402.6	11,902.9	0	16,971.0	
1996	1,254.9	3,936.5	15.0	429.9	12,885.7	0	18,522.0	
1997	1,424.2	4,370.3	16.1	459.0	13,949.7	0	20,219.0	
1998	1,616.3	4,852.0	17.3	490.0	15,101.5	0	22,077.1	
1999	1,834.4	5,386.7	18.5	523.2	16,348.5	0	24,111.3	
2000	2,081.8	5,969.4	19.8	556.6	17,471.0	0	26,098.6	
2001	2,362.7	6,615.2	21.1	592.2	18,670.6	0	28,262.8	
2002	2,681.4	7,330.9	22.5	630.0	19,952.5	0	30,617.3	
2003	3,043.2	8,124.0	24.0	670.3	21,322.5	0	33,184.0	
2004	3,453.7	9,002.9	25.6	713.1	22,786.5	0	35,981.8	
Total	25,760.6	73,022.9	283.1	8,200.9	236,412.7	2,254.6	345,935.8	

9.3.3 Indirect Benefits

1) Employment effect

The New CPS Airport will create employment opportunities for the airport administration, maintenance and operation personnel. The new airport project will also help absorb the labor surplus that is expected to occur after the completion of the Itaipu Dam construction Phase I scheduled in 1982.

2) Economic repercussion effect

Through increased employment as well as through procurement of materials and equipment both during and after the construction, the New CPS Airport is expected to bring multiplier effects in the consumer behavior and in the overall national economy of Paraguay.

9.4 Results of Economic Cost-Benefit Analysis

9.4.1 Economic Evaluation

The cost-benefit analysis based on the cashflow of the economic costs and the economic benefits as identified in the foregoing resulted in an economic internal rate of return of the Project of 10.8%. In view of the fact that the social discount rate of Paraguay is 10%, the New CPS Airport Construction Project is termed feasible from the point of view of national economy. If the intangible benefits, both direct and indirect, that accompany the development project of this nature and magnitude were taken into account the economic worth brought about in Paraguay by the Project would be even greater.

Table 9.7 CASH FLOW OF ECONOMIC COSTS AND BENEFITS OF NEW CPS AIRPORT

(In 1979 thousand US\$)

Year	Costs			Benefits						ASU Airport Investment Delay	Total Benefit			
	Construction Cost	Maintenance Cost	Total Cost	Time Saving		International Passengers	International Cargo	Fuel Cost Saved	Net Increase in Foreign Expenditure					
				Domestic Passengers	International Passengers									
'81	3,880.0		3,880.0											0.0
'82	8,241.0		8,241.0											0.0
'83	32,946.0		32,946.0											0.0
'84	32,378.0		32,378.0											0.0
'85		1,228.2	1,228.2	188.9	209.3	5.6	187.1	2,843.8	2,254.6	5,689.3				
'86		1,232.1	1,232.1	226.7	319.1	6.2	202.7	3,453.4		4,208.1				
'87		1,236.1	1,236.1	272.0	486.5	6.8	219.6	4,193.7		5,178.6				
'88		1,240.1	1,240.1	326.4	741.7	7.5	237.9	5,092.8		6,406.3				
'89		1,244.0	1,244.0	391.6	1,130.8	8.3	257.8	6,184.5		7,973.0				
'90		1,247.7	1,247.7	469.9	1,391.8	9.1	278.2	6,938.8		9,087.8				
'91		1,251.5	1,251.5	563.9	1,713.0	9.9	300.2	7,785.0		10,372.0				
'92		1,255.7	1,255.7	676.7	2,108.3	10.9	323.9	8,734.5		11,674.3				
'93	498.0	1,259.2	1,757.2	811.9	2,594.7	11.9	349.5	9,799.8		13,568.0				
'94	10,463.0	1,263.9	11,726.9	974.3	3,193.8	13.0	377.1	10,995.0		15,553.2				
'95		1,393.2	1,393.2	1,105.7	3,545.8	14.0	402.6	11,902.9		16,971.0				
'96		1,397.0	1,397.0	1,254.9	3,936.5	15.0	429.9	12,885.7		18,522.0				
'97		1,400.9	1,400.9	1,424.2	4,370.3	16.1	459.0	13,949.7		20,219.3				
'98		1,404.8	1,404.8	1,616.3	4,852.0	17.3	490.0	15,101.5		22,077.1				
'99		1,408.7	1,408.7	1,834.4	5,386.7	18.5	523.2	16,348.5		24,111.3				
2000		1,413.4	1,413.4	2,081.8	5,969.4	19.8	556.6	17,371.0		26,098.6				
'01		1,418.2	1,418.2	2,362.7	6,615.2	21.1	592.2	18,670.6		28,262.8				
'02		1,423.0	1,423.0	2,681.4	7,330.9	22.5	630.0	19,952.5		30,617.3				
'03		1,428.0	1,428.0	3,043.2	8,124.0	24.0	670.3	21,322.5		33,184.0				
'04		1,432.9	1,432.9	3,453.7	9,002.9	25.6	713.1	22,786.5		35,981.8				
Total	88,406.0	26,578.6	114,984.6	25,760.6	73,022.9	283.1	8,200.9	236,412.7	2,254.6	345,935.8				

Economic Internal Rate of Return: 10.8%

9.4.2 Sensitivity Analysis

Sensitivity analysis was made by calculating the FIRR for several of the assumed cases of varied cost and benefit elements, with the following results.

1) Construction cost increased 10%	9.9%
2) " " decreased 10%	11.9
3) Passenger traffic increased 10%	11.1
4) " " decreased 10%	10.6
5) Construction cost and passenger traffic both increased 10%	10.2
6) Construction cost increased 10% and passenger traffic decreased 10%	9.7
7) Construction cost decreased 10% and passenger traffic increased 10%	12.1
8) Construction cost and passenger traffic both decreased 10%	11.6
9) Value-added ratio of foreign exchange earnings assumed at 45%	10.1

