

#### 11.3.4 Access Road and Parking Lot

As a short term development, access road from the airport perimeter to the public road shall be provided with approximate 100 m length and 17 m width. In the airport area, landside service road shall be provided as circulation road in front of the buildings such as passenger terminal building, cargo building and administration building etc. The service road in front of passenger terminal building has 30 m width including curb side lanes, through traffic lanes, green belt zone and walk way. The other part of the service road has 15 m width for traffic lanes and walk way with green belt. Regarding the car parking space, approximate 5,200 m<sup>2</sup> of the space shall be allocated for about 206 numbers of the vehicles in front of the passenger terminal building.

#### 11.4 Airport Support Facility Developments

##### 11.4.1 Control Tower

As it is stated in 9.4.1 the control tower should be constructed in the first stage, and it should be completed as designed in the master plan. There will be no extension planned for year 2010.

##### 11.4.2 Administration Building

Plan for year 2000 will be further studied according to the organization chart of Figure 10.7-1.

##### 11.4.3 CFR Building

CFR building for year 2000 is illustrated in Attachment Drawing 11-3 and 11-4. The extension will be made by adding one bay to accommodate one more major fire fighting vehicle in future. The arrangement of the function remains to be the same.

##### 11.4.4 Maintenance Shop

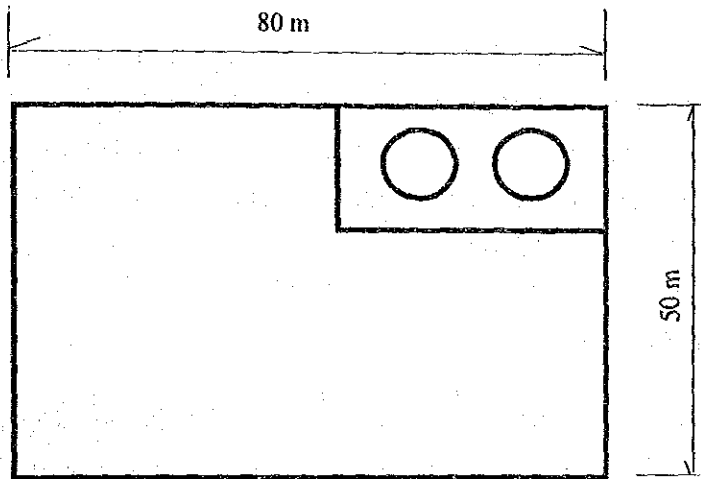
Maintenance shop for year 2000 plan will be basically the same with the master plan. It will be elaborated during the course of the study.

##### 11.4.5 Fuel Farm

The required amount of fuel for a week is estimated to be about 520 kl for the year 2000. Using the JCAB standards in computing the required fuel storage capacity

at Tokua Airport, it is estimated to need 2 tanks of each tank capacity of 300 kl in the fuel farm area of 4,000 m<sup>2</sup> to cope with the requirement of 600 kl for the year 2000.

It is important to prepare the land capable to expand the area to 6,000 m<sup>2</sup> for the year 2010. Assuming that each tank has a storage capacity of 300 kl, the required minimum tank yard area is roughly 4,000 m<sup>2</sup> as illustrated below.



#### 11.4.6 Electrical Facility

Commercial power should be supplied to the airport by extending from Kokopo. And a suitable capacity of diesel engine generators should be also equipped as a secondary power supply system.

#### 11.5 Operational Equipment Developments

##### 11.5.1 Navigation Aids

The facilities for navigation aids to be proposed for provision under the short term development will involve the following:

- 1) D-VOR/DME
- 2) NDB

The site of NDB will be re-considered at the stage of Detailed Design.

Installation of ILS will be contemplated in the runway extension to the localizer site in the subsequent phase of the master plan.

Transfer to the precision approach requirement from the proposing non-precision approach procedure is desirable, because 150 m runway strip was proposed due to saving the construction cost.

#### 11.5.2 Telecommunication Systems

Telecommunications facility in this phase will include AMS and AFS consisting of VHF air-ground radios and AFTN circuit with HF back-up. To establish the system, the connection of Tokua Airport and the present PTC line is necessary via Tomavatur repeater station. The required channels at the airport will be smaller than 60 channels which can be installed as a minimum.

#### 11.5.3 Lighting Systems

Major part of the airfield lighting is expected to be developed in this stage including SALS. The approach lighting system (ALS) should be introduced after the completion of the runway extension in the subsequent phase of the master plan.

The proposed Naviaids plan is shown in Figure 11.5-1

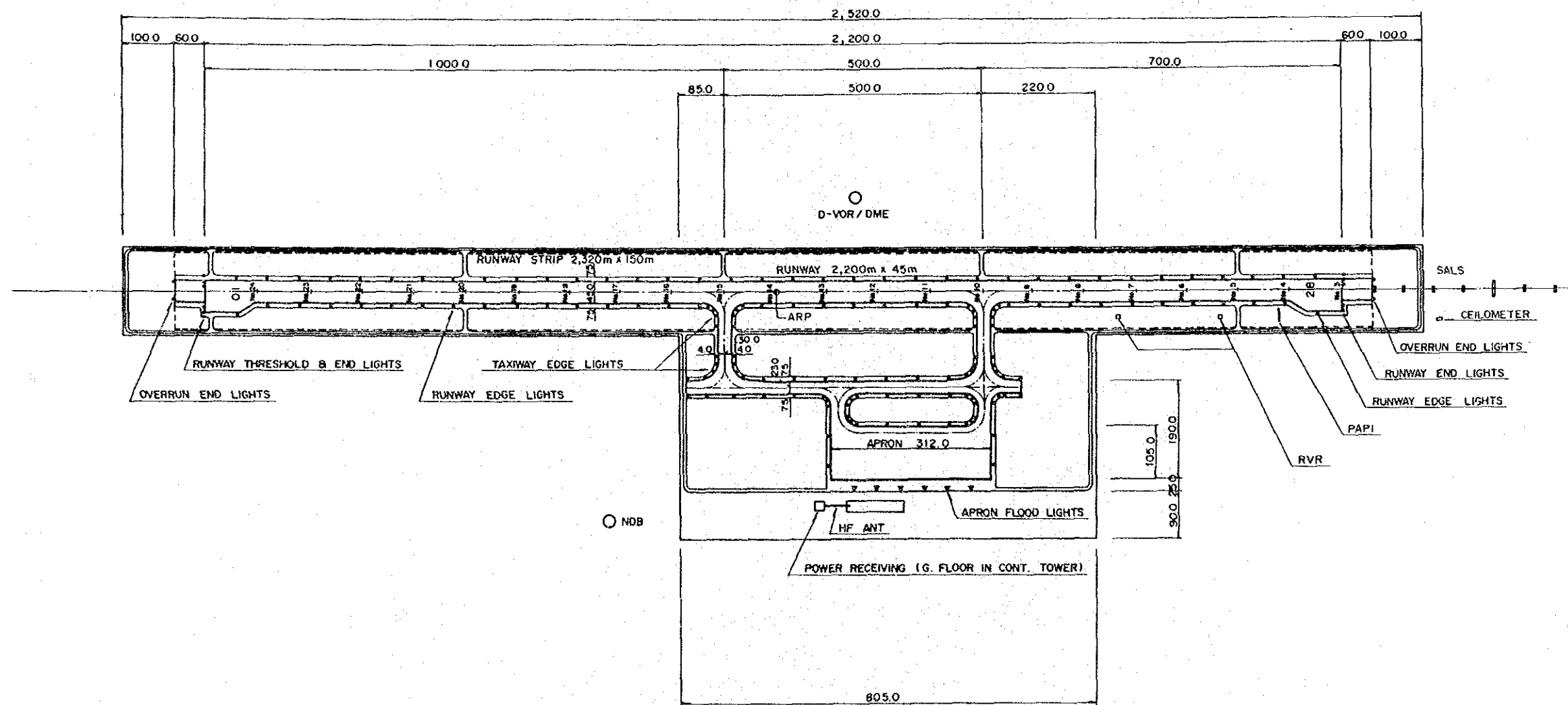


Figure 11.5-1 Proposed Navaids Plan for Short Term Development



## 11.6 ATC Operations

### 11.6.1 Obstacle Limitation Surfaces

For the Tokua Airport, the obstacle limitation surfaces are defined as in Figure 9.6-1 and as summarized below.

Surfaces and dimensions (Code 4)			
1. General		Non-instrument	Precision
Conical	Slope	5%	5%
	Height	100 m	100 m
Inner Horizontal	Height	45 m	45 m
	Radius	4000 m	4000 m
Transitional Slope		14.3%	14.3%
2. Approach			
Length of inner edge		150 m	300 m
Distance from threshold		60 m	60 m
Divergence (each side)		10%	15%
First section	Length	3000 m	3000 m
	Slope	2.5%	2%
Second section	Length	–	3600 m
	Slope	–	2.5%
Horizontal section	Length	–	8400 m
	Total length	–	15000 m
3. Take-Off Climb			
Length of inner edge			180 m
Distance from runway end			60 m
Divergence (each side)			12.5%
Final width			1200 m
Length			15000 m
Slope			2%

### 11.6.2 Air Traffic Control

#### 1) Tokua Control Zone (Refer to 2.8.5 Annex 11, ICAO)

Lateral limits shall extend to between 5 and 10 NM radius from TOK.

Upper limits 0 ~ 3000 feet.

2) Tokua Approach Control area

An approach controller should be responsible for the whole airspace of 60 NM radius without divided into two airspaces of APP control and Area control, because it is not foreseen for the time being that traffic volumes and associated manoeuvres require their respective controls.

Lateral limits 60 NM radius from TOK

Upper limits 15,000 feet

Area Control 15,000 ~ FL 245

3) Requirements for ATS

- (1) Aeronautical mobile service (AMS) equipments
- (2) Aeronautical fixed service (AFS) equipments for communications between air traffic services units/other units.
- (3) Communication equipments for the control of vehicles other than aircraft on maneuvering areas.
- (4) Equipments for Meteorological information
- (5) Equipments for informations on aerodrome conditions, operational status of associated facilities, naviaids and other safety

### 11.6.3 SIDs and STARS

In the interest of efficiency, regularity and economy every effort should be made to ensure that procedures are evolved so as to keep to the minimum consistent with safety, both the time taken in executing Instrument Flights and the airspace necessary for the associated manoeuvres. Therefore, the joint consideration by DCA and operators concerned is desirable to establish SIDs and STARS.

1) An example of SID

Tokua one Departure

Take off Runway 28, turn left (take off Runway 10, turn right), climb via TOK R-216 (216 degrees from TOK VOR) and proceed to A fix (05°55'6"S, 150°55'2"E).

Climb to 10000 feet or above within 25 NM from TOK and maintain Assigned or Specified altitude by TOK APP.

2) An example of STAR

Tokua one Arrival

From HKN NDB, proceed via HKN 054° (From TOK 234°) to TOK.

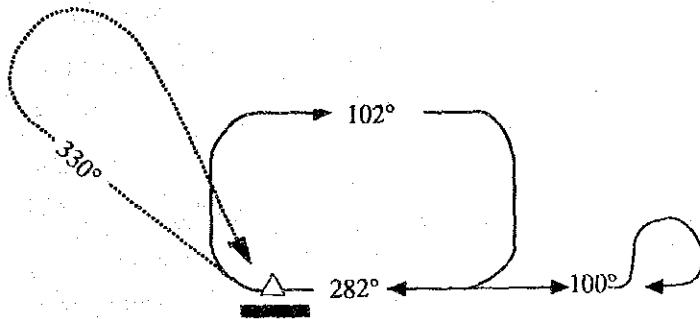
Maintain 10000 feet or above (or specified altitude by TOK APP) until 25 NM from TOK.

11.6.4 Let-downs

Only one procedure should be specified for each type of radio aid in relation to a particular runway.

1) An example of let-downs

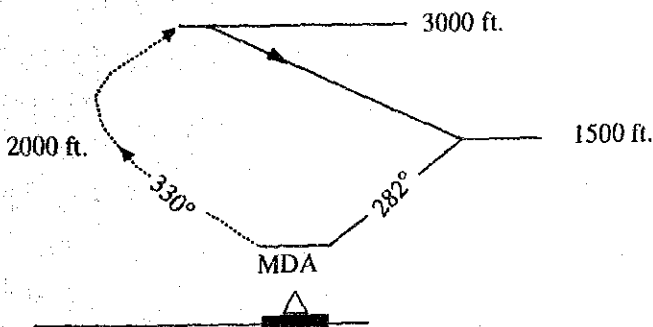
VOR/DME RWY 28



(1) Holding at VOR  
Right turn 1 minute at 3000 ft. or above.

(2) Procedure turn  
Outbound 102°, Procedure turn at 1500 ft. within 10 NM.

(3) MDA.....



(4) Missed Approach  
At VOR, turn right onto 330° radial and climb to 2000 ft. within 5 NM and turn right climbing to 3000 ft. and direct to VOR.



## 11.7 Airport Administrations

First of all, Government of PNG should decide and specify the subject agencies who are completely responsible for the respective management of airport support services such as terminal building, shops, fuels, access facilities and security etc.

The government organization and manpower of Tokua Airport at the year 2000 will be efficiently introduced from the Table 11.7-1, to cope with various requirements, taking into account the total aviation system in PNG.

Table 11.7-1 Preliminarily Estimated Staff Requirement (2000)

Discipline	Work-Hour	Man-Power
<u>Administrator</u>	Day	<u>1</u>
<u>Secretary</u>	Day	<u>1</u>
<u>General Affairs</u>	Day	<u>5 (1 + 4)</u>
Accounting		2
Store		1
Concessionaire		1
<u>Personnel Affairs</u>	Day	<u>4 (1 + 3)</u>
Personnel Affairs		2
Dispensary		1
<u>Maintenance</u>	Shift	<u>19 (1 + 12 + 6)</u>
Cleaning		6 x 2
Plumbing (Utilities)		2
Carpentry		2
Workshop		2
<u>Security</u>	Shift	<u>13 (1 + 6 x 2)</u>
<u>Electricity</u>	Shift	<u>5 (1 + 4)</u>
<u>Telecommunication</u>	Shift	<u>7 (1 + 6)</u>
Air/Ground Communication and		2
Navigational Aids		2
<u>Meteorological Observation</u>		4
<u>Air Traffic Control</u>	Shift	<u>13 (1 + 4 x 3)</u>
Shift Supervisor		1
Approach Control		1
Aerodrome Control		1
Flight Data		1
<u>Operations</u>	Shift	<u>13 (1 + 4 x 3)</u>
Flight plan and		2
Teletypewriter		
Ramp		2
<u>Fire Crews</u>		<u>11 [1 + (5 x 2)]</u>
		Total : 92

## 11.8 Project Evaluation

### 11.8.1 Financial Evaluation

#### 1) Financial Cost

Financial costs of project evaluation comprise of construction cost and engineering services cost including price contingency and physical contingency. Basically, cost of civil works in year 2000 as an element of construction costs was estimated for the construction of runway with 2,200 m.

Total financial cost for the short term development plan (2000) is estimated to be 68 million Kina and that of the master plan (2010) was figured out as 150 million Kina. According to this investment plan, 46% of total financial cost would be invested for the short term development plan.

The construction costs for the short term development plan were estimated on the basis of traffic demand forecast for the level of medium. If the traffic demand for the level of minimum would be realized, these construction costs for the short term development plan would be able to cope sufficiently with the traffic demand after the year of 2010 corresponding to the master plan. Then the construction costs for the Project would be saved as a whole.

The annual disbursement schedule was drawn up on the assumption that the construction would be carried out during the period from 1995 to 1997 and the operation would be started from the year of 1997 as referred to in Part III Time Schedule.

These costs were divided into local currency portion and foreign currency portion respectively. The exchange rates of Kina to Yen and US dollar are set at 140 Yen and 1.04 US dollar. (Refer to Table 11.8-1)

Besides the detailed cost of each work item was estimated as shown in Table 11.8-2, Table 11.8-3 and Table 11.8-4.

Table 11.8-1 Annual Disbursement Schedule (Financial Cost)

As of December 1991  
1 Kina = 1.04 US\$

Work Item	Total (1000 K.)	1995			1996			1997		
		F.C. (1000 US\$.)	L.C. (1000 K.)	F.C. (1000 US\$.)	L.C. (1000 K.)	F.C. (1000 US\$.)	L.C. (1000 K.)	F.C. (1000 US\$.)	L.C. (1000 K.)	
A. Construction Cost	62,240	33,003	30,507	1,264	3,622	12,864	13,487	18,874	13,398	
1. Civil Works	32,349	14,894	18,028	1,204	2,862	7,447	9,014	6,243	6,152	
2. Building Works	10,500	8,376	2,100	0	0	4,368	1,050	4,368	1,050	
3. Operational Facilities	8,992	6,928	2,331	0	0	0	0	6,928	2,331	
4. Utility	1,050	874	210	0	0	437	105	437	105	
Sub-total (Base Cost)	52,891	31,431	22,669	1,204	2,862	12,252	10,169	17,975	9,638	
5. Price Conti. *1)	6,704	0	6,704	0	617	0	2,810	0	3,278	
6. Physical Conti. *2)	2,645	1,572	1,133	60	143	613	508	899	482	
B. Engineering Services	6,052	3,300	2,879	126	362	1,286	1,287	1,887	1,230	
1. Base Cost *3)	5,289	3,143	2,267	120	286	1,225	1,017	1,798	964	
2. Price Conti. *1)	489	0	489	0	62	0	219	0	208	
3. Physical Conti. *2)	275	157	124	6	14	61	51	90	59	
C. Grand Total	68,292	36,303	33,386	1,391	3,984	14,151	14,774	20,762	14,628	

Notes \*1) Average growth rates per annum are 0% for F.C. and 5% for L.C. respectively.

\*2) 5% of base cost.

\*3) 10% of the total base cost of A.

Table 11.8-2 Detailed Costs of Civil Works

As of December 1991  
1 Kina = 1.04 US\$

Work Item	Unit	Quantity	Total (1000 K.)	F.C. (1000 US\$.)	L.C. (1000 K.)
A. Earthwork			10,821	2,252	8,656
1. Stumping	sq.m	760,000	646	134	517
2. Strip Topsil	sq.m	576,000	945	197	756
3. Excavation	cu.m	668,700	6,279	1,306	5,023
4. Heaulage	cu.m	668,700	1,438	300	1,150
5. Embankment	cu.m	564,600	1,513	315	1,210
B. Drainage			2,302	1,680	687
1. U-trench	cu.m	4,309	933	679	280
2. Trench (to sea)	cu.m	3,188	690	502	207
3. Box Culvert	cu.m	3,060	663	483	199
4. Pipe Culvert			16	16	1
1) dia. 900 mm	m	38	6	6	0
2) dia. 1,350 mm	m	38	10	9	1
C. Pavement			10,249	5,438	5,020
1. Runway	sq.m	99,000	4,867	2,632	2,336
2. Overrun	sq.m	7,200	138	63	77
3. Taxiway	sq.m	30,870	1,518	821	729
4. P. T. Apron	sq.m	21,530	1,226	778	478
5. G. A. Apron	sq.m	11,240	640	293	358
6. Shoulders	sq.m	46,680	896	410	502
7. GSE	sq.m	8,175	157	72	88
8. Airfield Road	sq.m	42,070	807	369	452
D. Parking Lot	sq.m	5,500	106	49	59
E. Access Road	sq.m	1,700	33	16	18
F. Service Road	sq.m	25,800	495	227	277
G. Miscellaneous Works			2,401	2,497	0
H. Overhead & Others			5,942	2,736	3,311
Total			32,349	14,894	18,028

Notes 1. Runway : 2,200 m x 45 m  
2. Runway Strip : 2,320 m x 150 m

Table 11.8-3 Detailed Costs of Buildings & Utilities

As of December 1991  
1 Kina = 1.04 US\$

Work Item	Quantity (sq.m)	Total (1000 K.)	F.C. (1000 US\$.)	L.C. (1000 K.)
<b>A. Building Works</b>	8,078	10,501	8,737	2,100
1. Passenger Terminal	5,000	7,503	-	-
2. Cargo terminal	360	216	-	-
3. CFR Building	381	272	-	-
4. Maintenance Shop	924	555	-	-
5. Administration	778	1,050	-	-
6. Control Tower	635	905	-	-
<b>B. Utility</b>	-	1,050	874	210
1. Water Supply & Sewage Treatment etc.	-	1,050	-	-
<b>Total</b>		<b>11,551</b>	<b>9,611</b>	<b>2,310</b>

Notes 1. "CFR" stands for "Crush, Fire & Rescue".

Table 11.8-4 Detailed Costs of Operational Facilities

As of December 1991  
1 Kina = 1.04 US\$

Work Item	Quantity	Total (1000 K.)	F.C. (1000 US\$.)	L.C. (1000 K.)
A. Electrical Power Supply System		2,829	2,102	808
1. Commercial Power Supply System	1 lot	486	297	200
2. Emergency Power Supply System	1 lot	463	357	120
3. Flight Information & Clock System	1 lot	964	743	250
4. CCTV Security System	1 lot	386	297	100
5. Telephone System	1 lot	289	223	75
6. Public Address System	1 lot	87	67	23
7. Fire Alarm System	1 lot	77	59	20
8. Power Supply Monitoring & Lighting Protection System	1 lot	77	59	20
B. Navigation Aids		1,625	1,300	375
1. D-VOR	1 set	1,049	839	242
2. DME	1 set	464	371	107
3. NDB	1 set	111	89	26
C. Communications		620	496	143
1. VHF Air Ground Ratio	4 freq	223	178	51
2. PTC Extension to Tokua	1 lot	186	149	43
3. AFTN Console	1 set	111	89	26
4. HF SSB Radio	1 set	56	45	13
5. AFTN Peripheral	5 sets	45	36	10
D. Lighting System		1,883	1,451	488
1. ABN	1 set	69	53	18
2. SALS	2 sets	77	59	20
3. PAPI	2 sets	52	40	13
4. HIRL	1 lot	563	434	146
5. REL	4 sets	197	152	51
6. PWOL	4 sets	30	23	8
7. TWL	1 lot	151	117	39
8. AFL	1 lot	405	312	105
9. WDIL	2 sets	83	64	22
10. CCR, Others	1 lot	183	141	48
11. RTIL	1 set	72	55	19
E. Met Equipment		2,035	1,578	517
1. Automatic Weather Station	1 lot	1,115	869	279
2. Com. & Monitoring Interface with National Met Center	1 lot	920	709	238
Total		8,992	6,928	2,331

## 2) Financial Benefit

Financial benefit is composed of net increase of revenues paid for various kinds of charges. The net increase of these charges was estimated by reducing the charges in case of "without the Project" condition from them in case of "with the Project".

### (1) Review of Aviation Charges

Before the amendment of "The Civil Aviation Charges Regulation 1974", it was pointed by the Report "MANUAL OF AIRPORT AND AIR NAVIGATION FACILITY TARIFFS", 1986 Edition by ICAO, as follows.

"Papua New Guinea does not have a policy of full recovery of costs properly attributable to the aviation industry for the provision and operation of aerodrome and airways facilities and services.

Since Papua New Guinea gained independence in 1975, it adopted what is called the "Public Service" or "Social Service" policy. Under this approach, the prices charged for infrastructure services are below the respective average costs of supplying them. In some instances, they are non-existent altogether.

The principles on which costs are allocated are currently under review. This administration is studying the possibility of adopting a policy of full recovery along similar lines to that of Australia. The review involves the studying of present rates with a view of increasing them to a level of commensurate with costs incurred for the provision and operation of infrastructure services and possible new avenues of cost recovery".

After the amendment of "The Civil Aviation Charges Regulation 1974", "The Civil Aviation Aircraft Charges (Domestic Services Operations) Regulation 1976" was put into effect and, for international flights, the Papua New Guinea Civil Aviation (Aircraft Charges) Regulation (as amended) made under the Civil Aviation Act provides for the determination and collection of charges for the use by aircraft of aerodromes, air route and airways facilities, meteorological, search and rescue services, operated and provided by the state.



In this regulation, a new charging system has been introduced for aircraft operations with regard to international airline operations and international general aviation aircraft. The new charging arrangement involves the introduction of a landing charge and an international enroute charge. These charges are based directly on aircraft weight and frequency of movement.

As a whole, the present charging system is considered to be almost the same as that of Australia, but the Study Team judges that the charges for aircraft operations should be equal to or more than the respective average costs of supplying all kinds of services for aerial works.

It is necessary for the charging system to be strictly and successively reviewed by comparing of the costs to the charges in the future.

## (2) Categories of Charges

In this Study, the charges are categorized as follows by referring to charging system carried out in Japan.

### a) Charges for Use of Airport

They are imposed on all aircrafts landed on airports from domestic airports or international airports and use airport facilities. The charges comprise of the following items.

#### (a) Usual Landing charges

#### (b) Special Landing charges

They are imposed on the basis of maximum take-off weight and noise level.

#### (c) Lighting Charges during Night Time

#### (d) Parking Charges

#### (e) Charges for Use of Hanger

Of these charges, only the item (a) is formally imposed in PNG. Landing charges for international flights are

independently imposed, but ones for domestic flights are included in charges for use of air navigation facilities. With regard to item(e), rental charges are levied on users of land as business concession.

b) Charges for Use of Air Navigation Facilities

They are imposed on aircraft supported for their navigation including their usage of navigation facilities such as radar, radio, control facilities and etc.

c) Tax of Fuels for Aircraft

It will be spent for source of revenue for improvement of airports and airway facilities. But this tax is not charged in PNG.

d) Other charges

They include charges or fees for car parking near airports, passengers for departure from airports etc.

(3) Charges for Domestic Flights

In this Study, charges for airports are calculated by being divided into domestic flights and international flights.

The charges for aircraft engaged in domestic service operation are classified into charges for Air Niugini and those for other airlines. According to categories mentioned above, these charges for domestic flights are classified as navigation charges.

The charges are payable in respect of the use by aircraft of aerodromes, air route and airway facilities, meteorological services and search and rescue services maintained, operated or provided by the State.

The charges for Air Niugini are imposed on the basis of hours flown, speed, capacity (tonnes) and rate (0.01 Kina) by aircraft type.

The charges for other airlines are imposed on the basis of three categories such as "private", "aerial work", and "charter" which are levied by unit charge (0.24 Kina per 100 kg, per week) and weight.

These charges include the landing charges as already mentioned.

(4) Charges for International Flights

The charges for international flights are classified into two categories which are "landing charges" and "international enroute charges". The former comprises of "Australia-Papua New Guinea flights" and "flights from other countries other than Australia" which are imposed on the basis of airports component, a terminal navigation component and fire services (RFFS) component taken account of weight of aircraft.

The latter, "international enroute charges", is classified as navigation charges according to the categories mentioned above. They are imposed on the basis of elements as follows:

- a) a rate of \$2.07 (Australian dollar), a factor of having the value of,
  - in relation of international flights between Papua New Guinea ports - 1, or
  - in relation to other international flights - 2.
- b) the distance travelled by aircraft -
  - between the first point of entry into PNG (Flight Information Region) and the first aerodrome of destination in PNG territory.
  - between two aerodromes in PNG territory as the case requires.

and finally,

c) the square root of the weight of the aircraft.

The net increase of these charges mentioned above is estimated as 7 thousand Kina in 1995, and 454 thousand Kina in 2000, and 839 thousand Kina in 2010, respectively.

(5) Charges of Usage of Airport Facilities by Passengers

The charges of usage of airport facilities are imposed on international passengers. The revenue of this charges paid is estimated on the basis of unit charge of 15 Kina per passenger. The estimated charges are figured out to be 150 thousand Kina in 2000 and 293 thousand Kina in 2010.

(6) Rental Charges

The rental charges for the use of land and building in airports area are imposed mainly on airline companies such as Air Niugini, Airlinks, Island Helicopter, and Pacific Helicopter.

When Tokua Airport is constructed, these land users are expected to move from Rabaul Airport to Tokua Airport. But the rate of rental will be kept almost the same as the present level, then the net increase of rental charges seems to be negligibly small. Recent rate of rental charges is 240 Kina per year which is same for all companies.

The financial benefit is summed up of all the net increase of revenue mentioned above (Refer to Table 11.8-7).

3) Necessity of Leveling up for Aviation Charges

Judging from the estimates of indices for evaluation such as FIRR, NPV and B/C ratio, and financial statements on the basis of present condition for operation of airport such as aviation charges and operating cost etc., it proved to be clear that the financial feasibility of the Project can not be expected.

Then the Study Team tried to analyze the level of aviation charges of PNG for the purpose of judgement whether the present level of charges of PNG is reasonable or not. The present level of charges means such as charges for the use by aircraft of aerodrome and air-route facilities

etc. The analysis was focused on two points. The one was the comparison of landing charges between PNG and some neighboring countries. The other was the comparison of total charges corresponding to the revenues from passenger fare acquired by airlines with regard to Rabaul Airport.

The comparison of total charging systems for these countries is impossible, because the basic principles for imposing charges vary with countries. But the ways of landing charge are relatively based on the same principle.

The following table shows the comparison of landing charges for six countries concerning the type of aircraft of B737. The level of charges of Japan is the highest which is more than two times of that of PNG, followed by Australia (1.8 times), and New Zealand (1.4 times) respectively. However, the level of domestic passenger fare of PNG is higher than neighboring countries. Then the higher level of charges can be imposed on airlines in PNG. Judging from these comparisons, it is reasonable that the landing charges of PNG is raised up to the same level\* as other countries such as Australia, New Zealand and Japan, corresponding to the level of revenues of passenger fare of PNG.

\* This same level means the share of aviation charges in total revenues for airlines. The examples of this share show more than 10% in foreign countries.

Table 11.8-5 Comparison of Landing Charges for International Flights and Passenger Fares

Name of Countries	Type of Aircraft : B737 Maximum Take-off Weight : 52,440 kg.	
	Landing Charges (Kina)	Fares (Kina)*2
PNG	343 (100)	POM-RAB 187 (100)
Australia	624 (182)	SYD-MLB 157 (84)
New Zealand	476 (139)	WEL-OAK 103 (55)
Indonesia	223 (65)	JKT-DPS 114 (61)
Philippines	159 (46)	MNL-DVO 79 (42)
Japan	778 (227) *1	JTT-JCC 170 (91)

Note \*1 : Including the special charges with regard to noise.

\*2 : The distances of all routes are approximately same.

The Study Team compared with regard to revenues of actual aviation charges and revenues of aviation charges calculated from passenger fares acquired by airlines for Rabaul Airport. The former was estimated by levying on aircraft operating the domestic flights departing from Rabaul Airport. The latter is estimated by multiplying revenues from fares acquired by airlines by 0.10. The rate of 0.10 is based on an average share of aviation charges paid in total expenditures (or revenues) of representative airlines in other countries.

According to the estimates, the amount of annual actual revenue from charges is 122 thousands Kina, and the charges calculated on the basis of fares paid by domestic passenger was figured out as 750 thousands Kina respectively. The latter is approximately 6 times of the former. (Refer to Table 11.8-6)

Then the financial evaluation is carried out on the assumption that the present level of aviation charges will be raised up to six times.

Table 11.8-6 Comparison of Future Charges and Present Charges  
(1989 : Rabaul airport)

		(Unit: '000 Kina)
Revenue from Fare for domestic Passengers	:	7,502.0(A)
10% of (A)	:	750.2
Revenue from Charges for Aircraft Operating Domestic Flights	:	122

#### 4) Financial Feasibility of the Project

The Project is evaluated from the financial viewpoint by figuring out the financial viability in terms of internal rate of return (IRR), benefit cost ratio (B/C), and the net present value (NPV). All the monetary calculations were based on the price level of December 1991, and the Project life (for financial evaluation) is fixed at 30 years including the construction period.

The calculation of IRR, B/C and NPV was based on the annual cash flow that was prepared from the above mentioned financial cost and annual financial benefit in accordance with the implementation schedule or annual disbursement schedule. A discount rate of 15% is applied for

the calculation of B/C ratio and NPV, because this rate is considered to be a capital cost for the Project equal to the average interest rate for loan in PNG as a criterion of judgment for financial feasibility. The indices for judgment of financial feasibility of the Project are thus figured out as follows. (Refer to Table 11.8-7)

- FIRR : 3.1%
- B/C : 0.32
- NPV : -34,203 thousand Kina

From the results of above calculation, the Study Team judges that the Project is not viable from the financial viewpoint by the following reasons.

- a) FIRR, as a discount rate to make the total costs in the Project life equal to the total benefits, is less than 15% as the average interest rate for loan in PNG.
- b) The total benefits are less than the total costs when they are discounted by 15%. As a result, B/C is less than 1.00 and NPV is negative.

#### 5) Estimation for Profit and Loss Statement

On the assumption that Tokua Airport will be operated independently from the financial view point, the profit and loss statement is prepared.

The basic conditions of the estimation are as follows;

- The average life time of invested assets is 30 years.
- The share of foreign loan of construction cost is 80% and 20% of it will be financed by the PNG side.
- The average commercial interest rate for loan and deposit in domestic banks is 15% and 10% respectively. The loan will be repaid the next year and the period of deposit is not fixed.
- The income tax rate is 30%
- The raise up rate of maintenance and administration cost is 3% per annum.

Table 11.8-7 Financial Cost Benefit Cash Flow

		Financial Cost					(Unit: '000 Kina)		
No.	Year	Const.	Phys. Conti.*1	E.S.*2	O&M	Rep.*3	Total	Annual Financial Benefit*5	Annual Cash Flow
1	1995	4,019.6	201.0	402.0			4,622.6	0.0	(4,622.6)
2	1996	21,943.8	1,097.2	2,194.4			25,235.4	0.0	(25,235.4)
3	1997	26,916.4	1,345.8	2,691.6			30,953.8	0.0	(30,963.8)
4	1998				1,586.4		1,586.4	48.1	(1,538.3)
5	1999				1,586.4		1,586.4	50.2	(1,536.2)
6	2000				1,586.4		1,586.4	3,621.6	2,035.2
7	2001				1,586.4		1,586.4	3,938.4	2,352.0
8	2002				1,586.4		1,586.4	4,255.2	2,668.8
9	2003				1,586.4		1,586.4	4,572.6	2,986.2
10	2004				1,586.4		1,586.4	4,889.4	3,303.0
11	2005				1,586.4		1,586.4	5,206.2	3,619.8
12	2006				1,586.4		1,586.4	5,523.0	3,936.6
13	2007				1,586.4		1,586.4	5,839.8	4,253.4
14	2008				1,586.4		1,586.4	6,157.2	4,570.8
15	2009				1,586.4		1,586.4	6,474.0	4,887.6
16	2010				1,586.4		1,586.4	6,790.8	5,204.4
17	2011				1,586.4		1,586.4	6,790.8	5,204.4
18	2012				1,586.4		1,586.4	6,790.8	5,204.4
19	2013				1,586.4		1,586.4	6,790.8	5,204.4
20	2014				1,586.4		1,586.4	6,790.8	5,204.4
21	2015				1,586.4		1,586.4	6,790.8	5,204.4
22	2016				1,586.4		1,586.4	6,790.8	5,204.4
23	2017				1,586.4	9,441.9	11,028.3	6,790.8	(4,237.5)
24	2018				1,586.4		1,586.4	6,790.8	5,204.4
25	2019				1,586.4		1,586.4	6,790.8	5,204.4
26	2020				1,586.4		1,586.4	6,790.8	5,204.4
27	2021				1,586.4		1,586.4	6,790.8	5,204.4
28	2022				1,586.4		1,586.4	6,790.8	5,204.4
29	2023				1,586.4		1,586.4	6,790.8	5,204.4
30	2024				1,586.4		1,586.4	6,790.8	5,204.4
							FIRR	=	3.08%
							B/C *4	=	0.32
							NPV *4	=	-34,203.43

- Notes:
- \*1 : 5% of construction cost.
  - \*2 : 10% of construction cost
  - \*3 : Including of 5% of physical contingency for operational facilities.
  - \*4 : Discount rate is 15% per annum.
  - \*5 : After 2010, annual financial benefit was estimated to be constant because the airport capacity will be constrained by the Short Term Development Plan.



- The level of air navigation charges will go upward to six times of the present level.
- The weight of maintenance and administration cost is 3% of total construction cost.

The estimated profit and loss statement shows that the deficit will continue until eleventh year from the beginning of construction (1995), but from the twelfth year, net profit will be changed into positive. The accumulated net profit will become to positive in the nineteenth year of the Project life (2013) which is later than the year when annual surplus will be changed into positive figure (Refer to Table 11.8-8).

#### 6) Repayment Schedule

The repayment schedule of foreign loan is estimated on the assumption as follows:

- amortization period : 20 years
- starting year of amortization : 11th year of the Project year
- introducing year of loan : 1st year of the Project life
- loan interest rate : 2.7% per annum
- method of repayment : level yearly payment of principal and interest

The amount of annual amortization was calculated as 3,506 thousand Kina (Refer to Table 11.8-9).

#### 7) Money Flow Table

By estimation of money flow table, the surplus or shortage of funds can be recognized. The funds will be shortened till the thirteenth year of the Project life, but from the fourteenth year (2008), the funds will be changed into the surplus on the assumption that the level of air navigation charges will be raised up to six times of the present level (Refer to Table 11.8-10).

Table 11.8-8 Estimated Profit and Loss Statement

(Unit: '000 Kina)

Year	Revenue	Salvage Value	Interest on		Total Revenue	Interest Payable	Maintenance and Administration Cost	Depreciation Cost	Income Tax	Total Cost	Net Profit	Accumulated Net Profit
			Depreciation Allowance	Surplus								
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1448	0	177	0	1625	-1625	-1625
3	0	0	18	-217	-199	1448	0	1123	0	2571	-2771	-4396
4	1182	0	130	-682	630	1448	1634	2276	0	5358	-4728	-9124
5	1236	0	358	-1514	80	1448	1683	2276	0	5407	-5327	-14451
6	7062	0	585	-2803	4844	1448	1734	2276	0	5458	-614	-15066
7	7608	0	813	-3844	4577	1448	1786	2276	0	5510	-933	-15999
8	8160	0	1040	-4683	4517	1448	1839	2276	0	5563	-1046	-17045
9	8706	0	1268	-5338	4636	1448	1894	2276	0	5618	-982	-18027
10	9252	0	1496	-5798	4950	1448	1951	2276	0	5675	-726	-18752
11	9804	0	1723	-6026	5501	1448	2010	2276	0	5734	-233	-18985
12	10350	0	1951	-6256	6045	1393	2070	2276	0	5739	306	-18679
13	10896	0	2179	-6416	6659	1336	2132	2276	92	5835	823	-17855
14	11442	0	2406	-6422	7426	1277	2196	2276	247	5996	1430	-16425
15	11994	0	2634	-6170	8458	1217	2262	2276	429	6184	2274	-14151
16	12540	0	2861	-5766	9635	1155	2330	2276	682	6443	3192	-10960
17	12540	0	3089	-5197	10432	1091	2400	2276	958	6725	3707	-7252
18	12540	0	3317	-4518	11339	1026	2472	2276	1112	6887	4452	-2800
19	12540	0	3544	-3713	12371	959	2546	2276	1336	7117	5254	2454
20	12540	0	3772	-2766	13546	891	2622	2276	1576	7365	6181	8635
21	12540	0	3999	-1653	14887	820	2701	2276	1854	7651	7235	15870
22	12540	0	4277	-351	16416	747	2782	2276	2171	7976	8440	24310
23	12540	0	4455	779	17774	673	2865	2276	2532	8346	9427	33738
24	12540	0	4682	1919	19141	596	2951	2276	2828	8652	10490	44227
25	12540	0	4910	3188	20638	518	3040	2276	3147	8981	11657	55884
26	12540	0	5137	4597	22274	437	3131	2276	3497	9341	12933	68817
27	12540	0	5365	6161	24066	354	3225	2276	3880	9735	14330	83147
28	12540	0	5593	7894	26027	269	3322	2276	4299	10167	15860	99007
29	12540	0	5820	9814	28174	182	3421	2276	4758	10637	17537	116544
30	12540	0	6048	11939	30527	92	3524	2276	5261	11153	19373	135917

Table 11.8-9 Repayment Plan for Foreign Loan

(Unit: '000 Kina)

Year	Annual Amortization	Loan Interest	Redemption of Principal	Loan Residual
1	0	0	0	53634
2	0	1448	0	53634
3	0	1448	0	53634
4	0	1448	0	53634
5	0	1448	0	53634
6	0	1448	0	53634
7	0	1448	0	53634
8	0	1448	0	53634
9	0	1448	0	53634
10	0	1448	0	53634
11	3506	1448	2058	51576
12	3506	1393	2113	49463
13	3506	1336	2170	47293
14	3506	1227	2229	45064
15	3506	1217	2289	42775
16	3506	1155	2351	40424
17	3506	1091	2414	38010
18	3506	1026	2480	35530
19	3506	959	2546	32984
20	3506	891	2615	30368
21	3506	820	2686	27682
22	3506	747	2758	24924
23	3506	673	2833	22091
24	3506	596	2909	19182
25	3506	518	2988	16194
26	3506	437	3069	13125
27	3506	354	3151	9974
28	3506	269	3237	6737
29	3506	182	3324	3414
30	3506	92	3414	0

Table 11.8-10 Money Flow Table

Year	Loan		Total Loan Redemption	Loan Interest	Maintenance and Administration	Investment	Total Expenditure	Total Revenue	Money Surplus	Accumulated Money Surplus
	Residual	Total Loan								
1	53634	0	0	0	0	5321	5321	0	0	0
2	53634	0	0	1448	0	28370	29818	0	-1448	-1448
3	53634	1448	1448	1448	0	34592	37488	-199	-3096	-4544
4	53634	3096	3096	1448	1634	0	6178	630	-5547	-10091
5	53634	5547	5547	1448	1683	0	8678	80	-8599	-18690
6	53634	8599	8599	1448	1734	0	11781	4844	-6937	-25627
7	53634	6937	6937	1448	1786	0	10171	4577	-5594	-31221
8	53634	5594	5594	1448	1839	0	8881	4517	-4364	-35585
9	53634	4364	4364	1448	1894	0	7706	4636	-3070	-39654
10	53634	3070	3070	1448	1951	0	6469	4950	-1519	-40173
11	51576	3577	3577	1448	2010	0	7035	5501	-1533	-41707
12	49463	3647	3647	1393	2070	0	7109	6045	-1064	-42771
13	47293	3235	3235	1336	2132	0	6702	6659	-43	-42814
14	45064	2272	2272	1277	2196	0	5745	7426	1681	-41133
15	42775	2289	2289	1217	2262	0	5768	8458	2690	-38443
16	40424	2351	2351	1155	2330	0	5836	9635	3799	-34644
17	38010	2414	2414	1091	2400	0	5906	10432	4527	-30118
18	35530	2480	2480	1026	2472	0	5978	11339	5361	-24756
19	32984	2546	2546	959	2546	0	6052	12371	6319	-18438
20	30368	2615	2615	891	2622	0	6128	13546	7429	-11019
21	27682	2686	2686	820	2701	0	6207	14887	8680	-2339
22	24924	2758	2758	747	2782	0	6288	16416	10128	7789
23	22091	2833	2833	673	2865	0	6371	17774	11403	19192
24	19182	2909	2909	596	2951	0	6457	19141	12685	31876
25	16194	2988	2988	518	3040	0	6546	20638	14092	45968
26	13125	3069	3069	437	3131	0	6637	22274	15637	61605
27	9974	3151	3151	354	3225	0	6731	24066	17335	78940
28	6737	3237	3237	269	3322	0	6828	26027	19199	98139
29	3414	3324	3324	182	3421	0	6927	28174	21247	119386
30	0	3414	3414	92	3524	0	7030	30527	23497	142883

Note: Money surplus does not include "investment cost" on the assumption that it's 80% will be financed from foreign loan and 20% will be financed by the PNG side.

## 8) Overall Financial Evaluation

On the basis of the results mentioned above, overall financial evaluation of the Project is as follows:

- (1) Judging from the estimates of FIRR, NPV and B/C ratio as the indices for evaluation and profitability by financial statements on the basis of present conditions for operation of airport such as aviation charges and operating cost etc., it proved to be clear that the financial feasibility of the Project can not be expected.
- (2) In PNG, the passenger fare is expensive but the aviation charges such as landing charges are cheap with comparison to the neighboring countries. Besides the payment ratio of aviation charges to revenues acquired by airlines is too low by comparing with the airlines abroad.

On the basis of the present level of charges and present interest rate of loan (15%), it is never sufficient to recover not only the annual operating costs but the total Project costs included the construction costs.

- (3) On the assumption that the present level of aviation charges will be raised up to sixfold, and a low interest rate of loan (ex. 2.7%) will be applied, it is possible that the annual deficit will be changed into positive figure and the cost of the Project will be recovered in the long term and then the Project can be expected to be feasible.

This means that it is necessary to consider policies such as governmental subsidies and/or loan with low interest rate by laying stress on social and public necessity.

### 11.8.2 Economic Evaluation

#### 1) Economic Cost

Financial costs for the project evaluation are converted into the economic costs. 50% of local currency portion is assumed to be unskilled labor, then it is converted into economic costs by applying shadow wage rate (SWR) of 0.90.

Costs of foreign currency portion are mainly imported materials and equipments. Transfer payment such as taxes and duties are subtracted from the financial cost. In this Study, 10% of total financial cost is deducted.

Total economic costs for the short term development plan (2000) is assumed to be 54 million Kina (Refer to Table 11.8-11).

## 2) Economic Benefits

The components of economic benefit of this Project are savings of fuel consumption for navigation, expenditure by foreign tourists, passengers' benefit by willingness to pay etc.

### (1) Savings of Fuel Consumption for Air Navigation

Savings for fuel will occur for aircraft navigation because aircraft will be large in size as capacity of airport would be expanded. In this Study, cost savings for fuel are estimated by taking into consideration of air passenger traffic demand and aircraft type for commercial and general aviation by route, distance of air navigation, economic price of fuel (0.03 Kina/liter), and efficiency of fuel consumption.

### (2) Expenditures by Foreign Tourists

The following factors are assumed for estimation of expenditures by foreign tourists to visit in future Tokua and Rabaul area.

- a) Ratio of tourists of air passengers to arrive at Tokua Airport is considered to be 39.2% based on traffic survey.
- b) Annual growth ratio of GDP per capita of foreign tourists is 3% in real term.
- c) Average expenditures of foreign tourists for one journey is 490 Kina in 1989.

Based on these assumptions, the expenditures of 39.2% of international air passengers of revealed traffic demand of potential demand as mentioned in Chapter 3, are calculated.

Table 11.8-11 Economic Cost Benefit Cash Flow

(Unit: '000 Kina)

No.	Year	Economic Cost					Total	Annual Economic Benefit*5	Annual Cash Flow
		Const.	Phys. Conti.*1	E.S.*2	O&M	Rep.*3			
1	1995	3,488.9	174.4	348.9			4,012.3	0.0	(4,012.3)
2	1996	19,291.8	964.6	1,929.2			22,185.6	0.0	(22,185.6)
3	1997	23,791.0	1,189.6	2,379.1			27,359.7	0.0	(27,359.7)
4	1998				1,397.2		1,397.2	9,258.0	7,860.8
5	1999				1,397.2		1,397.2	9,803.0	8,405.8
6	2000				1,397.2		1,397.2	10,348.0	8,950.8
7	2001				1,397.2		1,397.2	11,042.0	9,644.8
8	2002				1,397.2		1,397.2	11,738.0	10,340.8
9	2003				1,397.2		1,397.2	12,432.0	11,034.8
10	2004				1,397.2		1,397.2	13,126.0	11,728.8
11	2005				1,397.2		1,397.2	13,822.0	12,424.8
12	2006				1,397.2		1,397.2	14,520.0	13,454.8
13	2007				1,397.2		1,397.2	15,882.0	14,484.8
14	2008				1,397.2		1,397.2	16,910.0	15,512.8
15	2009				1,397.2		1,397.2	17,940.0	16,542.8
16	2010				1,397.2		1,397.2	18,970.0	17,572.8
17	2011				1,397.2		1,397.2	18,970.0	17,572.8
18	2012				1,397.2		1,397.2	18,970.0	17,572.8
19	2013				1,397.2		1,397.2	18,970.0	17,572.8
20	2014				1,397.2		1,397.2	18,970.0	17,572.8
21	2015				1,397.2		1,397.2	18,970.0	17,572.8
22	2016				1,397.2		1,397.2	18,970.0	17,572.8
23	2017				1,397.2	8,387.5	9,784.7	18,970.0	9,185.3
24	2018				1,397.2		1,397.2	18,970.0	17,572.8
25	2019				1,397.2		1,397.2	18,970.0	17,572.8
26	2020				1,397.2		1,397.2	18,970.0	17,572.8
27	2021				1,397.2		1,397.2	18,970.0	17,572.8
28	2022				1,397.2		1,397.2	18,970.0	17,572.8
29	2023				1,397.2		1,397.2	18,970.0	17,572.8
30	2024				1,397.2		1,397.2	18,970.0	17,572.8
							EIRR	=	18.51%
							B/C *4	=	1.24
							NPV*4	=	10,771.95

- Note \*1 : 5% of construction cost.  
\*2 : 10% of construction cost.  
\*3 : Including of 5% of physical contingency for operational facilities.  
\*4 : Discount rate is 15% per annum.  
\*5 : After 2010, annual economic benefit was estimated to be constant because the airport capacity will be constrained by the Short Term Development Plan.

(3) Passenger Benefit by Willingness to Pay

The benefit with revealed traffic demand of potential demand is calculated based on assumption that passengers get some utility from their trips by principle of "Willingness to Pay". This utility corresponds to fares paid by them.

Using the information and data of fares and traffic demand by route for commercial and general aviation provided by DCA, passengers' benefit from their trip utility is estimated.

(4) Time Savings of Passengers in Terminal

The procedures for check-in and -out in Tokua air terminal will be more effective than that of Rabaul air terminal because of expanded modernized facilities.

The Study Team assumes that total time saving for check-in and -out per passenger is one hour. Then time savings of passengers in terminal are estimated on the basis of the assumption that time value per hour is approximately 1.7 Kina estimated from the data for an average wage per week, 66.94 Kina, in 1990 of "Trade Men B1 & B2 of Class 5 in urban area", and an average annual growth rate of wage is 4%.

(5) Savings of Operating and Maintenance Costs

Operating and maintenance costs will be saved by closure of Rabaul Airport. These costs are estimated approximately at 901 thousand Kina per annum.

(6) Savings of Replacement Cost

Because of the same reason as savings of operating and administration costs, replacement cost for Rabaul Airport is considered to be saved on annual expenditures for replacement cost of 40 thousand Kina.

The economic benefit is summarized in the Table 11.8-11.



### 3) Economic Feasibility of the Project

The Project is evaluated from the economic viewpoint by figuring out the economic viability in terms of internal rate of return (IRR), benefit-cost ratio (B/C), and the net present value (NPV).

All the monetary calculations were based on the price level of December 1991, and the Project life (for economic evaluation) is fixed at 30 years including the construction period.

The calculation of IRR, B/C and NPV was based on the annual cash flow that was prepared from the above mentioned economic cost and annual economic benefit in accordance with the implementation schedule or annual disbursement schedule. A discount rate of 15% is applied for the calculation of B/C ratio and NPV, because this rate of 15% is considered to be the opportunity cost as the capital to be invested for the Project. In this Study, the available information for an opportunity cost in PNG was not acquired, then the equal rate to interest rate of long term loan in PNG was used as the opportunity cost of capital in this Project.

The indices for economic viability of the Project is thus figured out as follows.

- EIRR : 18.5%
- B/C : 1.24
- NPV : 10,772 thousand Kina

### 4) Sensitivity Analysis

Sensitivity analysis is carried out for the Project to identify the sensitivity of economic viability in case that the actual conditions may change in the construction period or project life.

The change of EIRR, the most important economic index to express the viability, is studied on the assumptions of increase of construction cost and decrease of annual benefit. The results are shown below:

-	Construction cost	5% up	:	17.7%
-	Construction cost	10% up	:	17.0%
-	Construction cost	15% up	:	16.3%
-	Annual benefit	5% down	:	17.7%
-	Annual benefit	10% down	:	16.8%
-	Annual benefit	15% down	:	16.0%

It can be concluded from above economic analysis that the Project has high economic feasibility by the following reasons and is to be implemented in the earliest future.

- (1) EIRR, as a discount rate to make the total costs in the Project life equal to the total benefits, is more than 15% as an opportunity cost of capital.
- (2) The total benefits are more than total costs when they are discounted by 15%. As a result, B/C is more than 1.00 and NPV is positive.



**PART-III CONCLUSION AND  
RECOMMENDATION**



## PART III CONCLUSION AND RECOMMENDATION

The previous chapters of this Report set forth the Master Plan (2010) Study and the Feasibility Study of the Short Term Development Plan (2000) for Tokua Airport and have shown them justifiable through the overall analyses and discussions.

Tokua Airport should be developed to substitute the present Rabaul Airport in the very near future because of its various constraints and safety considerations, and the capacity of the present Rabaul Airport has already reached saturation point. If developments delay until the next century, the number of potential passengers who could not make their planned flights because of the inadequate capacity would be so large as to cripple the air transport sector in PNG. And the adverse impact of these cancelled or unrealized trips on the economy would be severe.

For these reasons a possible conclusion for the project implementation is to start the Short Term Plan of year 2000 as early as possible before year 2000.

### III.1 RUNWAY CONFIGURATION

In order to review the secondary runway of Tokua Airport, it is recommended that the wind coverage evaluation should be re-calculated by the perfect wind data because the present wind data with several missing record especially after September was insufficient.

### III.2 IMPLEMENTATION OF URGENT PROGRAMS

The total factors of physical conditions at Rabaul Airport were reported by the previous studies. In order to defend the people from volcanic disaster and cope with an anticipated traffic demand increase, it is considered that the project should be urgently implemented before the short term development plan targeted on the year 2000. Therefore, it is very important for a realization of the proposed project to provide a practically phased approach so that the project will not terminate in nothing but a mere study. On the other hand, once the project construction is set about, it is necessarily followed by the further implementation.

Considering the time needed for engineering design, bidding and construction, the short term development plan is recommended to be implemented as soon as practically possible which would apply to items needing an immediate attention because of safety considerations on people coming in and out and working at the present Rabaul Airport and because of constraints of the current airport operations.

The urgent implementation of the short term development plan is a transitional stage for the project implementation before the year 2000 to the extent that Rabaul Airport operational penalty at present can be improved and operated by A300 class aircraft in a new airport at Tokua. This earlier implementation will make it easy and stimulate the stage of master plan.

#### Time Schedule

Items \ Year	Year				
	1 (1993)	2 (1994)	3 (1995)	4 (1996)	5 (1997)
Detailed Design	—————				
Negotiation/Bidding		—			
Construction					
(1) Civil Works		—————			
(2) Buildings			—————		
(3) Equipments				—————	
Flight Check					—
Airport Opening					→

(It is noted that all the construction works would be conducted on contract basis.)

As the conclusion of this report, this project can not be assumed financially feasible, should the loan interest rate be based on the present domestic average loan interest of approximately 15%.

In order to have the project be financially feasible, it is essentially required for the Government to consider to introduce low interest rate loans and/or governmental subsidies.

However, the subject project is considered to be feasible from the economic, technical and environmental point of view. Besides, the existing Rabaul Airport being located in the midst of active volcanoes should be relocated as soon as possible to the Tokua site in order to maintain the safety of operation and to avoid volcanic disasters which would surely result in the suspension of airport function and the paralysis of transportation in the region.

Furthermore, the requirement for an early development of Tokua Airport which is considered to be the most optimum site should be stressed to also cope with the increasing air traffic demand envisaged for the very near future.

We, therefore, wish to strongly recommend the earliest realization of this Airport Project.





**ATTACHMENT**

SURVEY SHEET FOR PASSENGERS  
(Tokua Airport Project Study Team)

Name of Airport : \_\_\_\_\_  
 Date of Survey : \_\_\_\_\_  
 Flight No. : \_\_\_\_\_

1. What is your nationality?  
 Please circle the number of the applicable country.
- |                    |              |                |
|--------------------|--------------|----------------|
| 1. PNG             | 2. Australia | 3. New Zealand |
| 4. Solomon Islands | 5. Guam      | 6. Philippines |
| 7. Hong Kong       | 8. Singapore | 9. Indonesia   |
| 10. Japan          | 11. Others   |                |

2. What is the purpose of your trip?
- |                       |                        |
|-----------------------|------------------------|
| 1. Tourist            | 2. Commercial/Business |
| 3. Visiting Relatives | 4. Official Matters    |
| 5. Others             |                        |

3. Where did you come from? (Only for PNG nationalities and foreign residents in PNG).
- |                 |               |                |
|-----------------|---------------|----------------|
| 1. Port Moresby | 2. Lae/Nadzab | 3. Madang      |
| 4. Wewak        | 5. Goroka     | 6. Mount Hagen |
| 7. Others       |               |                |

4. What is the scheduled route of your trip and staying days?  
 Please fill the following blanks with the numbers of the suitable countries/cities and dates of departure from each visited places or to be visited.
- City ->  ->  ->  ->  ->  ->
- Date of Departure [ / ] [ / ] [ / ] [ / ] [ / ]

- |                  |                |                    |
|------------------|----------------|--------------------|
| 1. Australia     | 2. New Zealand | 3. Solomon Islands |
| 4. Guam          | 5. Philippines | 6. Hong Kong       |
| 7. Singapore     | 8. Indonesia   | 9. Japan           |
| 10. Port Moresby | 11. Lae        | 12. Madang         |
| 13. Wewak        | 14. Goroka     | 15. Mount Hagen    |
| 16. Rabaul       | 17. Kokopo     | 18. Others         |

5. What kind of transportation did you use to get access to this airport ?
- |             |                |        |
|-------------|----------------|--------|
| 1. Taxi     | 2. Private Car | 3. PMV |
| 4. Hire Car | 5. Others      |        |

6. What were the cost (fare) and time required to arrive at this airport?
- (1) Access time : \_\_\_\_\_ (hours) \_\_\_\_\_ (minutes)  
 (2) Fare : \_\_\_\_\_ Kina per person, or \_\_\_\_\_ Kina per group.

7. The total pieces of luggage carried and the total weight. eg: is three pieces of luggage weighing 14 Kilograms.
- |   |    |                      |                      |
|---|----|----------------------|----------------------|
| 3 | 14 | <input type="text"/> | <input type="text"/> |
|---|----|----------------------|----------------------|

8. How many times did you use this flight during the past one year? Please fill the following blank with a figure for the number of times.
- times.

9. How many times have you experienced that you could not make reserve for this flight during the past one year? Please fill the following blank with a figure for the number of times.
- times.

10. Please let me know the number of persons who came to this airport to see you off. Please fill the following blank with a figure for the number of persons.
- persons.

11. Please answer the following questions.
- (1) What is your sex? 1. Male 2. Female  
 (2) What is your age? 1. Less than 19 2. 20 - 29  
 3. 30 - 39 4. 40 - 49  
 5. More than 50

12. What is your occupation ?
- |                       |                               |
|-----------------------|-------------------------------|
| 1. Executive Official | 2. Government Official        |
| 3. Professional       | 4. Private Company Worker     |
| 5. Self-employed      | 6. Agricultural/Fisher Worker |
| 7. Student            | 8. Housewife                  |
| 9. Unemployed         | 10. Others                    |



## Attachment 3-2 Results of Traffic Survey

- |                              |   |   |
|------------------------------|---|---|
| 1. Date                      | : | 11th and 12th of June, 1991             |
| 2. Place                     | : | Rabaul Airport and Port Moresby Airport |
| 3. Number of Samples         |   |   |
| (1) Rabaul                   | : | 144                                     |
| (2) Port Moresby             | : | 681                                     |
| Total                        | : | 825                                     |
| 4. Passengers to be Surveyed |   | Only Passengers for Departure           |

OD Passenger Traffic Between Rabaul/Port Moresby and Other Airports

(Unit : Persons ; %)

Arrival Airport	RAB	(%)	POM	(%)	TOTAL	(%)
PORT MORESBY	37	25.7	0	0.0	37	4.5
BIALLA	12	8.3	0	0.0	12	1.5
OPEN BAY	3	2.1	0	0.0	3	0.4
NAMATANAI	18	12.5	0	0.0	18	2.2
TOL	3	2.1	0	0.0	3	0.4
HOSKINS	26	18.1	0	0.0	26	3.2
BUKA	10	6.9	0	0.0	10	1.2
NADZAB (LAE)	17	11.8	192	28.2	209	25.3
KAVIENG	11	7.6	0	0.0	11	1.3
POPONDETTA	0	0.0	20	2.9	20	2.4
MADANG	0	0.0	12	1.8	12	1.5
GOROKA	0	0.0	53	7.8	53	6.4
MOUNT HAGEN	0	0.0	59	8.7	59	7.2
WAPENAMNDA	0	0.0	7	1.0	7	0.8
GURNEY	0	0.0	18	2.6	18	2.2
RABAU	0	0.0	39	5.7	39	4.7
DARU	0	0.0	9	1.3	9	1.1
KERMA	0	0.0	16	2.3	16	1.9
TABUBIL	0	0.0	4	0.6	4	0.5
MENDI	0	0.0	10	1.5	10	1.2
KUNDIAWA	0	0.0	13	1.9	13	1.6
WAU	0	0.0	2	0.3	2	0.2
CAIRNS	0	0.0	81	11.9	81	9.8
BRISBANE	0	0.0	55	8.1	55	6.7
SINGAPORE	0	0.0	43	6.3	43	5.2
HONIARA	0	0.0	25	3.7	25	3.0
CHARTER	5	3.5	2	0.3	7	0.8
N. A.	2	1.4	21	3.1	23	2.8
<b>TOTAL</b>	<b>144</b>	<b>100.0</b>	<b>681</b>	<b>100.0</b>	<b>825</b>	<b>100.0</b>

### Nationality

(Unit : Persons ; %)

	RAB	(%)	POM	(%)	TOTAL	(%)
1. PNG	100	69.4	402	59.0	502	60.8
2. Australia	23	16.0	132	19.4	155	18.8
3. New Zealand	1	0.7	24	3.5	25	3.0
4. Solomon Is.	1	0.7	14	2.1	15	1.8
5. Guam	0	0.0	1	0.1	1	0.1
6. Philippines	0	0.0	19	2.8	19	2.3
7. Hong Kong	0	0.0	2	0.3	2	0.2
8. Singapore	2	1.4	8	1.2	10	1.2
9. Indonesia	0	0.0	1	0.1	1	0.1
10. Japan	1	0.7	12	1.8	13	1.6
11. Others	16	11.1	60	8.8	76	9.2
12. N. A.	0	0.0	6	0.9	6	0.7
<b>Total</b>	<b>144</b>	<b>100.0</b>	<b>681</b>	<b>100.0</b>	<b>825</b>	<b>99.8</b>

### Purpose of Trip

(Unit : Persons ; %)

	RAB	(%)	POM	(%)	TOTAL	(%)
1. Tourist	8	5.7	65	9.5	73	8.9
2. Commercial/Business	54	38.6	197	28.9	251	30.6
3. Visiting Relatives	34	24.3	171	25.1	205	25.0
4. Official Matters	15	10.7	95	14.0	110	13.4
5. Others	29	20.7	126	18.5	155	18.9
6. N. A.	0	0.0	27	4.0	27	3.2
<b>Total</b>	<b>140</b>	<b>100.0</b>	<b>681</b>	<b>100.0</b>	<b>821</b>	<b>100.0</b>

Originated Areas (Airports)

(Unit : Persons ; %)

	RAB	(%)	POM	(%)	TOTAL	(%)
1. Port Moresby	44	30.6	370	54.3	414	50.2
2. Lae/Nadzab	17	11.8	78	11.5	95	11.5
3. Madang	0	0.0	11	1.6	11	1.3
4. Wewak	2	1.4	7	1.0	9	1.1
5. Goroka	0	0.0	25	3.7	25	3.0
6. Mount Hagen	1	0.7	25	3.7	26	3.2
7. Others	71	49.2	81	11.9	152	18.4
8. N. A.	9	6.3	84	12.3	93	11.3
Total	144	100.0	681	100.0	825	100.0

Access Modes

(Unit : Persons ; %)

	RAB	(%)	POM	(%)	TOTAL	(%)
1. Taxi	1	0.7	22	3.2	23	2.8
2. Private Cat	98	68.1	338	49.6	436	52.8
3. PMB	17	11.8	113	16.6	130	15.8
4. Hire Car	2	1.4	35	5.2	37	4.5
5. Others	10	6.9	102	15.0	112	13.6
6. N. A.	16	11.1	71	10.4	87	10.5
Total	144	100.0	681	100.0	825	100.0



Access Time

(Unit : Persons ; %)

Minute	RAB	(%)	POM	(%)	TOTAL	(%)
0 ~ 20	119	82.6	603	88.5	722	87.5
21 ~ 40	0	0.0	0	0.0	0	0.0
41 ~ 60	13	9.0	9	1.3	22	2.7
61 ~ 80	6	4.2	8	1.2	14	1.7
81 ~ 100	0	0.0	0	0.0	0	0.0
101 ~ 120	0	0.0	1	0.2	1	0.1
121 ~	0	0.0	6	0.9	6	0.7
N. A.	6	4.2	54	7.9	60	7.3
Total	144	100.0	681	100.0	825	100.0

Access Cost

(Unit : Persons ; %)

Kina	RAB	(%)	POM	(%)	TOTAL	(%)
0 ~ 1.0	15	10.4	0	0.0	15	1.8
1.1 ~ 2.0	4	2.8	3	0.4	7	0.85
2.0 ~ 4.0	3	2.1	4	0.6	7	0.85
4.1 ~ 6.0	0	0.0	6	0.9	6	0.7
6.1 ~ 10.0	3	2.1	5	0.7	8	1.0
10 ~	12	8.3	139	20.4	151	18.3
N. A.	107	74.3	524	77.0	631	76.5
Total	144	100.0	681	100.0	825	100.00

### Number of Baggages

(Unit : Persons ; %)

Piece	RAB	(%)	POM	(%)	TOTAL	(%)
0	5	3.5	31	4.5	36	4.4
1	44	30.6	217	31.9	261	31.6
2	49	34.0	237	34.8	286	34.7
3	17	11.8	77	11.3	94	11.4
4	8	5.6	46	6.8	54	6.5
5	10	6.9	40	5.9	50	6.1
More than 5	11	7.6	33	4.8	44	5.3
Total	144	100.0	681	100.0	825	100.0

### Weight of Baggages

(Unit : Persons ; %)

Kg.	RAB	(%)	POM	(%)	TOTAL	(%)
0 ~ 5	14	9.7	144	21.1	158	19.2
6 ~ 10	29	20.1	178	26.1	207	25.1
11 ~ 15	21	14.6	137	20.1	158	19.2
16 ~ 20	48	33.3	102	15.0	150	18.2
21 ~ 30	15	10.4	78	11.5	93	11.3
31 ~ 40	6	4.2	13	1.9	19	2.3
41 ~ 50	2	1.4	10	1.5	12	1.5
51 ~	9	6.3	19	2.8	28	3.4
Total	144	100.0	681	100.0	825	100.2

Number of Times of Boarding

(Unit : Persons ; %)

Times	RAB	(%)	POM	(%)	TOTAL	(%)
1 ~ 2	76	52.8	405	59.5	481	58.3
3 ~ 4	28	19.4	102	15.0	130	15.8
5 ~ 6	12	8.3	38	5.6	50	6.1
7 ~ 8	1	0.7	14	2.1	15	1.8
9 ~ 10	5	3.5	6	0.9	11	1.3
11 ~ 15	12	8.3	7	1.0	19	2.3
16 ~ 20	3	2.1	1	0.1	4	0.5
20 ~	3	2.1	3	0.4	6	0.7
N. A.	4	2.8	105	15.4	109	13.2
<b>Total</b>	<b>144</b>	<b>100.0</b>	<b>681</b>	<b>100.0</b>	<b>825</b>	<b>100.0</b>

Times of Failures for Reservation

(Unit : Persons ; %)

Times	RAB	(%)	POM	(%)	TOTAL	(%)
0	125	86.8	558	81.9	683	82.8
1 ~ 2	13	9.0	101	14.8	114	13.8
3 ~ 4	3	2.1	17	2.5	20	2.4
5 ~ 6	1	0.7	3	0.4	4	0.5
7 ~ 8	0	0.0	1	0.2	1	0.1
9 ~ 10	2	1.4	0	0.0	2	0.3
11 ~ 15	0	0.0	1	0.2	1	0.1
16 ~ 20	0	0.0	0	0.0	0	0.0
21 ~	0	0.0	0	0.0	0	0.0
<b>Total</b>	<b>144</b>	<b>100.0</b>	<b>681</b>	<b>100.0</b>	<b>825</b>	<b>100.0</b>

Number of Persons for Seeing Off

(Unit : Persons ; %)

Seeing Off	RAB	(%)	POM	(%)	TOTAL	(%)
0	21	14.6	232	34.1	253	30.7
1	42	29.2	175	25.7	217	26.3
2	26	18.1	117	17.2	143	17.3
3	21	14.6	50	7.3	71	8.6
4	9	6.3	45	6.6	54	6.5
5	5	3.5	20	2.9	25	3.0
6	3	2.1	14	2.1	17	2.1
7	0	0.0	8	1.2	8	1.0
8	3	2.1	1	0.1	4	0.5
9	0	0.0	0	0.0	0	0.0
10	8	5.6	6	0.9	14	1.7
10~	6	4.2	13	1.9	19	2.3
Total	144	100.0	681	100.0	825	100.0

Sex

(Unit : Persons ; %)

Sex	RAB	(%)	POM	(%)	TOTAL	(%)
1. Mail	105	72.9	482	70.8	587	71.2
2. Female	36	25.0	183	26.9	219	26.5
3. N. A.	3	2.1	16	2.3	19	2.3
Total	144	100.0	681	100.0	825	100.0

## Ages

(Unit : Persons ; %)

Ages	RAB	(%)	POM	(%)	TOTAL	(%)
~ 19	18	12.5	49	7.2	67	8.1
20 ~ 29	43	29.8	199	29.2	242	29.3
30 ~ 39	59	41.0	244	35.8	303	36.7
40 ~ 49	17	11.8	114	16.8	131	15.9
50 ~	2	1.4	48	7.0	50	6.1
N. A.	5	3.5	27	4.0	32	3.9
<b>Total</b>	<b>144</b>	<b>100.0</b>	<b>682</b>	<b>100.0</b>	<b>825</b>	<b>100.0</b>

## Occupation

(Unit : Persons ; %)

Occupation	RAB	(%)	POM	(%)	TOTAL	(%)
1. Executive Officer	2	1.4	55	8.1	57	6.9
2. Government Officer	31	21.5	118	17.3	149	18.1
3. Professional	9	6.2	79	11.6	88	10.7
4. Private Company Worker	55	38.2	139	20.4	194	23.5
5. Self-employed	2	1.4	50	7.3	52	6.3
6. Agricultural/Fisher Worker	3	2.1	4	0.6	7	0.9
7. Student	15	10.4	70	10.3	85	10.3
8. Housewife	7	4.9	41	6.0	48	5.8
9. Unemployed	5	3.5	49	7.2	54	6.5
10. Others	5	3.5	43	6.3	48	5.8
11. N. A.	10	6.9	33	4.9	43	5.2
<b>Total</b>	<b>144</b>	<b>100.0</b>	<b>681</b>	<b>100.0</b>	<b>825</b>	<b>100.0</b>

Purpose of Trip by Nationality (Port Moresby)

Nationality	(Unit: Persons ; %)						Total
	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	
1. PNG (%)	17 4.2	89 22.1	123 30.6	73 18.2	97 24.1	3 0.7	402 100.0
2. Australia (%)	21 15.9	63 47.7	25 18.9	6 4.5	8 6.1	9 6.8	132 100.0
3. New Zealand (%)	2 8.3	11 45.8	5 20.8	4 16.7	1 4.2	1 4.2	24 100.0
4. Solomon Is. (%)	0 0.0	5 35.7	3 21.4	3 21.4	3 21.4	0 0.0	14 100.0
5. Guam (%)	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0
6. Philippine (%)	0 0.0	3 15.8	6 31.6	1 5.3	4 21.1	5 26.3	19 100.0
7. Hong Kong (%)	0 0.0	1 50.0	0 0.0	1 50.0	0 0.0	0 0.0	2 100.0
8. Singapore (%)	2 25.0	1 12.5	1 12.5	0 0.0	4 50.0	0 0.0	8 100.0
9. Indonesia (%)	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	1 100.0
10. Japan (%)	1 8.3	8 66.7	1 8.3	2 16.7	0 0.0	0 0.0	12 100.0
11. Others (%)	22 36.7	14 23.3	4 6.7	5 8.3	8 13.3	7 11.7	60 100.0
12. N. A. (%)	0 0.0	1 16.7	2 33.3	0 0.0	1 16.7	2 33.3	6 100.0
Total (%)	65 9.5	197 28.9	171 25.1	95 14.0	126 18.5	27 4.0	681 100.0

Purpose of Trip by Nationality (Rabaul)

Nationality	Unit : Persons ; %						
	1	2	3	4	5	6	
	Tourist	Commercial/ Business	Visiting Relatives	Official Matters	Others	N. A.	Total
1. PNG (%)	0	35	28	14	20	3	100
	0.0	35.0	28.0	14.0	20.0	3.0	100.0
2. Australia (%)	5	11	5	0	2	0	23
	21.7	47.8	21.7	0.0	8.7	0.0	100.0
3. New Zealand (%)	0	0	1	0	0	0	1
	0.0	0.0	100.0	0.0	0.0	0.0	100.0
4. Solomon Is. (%)	0	0	0	0	1	0	1
	0.0	0.0	0.0	0.0	100.0	0.0	100.0
5. Guam (%)	0	0	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6. Philippine (%)	0	0	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7. Hong Kong (%)	0	0	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8. Singapore (%)	0	2	0	0	0	0	2
	0.0	100.0	0.0	0.0	0.0	0.0	100.0
9. Indonesia (%)	0	0	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10. Japan (%)	0	1	0	0	0	0	1
	0.0	100.0	0.0	0.0	0.0	0.0	100.0
11. Others (%)	3	5	0	1	6	1	18
	18.8	31.3	0.0	6.3	37.5	6.3	100.0
12. N. A. (%)	0	0	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (%)	4	8	54	34	15	29	144
	2.8	5.8	37.5	23.6	10.4	20.1	100.0

Purpose of Trip by Sex (Port Moresby)

Sex	(Unit : Persons ; %)						Total
	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	
1. Male (%)	40 8.3	170 35.3	107 22.2	77 16.0	70 14.5	18 3.7	482 100.0
2. Female (%)	23 12.6	22 12.0	59 32.2	17 9.3	54 29.5	8 4.4	183 100.0
3. N. A. (%)	2 12.5	5 31.3	5 31.3	1 6.3	2 12.5	1 6.3	16 100.0
Total (%)	65 9.5	197 28.9	171 25.1	95 14.0	126 18.5	27 4.0	681 100.0



Purpose of Trip by Sex (Rabaul)

(Unit : Persons : %)

Sex	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	Total
1. Male (%)	5 4.8	47 44.8	20 19.0	14 13.3	17 16.2	2 1.9	105 100.0
2. Female (%)	3 8.3	7 19.4	14 38.9	1 2.8	9 25.0	2 5.6	36 100.0
3. N. A. (%)	0 0.0	0 0.0	0 0.0	0 0.0	3 100.0	0 0.0	3 100.0
Total (%)	8 5.6	54 37.5	34 23.6	15 10.4	29 20.1	4 2.8	144 100.0

Purpose of Trip by Age (Port Moresby)

Age	Unit : Persons ; %)						Total
	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	
~ 19 (%)	9 18.8	0 0.0	21 43.8	1 2.1	16 33.3	1 2.1	48 100.0
20 ~ 29 (%)	5 2.5	32 16.1	75 37.7	23 11.6	54 27.1	10 5.0	199 100.0
30 ~ 39 (%)	28 11.5	91 37.3	45 18.4	45 18.4	31 12.7	4 1.6	244 100.0
40 ~ (%)	14 12.3	53 46.5	20 17.5	18 15.8	6 5.3	3 2.6	114 100.0
50 ~ (%)	6 12.5	11 22.9	7 14.6	6 12.5	13 27.1	5 10.4	48 100.0
N. A. (%)	3 10.7	10 35.7	3 10.7	2 7.1	6 21.4	4 14.3	28 100.0
Total (%)	65 9.5	197 28.9	171 25.1	95 14.0	126 18.5	27 4.0	681 100.0

Purpose of Trip by Age (Rabaul)

Age	Unit : Persons ; %)						
	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	Total
~ 19 (%)	0 0.0	1 5.6	12 66.7	0 0.0	5 27.8	0 0.0	18 100.0
20 ~ 29 (%)	1 2.3	15 34.9	8 18.6	4 9.3	15 34.9	0 0.0	43 100.0
30 ~ 39 (%)	4 6.8	26 44.1	10 16.9	9 15.3	6 10.2	4 6.8	59 100.0
40 ~ (%)	1 5.9	8 47.1	3 17.6	2 11.8	3 17.6	0 0.0	17 100.0
50 ~ (%)	0 0.0	2 100.0	0 0.0	0 0.0	0 0.0	0 0.0	2 100.0
N. A. (%)	2 40.0	2 40.0	1 20.0	0 0.0	0 0.0	0 0.0	5 100.0
Total (%)	8 5.6	54 37.5	34 23.6	15 10.4	29 20.1	4 2.8	144 100.0

Purpose of Trip by Originated Area (Port Moresby)

Originated Area	(Unit : Persons ; %)						
	1	2	3	4	5	6	
	Tourist	Commercial/ Business	Visiting Relatives	Official Matters	Others	N. A.	
Total						Total	
1. Port Moresby (%)	20 5.4	127 34.3	100 27.0	75 20.3	43 11.6	5 1.4	370 100.0
2. Lae/Nadzab (%)	9 11.5	18 23.1	15 19.2	2 2.6	31 39.7	3 3.8	78 100.0
3. Madang (%)	1 9.1	1 9.1	1 9.1	3 27.3	5 45.5	0 0.0	11 100.0
4. Wewak (%)	0 0.0	2 28.6	3 42.9	2 28.6	0 0.0	0 0.0	7 100.0
5. Goroka (%)	0 0.0	5 20.0	10 40.0	1 4.0	9 36.0	0 0.0	7 100.0
6. Mount Hagen (%)	5 20.0	4 16.0	3 12.0	1 4.0	12 48.0	0 0.0	25 100.0
7. Others (%)	7 8.6	19 23.5	23 28.4	8 9.9	21 25.9	3 3.7	81 100.0
8. N. A. (%)	23 27.4	21 25.0	16 19.0	3 3.6	5 6.0	16 19.0	84 100.0
Total (%)	65 9.5	197 28.9	171 25.1	95 14.0	126 18.5	27 4.0	681 100.0

Purpose of Trip by Originated Area (Rabaul)

(Unit: Persons ; %)

Originated Area	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	Total
1. Port Moresby (%)	2 4.5	9 20.5	6 13.6	9 20.5	18 40.9	0 0.0	44 100.0
2. Lae/Nadzab (%)	2 11.8	9 52.9	3 17.6	1 5.9	0 0.0	2 11.8	17 100.0
3. Madang (%)	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
4. Wewak (%)	0 0.0	0 0.0	2 100.0	0 0.0	0 0.0	0 0.0	2 100.0
5. Goroka (%)	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
6. Mount Hagen (%)	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	1 100.0
7. Others (%)	4 5.6	31 43.7	20 28.2	5 7.0	10 14.1	1 1.4	71 100.0
8. N. A. (%)	0 0.0	5 55.6	2 22.2	0 0.0	1 11.1	1 11.1	9 100.0
Total (%)	8 5.6	54 37.5	34 23.6	15 10.4	29 20.1	4 2.8	144 100.0

Purpose of Trip by Occupation (Port Moresby)

(Unit : Persons ; %)

Occupation	(Unit : Persons ; %)						Total
	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	
1. Executive Officer (%)	2 3.6	28 50.9	5 9.1	14 25.5	3 5.5	3 5.5	55 100.0
2. Government Officer (%)	6 5.1	35 29.7	14 11.9	48 40.7	14 11.9	1 0.8	118 100.0
3. Professional (%)	10 12.7	54 68.4	3 3.8	6 7.6	6 7.6	0 0.0	79 100.0
4. Private Company Worker (%)	17 12.2	43 30.9	40 28.8	14 10.1	21 15.1	4 2.9	139 100.0
5. Self-employed (%)	8 16.0	16 32.0	17 34.0	2 4.0	6 12.0	1 2.0	50 100.0
6. Agri./Fis. Worker (%)	0 0.0	0 0.0	2 50.0	0 0.0	2 50.0	0 0.0	4 100.0
7. Student (%)	9 12.9	1 1.4	35 50.0	1 1.4	23 32.9	1 1.4	70 100.0
8. Housewife (%)	9 22.0	1 2.4	17 41.5	1 2.4	1 2.4	12 29.3	49 100.0
9. Unemployed (%)	1 2.0	1 2.0	23 46.9	0 0.0	23 46.9	1 2.0	49 100.0
10. Others (%)	2 4.7	5 11.6	9 20.9	1 2.3	13 30.2	13 30.2	43 100.0
11. N. A. (%)	1 3.1	13 39.4	6 18.2	8 24.2	3 9.1	2 6.1	33 100.0
Total (%)	65 9.5	197 28.9	171 25.1	95 14.0	126 18.5	27 4.0	681 100.0

Purpose of Trip by Occupation (Rabaul)

(Unit : Persons : %)

Occupation	1 Tourist	2 Commercial/ Business	3 Visiting Relatives	4 Official Matters	5 Others	6 N. A.	Total
1. Executive Officer (%)	0	2	0	0	0	0	2
	0.0	100.0	0.0	0.0	0.0	0.0	100.0
2. Government Officer (%)	0	7	3	14	8	1	31
	0.0	22.6	9.7	45.2	19.4	3.2	100.0
3. Professional (%)	7	0	1	1	0	0	9
	77.8	0.0	11.1	11.1	0.0	0.0	100.0
4. Private Company Worker (%)	1	41	7	0	4	2	55
	1.8	74.5	12.7	0.0	7.3	3.8	100.0
5. Self-employed (%)	0	0	1	0	1	0	2
	0.0	0.0	50.0	0.0	50.0	0.0	100.0
6. Agri./Fis. Worker (%)	0	3	0	0	0	0	3
	0.0	100.0	0.0	0.0	0.0	0.0	100.0
7. Student (%)	0	1	13	0	1	0	15
	0.0	6.7	86.7	0.0	6.7	0.0	100.0
8. Housewife (%)	0	0	4	0	3	0	7
	0.0	0.0	57.1	0.0	42.9	0.0	100.0
9. Unemployed (%)	0	0	4	0	1	0	5
	0.0	0.0	80.0	0.0	20.0	0.0	100.0
10. Others (%)	0	0	0	0	5	0	5
	0.0	0.0	0.0	0.0	100.0	0.0	100.0
11. N. A. (%)	0	0	1	0	8	1	10
	0.0	0.0	10.0	0.0	80.0	10.0	100.0
Total (%)	8	54	34	15	29	4	144
	5.6	37.5	23.6	10.4	20.1	2.8	100.0

Attachment 8-1 Air Passengers in PNG (1)

(Unit: Persons)

Airports	1983	1984	1985	1986	1987	1988	1989	Component Ratio (%)	Annual Growth Rate (%)
International									
Chartered	83,907	106,472	86,378	99,211	105,900	117,783	132,230	7.2	7.9
Scheduled	4,316	3,041	85	-	765	627	517	0.0	-29.8
Sub total	88,223	109,513	86,463	99,211	106,665	118,410	132,747	7.2	7.0
Domestic									
Port Moresby	438,073	484,561	584,245	593,286	551,916	511,100	557,431	30.4	4.1
Nadzab (Lae)	195,823	191,474	187,244	189,504	196,634	221,704	231,926	12.6	2.9
Rabaul	116,330	112,759	109,298	101,705	111,182	132,823	146,255	8.0	3.9
Mt. Hagen	73,982	79,839	86,165	71,988	79,947	115,873	124,238	6.8	9.0
Goroka	65,354	65,039	64,726	60,470	66,742	78,509	82,124	4.5	3.9
Madang	78,680	74,337	70,253	64,177	65,073	81,560	81,638	4.5	0.8
Kieia	65,360	66,668	80,462	63,232	68,990	75,121	76,158	4.2	2.6
Wewak	60,288	66,981	74,541	51,186	52,037	67,194	69,438	3.8	2.4
Popondetta	33,938	35,201	36,515	32,571	33,962	38,802	41,049	2.2	3.2
Hoskins	30,915	33,578	36,524	27,494	29,546	35,206	40,764	2.2	4.7

Note: Component ratios were calculated for the year of 1989.



Air Passengers in PNG (2)

(Unit: Persons)

Airports	1983	1984	1985	1986	1987	1988	1989	Component Ratio (%)	Annual Growth Rate (%)
Gurney	25,481	24,998	24,526	26,153	27,522	32,482	37,239	2.0	6.5
Tabubil	24,954	27,993	31,711	15,454	12,620	27,594	35,575	1.9	6.1
Daru	15,462	15,772	16,088	15,990	12,835	20,301	23,213	1.3	7.0
Kavieng	10,099	19,916	21,465	18,265	17,876	20,378	22,967	1.3	14.7
Tari	6,897	6,002	5,269	7,557	7,018	23,047	21,851	1.2	21.2
Vanino	11,998	15,767	20,730	13,326	15,240	19,250	21,300	1.2	10.0
Chimbu (Kundiawa)	13,626	13,780	13,943	13,716	14,217	20,673	19,845	1.1	8.5
Manus	14,690	14,100	13,546	14,722	14,974	15,575	19,130	1.0	4.5
Kiunga	24,684	19,187	14,955	10,162	8,116	16,348	18,242	1.0	-4.9
Mendi	12,380	10,752	9,344	7,083	7,208	17,005	17,476	1.0	5.9
Misima	1,691	2,133	2,572	2,136	2,400	6,153	7,358	0.4	27.8
Lousia	4,542	4,679	4,820	6,048	3,009	5,375	5,694	0.3	3.8
Buka	10,415	9,756	9,157	10,950	10,909	0	0	0.0	-
Sub total	1,335,662	1,395,272	1,518,099	1,417,175	1,409,973	1,582,073	1,700,911	92.8	4.1
Total	1,423,885	1,504,785	1,604,562	1,516,386	1,516,638	1,700,483	1,833,658	100.0	4.3

Attachment 8-2 Outline of Methodology for Estimation of Potential Demand

It is assumed that the number of potential passengers (or the number of passengers when the number of seats are limitless) is "normal distribution N (P,  $\sigma^2$ )" of which mean value is P, and variance is  $\sigma^2$ .

When the number of supplied seats are S, the number of carried passengers, P' are

$$\text{when } P \leq S, P' = P$$

$$\text{when } P > S, P' = S.$$

Assuming the mean values are P and P', P' becomes the following formula ①.

$$P' = \frac{1}{\sqrt{2\pi\sigma}} \int_{-\infty}^S P \cdot e^{-\frac{1}{2}\left(\frac{P-\bar{P}}{\sigma}\right)^2} dp + S \cdot \frac{1}{\sqrt{2\pi\sigma}} \int_S^{\infty} e^{-\frac{1}{2}\left(\frac{P-\bar{P}}{\sigma}\right)^2} dp \dots\dots ①$$

When both sides of above formula are divided by S,

$$\frac{P'}{S} = \frac{1}{S} \cdot \frac{1}{\sqrt{2\pi\sigma}} \int_{-\infty}^S P \cdot e^{-\frac{1}{2}\left(\frac{P-\bar{P}}{\sigma}\right)^2} dp + \frac{1}{\sqrt{2\pi\sigma}} \int_S^{\infty} e^{-\frac{1}{2}\left(\frac{P-\bar{P}}{\sigma}\right)^2} dp \dots\dots ②$$

where P/S stands for load factor.

In the first term of right side of

$$\frac{1}{\sqrt{2\pi\sigma}} \int_{-\infty}^S P \cdot e^{-\frac{1}{2}\left(\frac{P-\bar{P}}{\sigma}\right)^2} dp$$

$$\frac{P-\bar{P}}{\sigma} = t \text{ is set,}$$

$$\begin{aligned} &= \frac{1}{\sqrt{2\pi\sigma}} \int_{-\infty}^{\frac{S-\bar{P}}{\sigma}} (\sigma t + \bar{P}) e^{-\frac{1}{2}t^2} \sigma dt \\ &= \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\frac{S-\bar{P}}{\sigma}} t e^{-\frac{1}{2}t^2} dt + \frac{\bar{P}}{\sqrt{2\pi}} \int_{-\infty}^{\frac{S-\bar{P}}{\sigma}} e^{-\frac{1}{2}t^2} dt \dots\dots\dots ③ \end{aligned}$$

If  $\frac{t^2}{2} = \theta$  is set, the first term of formula ③ is

$$\begin{aligned} & \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{\frac{S-\bar{P}}{\sigma}} t \cdot e^{-\frac{1}{2}t^2} dt = \frac{\sigma}{\sqrt{2\pi}} \int_{-\infty}^{(\frac{S-\bar{P}}{\sigma})^2/2} e^{-\theta} d\theta \\ & = \frac{\sigma}{\sqrt{2\pi}} [-e^{-\theta}]_{-\infty}^{(\frac{S-\bar{P}}{\sigma})^2/2} \\ & = \frac{-\sigma}{\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{S-\bar{P}}{\sigma})^2} \dots\dots\dots ④ \end{aligned}$$

If  $\frac{P-\bar{P}}{\sigma} = t$  is assumed,

and the second term of formula ② is

$$\begin{aligned} & \frac{1}{\sqrt{2\pi}\sigma} \int_S^{\infty} e^{-\frac{1}{2}(\frac{P-\bar{P}}{\sigma})^2} dP \\ & = \frac{1}{\sqrt{2\pi}} \int_{\frac{S-\bar{P}}{\sigma}}^{\infty} e^{-\frac{t^2}{2}} dt \\ & = 1 - \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\frac{S-\bar{P}}{\sigma}} e^{-\frac{t^2}{2}} dt \dots\dots\dots ⑤ \end{aligned}$$

Summing up formula ② by formula ③, ④, and ⑤,

$$\frac{P'}{S} = \frac{-\sigma}{S} \cdot \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{S-\bar{P}}{\sigma})^2} + 1 - \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\frac{S-\bar{P}}{\sigma}} e^{-\frac{t^2}{2}} dt \left(1 - \frac{\bar{P}}{S}\right) \dots\dots\dots ⑥$$

As  $\frac{S-\bar{P}}{\sigma} = \frac{\frac{1}{P/S} - 1}{\sigma/P}$ , the relation between P'/S and P/S is acquired by giving values parametrically to coefficient of variation,  $\sigma/P$ . That is to say, values of P'/S from formula ⑥ is acquired by giving some values orderly to P/S.

P'/S means load factor, and P/S means a ratio of an average of the number of actually carried passengers to the number of supplied seats. In case when this ratio is

more than one, it is meant that passenger traffic demand is more than the number of supplied seats.

But it must be noticed that the Study Team assumes that the distribution of potential traffic demand is logarithmic normal distribution, because the figure of potential demand could not be actually negative.

The principle way of thinking for methodology to estimate the potential traffic demand is cited from "Economics of Aviation" by Prof. Ota of Waseda University in Japan.

Attachment 8-3 OD Table of Air Passengers Between Key Airports (Air Niugini : 1989)

Origins	Destination																								(Unit: Persons)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15										
	PORT. M.	LAE	RAB.	MT. H.	GORO.	MADA.	KIE.	WEW.	POP.	HOS.	GUR.	TAB.	DAR.	KAV.	TARI										
1 PORT MORESBY	57,185	22,439	7,493	28,944	21,826	12,461	18,145	10,283	12,153	5,401	8,886	1,156	2,320	2,773	3,377										
2 NADZAB (LAE)	56,018									2,047				186											
3 RABAUL	24,395	7,185				684	9,430	89		4,072				5,273											
4 MT. HAGEN	27,166	2,233			387	1,105		1,255							35										
5 GOROKA	21,571	1,255		294		1,328		47																	
6 MADANG	12,959	3,178	382	211	1,651		5	4,245						427											
7 KIETA	21,980	1,028	10,714			72		244		635				330											
8 WEWAK	9,766	3,838	242	1,762	58	4,282								246											
9 POPONDETTA	12,005														172										
10 HOSKINS	4,900	1,923	4,769				592																		
11 GURNEY	7,857				387																				
12 TABUBIL	932			129		1							140												
13 DARU	2,369											183													
14 KAVIENG	2,319	695	5,416		7	556	96	263		279															
15 TARI	2,850			32																					
16 VANUWO	1,466			297				1,537																	
17 CHIMBU (KUNDIAWA)	4,799			0	14																				
18 MANUS	3,278	1,145	2,649			1,302	75	502						616											
19 KIUNGA	33			1																					
20 MENDI	3,731			18											1,203										
21 MISIWA	1,059																								
22 LOUSUIA																									
23 BUKA																									
24 WAPENAMANDA	2,426			85																					
Total	223,978	79,665	54,104	34,203	25,642	24,793	29,484	22,131	12,153	12,436	8,886	1,339	2,460	10,023	4,615										

OD Table of Air Passengers Between Key Airports (Air Niugini : 1989)

(Unit: Persons)

Origins	Destination	16 VAN.	17 CHI.	18 MAN.	19 KIU.	20 MEN.	21 MIS.	22 LOU.	23 BUK.	24 WAPE.	Total
1	PORT MORESBY	1,655	4,344	3,629	102	3,495	743			2,551	223,868
2	NADZAB (LAE)			1,152							789,459
3	RABAUL			1,912							53,040
4	MT. HAGEN	406							45		32,632
5	GOROKA								39		24,524
6	MADANG			1,123							24,181
7	KIETA			377							35,380
8	WEWAK	1,455		456	25						22,130
9	POPONDETTA										12,005
10	HOSKINS										12,356
11	GURNEY						586				8,830
12	TABUBIL										1,202
13	DARU										2,560
14	KAVIENG			582	8						10,213
15	TARI					1,512					4,394
16	VANIWO										3,300
17	CHIMBU (KUNDIAWA)										4,813
18	MANUS										9,567
19	KIUNGA										34
20	MENDI										4,952
21	MISIWA										1,059
22	LOUSUIA										0
23	BUKA										0
24	WAPENAMANDA					44					2,555
Total		3,516	4,344	9,231	135	5,051	1,329	0	0	2,635	572,054

Source: Policy, Planning & Programmes Branch of DCA in PNG

OD Table of Air Passengers Between Key Airports (Tairair : 1989)

Origins	Destination															(Unit: Persons)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	PORT. M.	LAE	RAB.	MT. H.	GORO.	MADA.	KIE.	WEW.	POP.	HOS.	GUR.	TAB.	DAR.	KAV.	TARI	
1 PORT MORESBY	5,407	6,212	983	1,757	3,335	493	110	266	1,811	833	3,064	2,268	4,436	17	1,043	
2 NADZAB (LAE)		1,711	1,540	4,068	3,259	1,390	37	1,225	1,696	2,009	349	120		4	11	
3 RABAUL	1,391					5	64		2	1,610				736		
4 MT. HAGEN	3,154	4,043	6		2,754	2,321		2,259	15		2,265				1,080	
5 GOROKA	4,594	3,418		2,797		1,765		698	11		5					
6 MADANG	311	1,257	79	2,688	1,567			562		8	229			15	67	
7 KIETA	82	61	12		15			24								
8 WEWAK	238	1,129		2,156	832	476					413					
9 POPONDETTA	2,050	2,254									348					
10 HOSKINS	879	1,741	1,630						62		7					
11 GURNEY	3,651	399							345	5						
12 TABUBIL	2,237	99	3	2,147	17	182		422				20			661	
13 DARU	4,117														15	
14 KAVIENG			718			5					12					
15 TARI	913			1,358	5	24		17				726	16			
16 VANIWO				192	24	7		1,391				42				
17 CHIMBU (KUNDIAWA)	944			1	819	408				6						
18 MANUS	23		4			15										
19 KIUNGA	2,784	58		720		47		84			1,394	1,329			36	
20 MENDI	1,213	1	9	439	21	3					14	3			80	
21 MISIWA	1,473										1,067					
22 LOUSUIA	2,031										658					
23 BUKA	26		1,500													
24 WAPENAMANDA	165			221				16			507				23	
25 NISSANI																
Total	37,683	22,383	6,484	18,544	12,648	7,141	211	6,964	3,942	4,471	5,505	8,003	5,784	772	3,016	

OD Table of Air Passengers Between Key Airports (Tal air : 1989)

(Unit: Persons)

Origins	Destination	16 VAN.	17 CHI.	18 MAN.	19 KIU.	20 MEN.	21 MIS.	22 LOU.	23 BUKA	24 WAP.	25 NIS.	Total
1	PORT MORESBY	1,514	70	2,715	1,509	1,457	2,123	3	215			36,234
2	NADZAB (LAE)		13	49	24							21,201
3	RABAU		13					1,222			9	6,799
4	MT. HAGEN	90	3	620	344				144			19,098
5	GOROKA	32	372	6								13,698
6	MADANG		460	120	46							7,409
7	KIETA		4			15	4		4			221
8	WEWAK	1,346	9	116			4		65			6,780
9	POPONDETTA		5									4,661
10	HOSKINS											4,319
11	GURNEY					800	797					5,997
12	TABUBIL	100		1,836	28				505			8,237
13	DARU			1,311								5,463
14	KAVIENG			3								738
15	TARI			2	96				3			3,160
16	VANIWO			15					2			1,673
17	CHIWMBU (KUNDIAWA)											2,172
18	MANUS											48
19	KIUNGA	4			4				4			6,464
20	MENDI			4	3				14			1,804
21	MISIWA						4					2,544
22	LOUSUIA											2,689
23	BUKA											1,526
24	WAPENAMANDA											932
25	NISSAN I.											0
Total		1,572	2,367	223	6,719	2,005	2,272	2,932	1,225	956	9	163,867

Source : Policy, Planning & Programmes Branch of DCA in PNG



Attachment 8-4. OD Matrix of Air Passengers for Key Airports (1989)

Origin	Destination	1	2	3	4	5	6	7
1.	PORT.M	0	64,973	26,113	31,222	24,397	14,532	20,780
2.	LAE	64,281	0	13,036	8,592	5,765	6,374	1,735
3.	RABAU	28,134	12,326	0	0	0	1,039	14,524
4.	MT. HAGEN	31,675	8,338	9	0	3,956	4,959	0
5.	GOROKA	25,623	5,831	0	3,817	0	3,221	0
6.	MADANG	15,192	6,440	724	4,172	4,436	0	8
7.	KIETA	20,840	1,312	14,039	0	17	95	0
8.	WEWAK	9,259	5,861	310	4,583	995	6,122	0
9.	POPON.	16,520	3,360	0	0	0	0	0
10.	HOSKINS	5,779	4,661	8,821	0	0	0	832
11.	GURNEY	14,456	635	0	0	0	0	0
12.	TABUBIL	5,501	216	7	4,898	35	427	0
13.	DARU	8,978	0	0	0	0	0	0
14.	KAVIENG	1,907	731	7,019	0	7	646	112
15.	TARI	4,447	0	0	2,060	7	39	0
16.	VANIMO	2,874	0	0	1,185	56	18	0
17.	CHIMBU	7,803	0	0	2	1,360	758	0
18.	MANUS	2,709	1,202	3,034	0	0	1,518	88
19.	KIUNGA	2,843	74	0	916	0	65	0
20.	MENDI	5,790	1	14	673	30	5	0
21.	MISIMA	2,215	0	0	0	0	0	0
22.	LOUSUIA	1,892	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	278,718	115,961	73,127	62,120	41,061	40,819	38,078

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	9,519	17,063	6,282	14,984	5,879	9,006	2,398
2.	LAE	5,745	2,677	5,306	575	263	0	213
3.	RABAU	109	3	7,728	0	0	0	7,025
4.	MT. HAGEN	4,117	24	0	0	4,936	0	0
5.	GOROKA	821	16	0	0	10	0	0
6.	MADANG	6,158	0	11	0	538	0	542
7.	KIETA	285	0	752	0	0	0	334
8.	WEWAK	0	0	0	0	802	0	244
9.	POPON.	0	0	0	629	0	0	0
10.	HOSKINS	0	93	0	11	0	0	184
11.	GURNEY	0	647	8	0	0	0	0
12.	TABUBIL	810	0	0	0	0	381	0
13.	DARU	0	0	0	0	564	0	0
14.	KAVIENG	244	0	289	15	0	0	0
15.	TARI	22	0	0	0	1,731	31	0
16.	VANIMO	6,330	0	0	0	153	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	465	0	6	0	0	0	542
19.	KIUNGA	95	0	0	0	2,887	2,183	0
20.	MENDI	0	0	0	0	34	6	0
21.	MISIMA	0	0	0	1,460	0	0	0
22.	LOUSUIA	0	0	0	955	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	34,719	20,524	20,382	18,619	17,787	11,606	11,484

OD Matrix of Air Passengers for Key Airports (1989)

Destination		15	16	17	18	19	20	21
Origin								
1.	PORT.M	5,239	3,103	8,334	3,160	2,556	5,553	1,843
2.	LAE	17	0	0	1,299	58	34	0
3.	RABAUL	0	0	0	2,240	0	0	0
4.	MT. HAGEN	1,700	1,178	5	0	729	493	0
5.	GOROKA	0	73	642	0	7	0	0
6.	MADANG	111	0	910	1,519	59	0	0
7.	KIETA	0	0	7	379	0	0	15
8.	WEWAK	0	5,932	15	450	147	0	0
9.	POPON.	0	0	10	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	1,821
12.	TABUBIL	1,600	356	0	0	3,492	65	0
13.	DARU	30	0	0	0	2,035	0	0
14.	KAVIENG	0	0	0	512	0	0	0
15.	TARI	0	0	0	0	3	2,586	0
16.	VANIMO	0	0	0	0	32	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	53	9	0	0	0	6	0
20.	MENDI	2,176	0	0	5	4	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	10,925	10,650	9,922	9,565	9,121	8,738	3,679

Destination		22	23	24
Origin				
1.	PORT.M	1,783	0	278,718
2.	LAE	0	0	115,961
3.	RABAUL	0	0	73,127
4.	MT. HAGEN	0	0	62,118
5.	GOROKA	0	0	41,061
6.	MADANG	0	0	40,819
7.	KIETA	4	0	38,078
8.	WEWAK	0	0	34,719
9.	POPON.	5	0	20,524
10.	HOSKINS	0	0	20,382
11.	GURNEY	1,051	0	18,619
12.	TABUBIL	0	0	17,787
13.	DARU	0	0	11,606
14.	KAVIENG	0	0	11,484
15.	TARI	0	0	10,926
16.	VANIMO	0	0	10,650
17.	CHIMBU	0	0	9,922
18.	MANUS	0	0	9,565
19.	KIUNGA	0	0	9,121
20.	MENDI	0	0	8,738
21.	MISIMA	4	0	3,679
22.	LOUSUIA	0	0	2,847
23.	BUKA	0	0	0
24.	TOTAL	2,847	0	850,451

Attachment 8-5 OD Matrix of Air Passengers for Key Airports (1995)

(Without)		Destination						
Origin		1	2	3	4	5	6	7
1.	PORT.M	0	77,524	31,115	44,340	30,044	15,052	23,480
2.	LAE	76,784	0	17,406	13,648	7,953	7,411	2,198
3.	RABAU	33,688	16,520	0	0	0	1,212	18,454
4.	MT. HAGEN	45,198	13,292	14	0	6,494	6,917	0
5.	GOROKA	31,783	8,093	0	6,281	0	5,101	0
6.	MADANG	15,832	7,524	845	5,826	5,354	0	9
7.	KIETA	23,585	1,663	17,778	0	22	104	0
8.	WEWAK	8,998	6,390	338	5,985	1,121	5,769	0
9.	POPON.	19,681	4,481	0	0	0	0	0
10.	HOSKINS	6,527	5,897	11,146	0	0	0	997
11.	GURNEY	19,145	940	0	0	0	0	0
12.	TABUBIL	5,414	238	8	6,462	40	408	0
13.	DARU	12,195	0	0	0	0	0	0
14.	KAVIENG	2,517	1,079	10,333	0	11	833	157
15.	TARI	8,077	0	0	4,846	15	70	0
16.	VANIMO	4,072	0	0	2,213	92	25	0
17.	CHIMBU	11,176	0	0	3	2,241	1,061	0
18.	MANUS	3,777	1,873	4,716	0	0	2,068	130
19.	KIUNGA	3,114	91	0	1,340	0	70	0
20.	MENDI	6,855	2	19	1,055	40	6	0
21.	MISIMA	3,773	0	0	0	0	0	0
22.	LOUSUIA	2,094	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	344,289	145,606	93,965	91,997	53,428	46,106	45,424

		Destination						
Origin		8	9	10	11	12	13	14
1.	PORT.M	9,242	20,392	7,093	20,013	5,779	12,254	3,167
2.	LAE	6,265	3,585	6,718	844	291	0	315
3.	RABAU	119	4	9,809	0	0	0	10,397
4.	MT. HAGEN	5,397	38	0	0	6,538	0	0
5.	GOROKA	931	23	0	0	12	0	0
6.	MADANG	5,834	0	13	0	517	0	704
7.	KIETA	294	0	903	0	0	0	469
8.	WEWAK	0	0	0	0	718	0	296
9.	POPON.	0	0	0	938	0	0	0
10.	HOSKINS	0	118	0	15	0	0	258
11.	GURNEY	0	961	11	0	0	0	0
12.	TABUBIL	725	0	0	0	0	480	0
13.	DARU	0	0	0	0	709	0	0
14.	KAVIENG	295	0	404	25	0	0	0
15.	TARI	38	0	0	0	2,935	69	0
16.	VANIMO	8,225	0	0	0	202	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	595	0	9	0	0	0	927
19.	KIUNGA	95	0	0	0	2,908	3,057	0
20.	MENDI	0	0	0	0	37	9	0
21.	MISIMA	0	0	0	3,060	0	0	0
22.	LOUSUIA	0	0	0	1,327	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	38,055	25,122	249,549	26,224	20,645	15,870	16,533

OD Matrix of Air Passengers for Key Airports (1995)

(Without)		15	16	17	18	19	20	21
Destination								
Origin								
1.	PORT.M	9,576	4,383	12,055	4,425	2,852	6,452	3,088
2.	LAE	34	0	0	2,035	72	45	0
3.	RABAU	0	0	0	3,513	0	0	0
4.	MT. HAGEN	4,041	2,203	10	0	1,091	763	0
5.	GOROKA	0	119	1,076	0	9	0	0
6.	MADANG	201	0	1,293	2,091	64	0	0
7.	KIETA	0	0	10	565	0	0	26
8.	WEWAK	0	7,691	19	580	149	0	0
9.	POPON.	0	0	16	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	3,726
12.	TABUBIL	2,733	466	0	0	3,601	70	0
13.	DARU	68	0	0	0	2,897	0	0
14.	KAVIENG	0	0	0	880	0	0	0
15.	TARI	0	0	0	0	5	5,048	0
16.	VANIMO	0	0	0	0	48	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	99	13	0	0	0	7	0
20.	MENDI	4,350	0	0	8	5	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	21,102	14,877	14,481	14,097	10,794	12,385	6,840

Destination		22	23	24
Origin				
1.	PORT.M	1,962	0	344,289
2.	LAE	0	0	145,606
3.	RABAU	0	250	93,965
4.	MT. HAGEN	0	0	91,997
5.	GOROKA	0	0	53,427
6.	MADANG	0	0	46,106
7.	KIETA	5	0	45,424
8.	WEWAK	0	0	38,055
9.	POPON.	6	0	25,122
10.	HOSKINS	0	0	24,959
11.	GURNEY	1,441	0	26,224
12.	TABUBIL	0	0	20,645
13.	DARU	0	0	15,870
14.	KAVIENG	0	0	16,533
15.	TARI	0	0	21,102
16.	VANIMO	0	0	14,877
17.	CHIMBU	0	0	14,482
18.	MANUS	0	0	14,097
19.	KIUNGA	0	0	10,794
20.	MENDI	0	0	12,385
21.	MISIMA	6	0	6,839
22.	LOUSUIA	0	0	3,420
23.	BUKA	0	0	250
24.	TOTAL	3,420	250	1,086,470

OD Matrix of Air Passengers for Key Airports (2000)

(Without)		1	2	3	4	5	6	7
Origin	Destination							
1.	PORT.M	0	98,605	39,720	52,390	38,976	17,324	28,772
2.	LAE	97,752	0	23,848	20,553	11,069	9,181	2,894
3.	RABAU	43,144	22,684	0	0	0	1,512	24,455
4.	MT. HAGEN	63,797	20,061	21	0	9,962	9,571	0
5.	GOROKA	41,441	11,309	0	9,652	0	6,484	0
6.	MADANG	18,302	9,353	1,056	8,069	6,799	0	11
7.	KIETA	28,934	2,190	23,511	0	30	124	0
8.	WEWAK	9,873	7,551	401	7,908	1,355	6,116	0
9.	POPON.	25,023	6,111	0	0	0	0	0
10.	HOSKINS	8,014	7,771	14,744	0	0	0	1,266
11.	GURNEY	25,945	1,364	0	0	0	0	0
12.	TABUBIL	6,148	291	9	8,791	50	449	0
13.	DARU	17,137	0	0	0	0	0	0
14.	KAVIENG	3,389	1,555	14,928	0	16	1,099	219
15.	TARI	12,540	0	0	8,610	25	107	0
16.	VANIMO	5,773	0	0	3,662	142	35	0
17.	CHIMBU	15,843	0	0	5	3,453	1,473	0
18.	MANUS	5,257	2,789	7,033	0	0	2,822	187
19.	KIUNGA	3,355	106	0	1,737	0	73	0
20.	MENDI	8,676	3	26	1,570	56	7	0
21.	MISIMA	5,692	0	0	0	0	0	0
22.	LOUSUIA	2,529	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	448,565	191,743	125,544	132,948	71,933	56,375	57,805

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	10,126	25,982	8,706	27,249	6,530	17,253	4,265
2.	LAE	7,399	4,904	8,859	1,232	354	0	454
3.	RABAU	142	6	13,014	0	0	0	15,068
4.	MT. HAGEN	7,145	57	0	0	8,881	0	0
5.	GOROKA	1,129	32	0	0	15	0	0
6.	MADANG	6,203	0	15	0	568	0	932
7.	KIETA	333	0	1,147	0	0	0	655
8.	WEWAK	0	0	0	0	747	0	374
9.	POPON.	0	0	0	1,369	0	0	0
10.	HOSKINS	0	156	0	22	0	0	360
11.	GURNEY	0	1,399	15	0	0	0	0
12.	TABUBIL	758	0	0	0	0	652	0
13.	DARU	0	0	0	0	957	0	0
14.	KAVIENG	372	0	563	39	0	0	0
15.	TARI	56	0	0	0	4,414	125	0
16.	VANIMO	10,909	0	0	0	275	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	777	0	13	0	0	0	1,444
19.	KIUNGA	93	0	0	0	2,974	3,948	0
20.	MENDI	0	0	0	0	45	13	0
21.	MISIMA	0	0	0	5,176	0	0	0
22.	LOUSUIA	0	0	0	1,845	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	45,441	32,536	32,333	36,932	25,761	21,991	23,553

OD Matrix of Air Passengers for Key Airports (2000)

(Without)		15	16	17	18	19	20	21
Destination								
Origin								
1.	PORT.M	14,920	6,194	17,199	6,176	3,109	8,090	4,617
2.	LAE	57	0	0	3,041	85	61	0
3.	RABAU	0	0	0	5,270	0	0	0
4.	MT. HAGEN	7,226	3,646	17	0	1,435	1,130	0
5.	GOROKA	0	184	1,677	0	10	0	0
6.	MADANG	311	0	1,815	2,873	68	0	0
7.	KIETA	0	0	15	817	0	0	41
8.	WEWAK	0	10,181	26	760	150	0	0
9.	POPON.	0	0	25	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	6,220
12.	TABUBIL	4,144	636	0	0	3,747	85	0
13.	DARU	122	0	0	0	3,775	0	0
14.	KAVIENG	0	0	0	1,374	0	0	0
15.	TARI	0	0	0	0	7	8,128	0
16.	VANIMO	0	0	0	0	63	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	144	17	0	0	0	8	0
20.	MENDI	7,088	0	0	11	6	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	34,012	20,858	20,775	20,322	12,455	17,500	10,878

Destination		22	23	24
Origin				
1.	PORT.M	2,362	0	448,565
2.	LAE	0	0	191,742
3.	RABAU	0	250	125,544
4.	MT. HAGEN	0	0	132,948
5.	GOROKA	0	0	71,932
6.	MADANG	0	0	56,375
7.	KIETA	6	0	57,804
8.	WEWAK	0	0	45,441
9.	POPON.	8	0	32,536
10.	HOSKINS	0	0	32,333
11.	GURNEY	1,988	0	36,931
12.	TABUBIL	0	0	25,761
13.	DARU	0	0	21,991
14.	KAVIENG	0	0	23,553
15.	TARI	0	0	34,013
16.	VANIMO	0	0	20,858
17.	CHIMBU	0	0	20,775
18.	MANUS	0	0	20,322
19.	KIUNGA	0	0	12,455
20.	MENDI	0	0	17,501
21.	MISIMA	10	0	10,878
22.	LOUSUIA	0	0	4,374
23.	BUKA	0	0	250
24.	TOTAL	4,374	250	1,444,880

OD Matrix of Air Passengers for Key Airports (2005)

(Without)								
Origin	Destination	1	2	3	4	5	6	7
1.	PORT.M	0	126,528	51,157	86,485	50,803	20,362	35,787
2.	LAE	125,536	0	32,495	30,054	15,256	11,460	3,814
3.	RABAU	55,716	30,964	0	0	0	1,900	32,425
4.	MT. HAGEN	88,661	29,383	30	0	14,766	13,038	0
5.	GOROKA	54,249	15,640	0	14,329	0	8,267	0
6.	MADANG	21,595	11,707	1,328	11,003	8,663	0	13
7.	KIETA	36,022	2,887	31,121	0	40	150	0
8.	WEWAK	11,105	9,027	482	10,342	1,650	6,619	0
9.	POPON.	32,109	8,292	0	0	0	0	0
10.	HOSKINS	9,996	10,260	19,541	0	0	0	1,620
11.	GURNEY	34,994	1,941	0	0	0	0	0
12.	TABUBIL	7,171	361	12	11,842	64	506	0
13.	DARU	23,920	0	0	0	0	0	0
14.	KAVIENG	4,543	2,200	21,156	0	22	1,441	303
15.	TARI	18,475	0	0	14,003	39	155	0
16.	VANIMO	8,085	0	0	5,759	212	48	0
17.	CHIMBU	22,111	0	0	8	5,141	2,014	0
18.	MANUS	7,228	4,043	10,212	0	0	3,802	265
19.	KIUNGA	3,627	122	0	2,193	0	75	0
20.	MENDI	11,090	4	35	2,271	77	9	0
21.	MISIMA	8,218	0	0	0	0	0	0
22.	LOUSUIA	3,106	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	587,558	253,357	167,817	188,289	96,733	69,849	74,226

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	11,371	33,396	10,856	36,880	7,578	24,121	5,716
2.	LAE	8,840	6,670	11,703	1,761	436	0	643
3.	RABAU	171	8	17,288	0	0	0	21,408
4.	MT. HAGEN	9,355	84	0	0	11,940	0	0
5.	GOROKA	1,379	44	0	0	19	0	0
6.	MADANG	6,730	0	18	0	640	0	1,227
7.	KIETA	384	0	1,470	0	0	0	904
8.	WEWAK	0	0	0	0	800	0	471
9.	POPON.	0	0	0	1,958	0	0	0
10.	HOSKINS	0	207	0	30	0	0	497
11.	GURNEY	0	1,998	21	0	0	0	0
12.	TABUBIL	814	0	0	0	0	884	0
13.	DARU	0	0	0	0	1,289	0	0
14.	KAVIENG	468	0	777	57	0	0	0
15.	TARI	78	0	0	0	6,330	207	0
16.	VANIMO	14,360	0	0	0	372	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	1,006	0	19	0	0	0	2,160
19.	KIUNGA	92	0	0	0	3,055	4,995	0
20.	MENDI	0	0	0	0	55	19	0
21.	MISIMA	0	0	0	8,142	0	0	0
22.	LOUSUIA	0	0	0	2,535	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	55,048	42,407	42,151	51,364	32,515	30,226	33,027

OD Matrix of Air Passengers for Key Airports (2005)

(Without)		15	16	17	18	19	20	21
Origin	Destination							
1.	PORT.M	22,043	8,648	24,131	8,510	3,397	10,274	6,621
2.	LAE	89	0	0	4,420	99	81	0
3.	RABAU	0	0	0	7,686	0	0	0
4.	MT. HAGEN	11,809	5,731	27	0	1,834	1,629	0
5.	GOROKA	0	275	2,519	0	12	0	0
6.	MADANG	455	0	2,504	3,894	72	0	0
7.	KIETA	0	0	22	1,159	0	0	61
8.	WEWAK	0	13,379	34	988	150	0	0
9.	POPON.	0	0	37	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	9694
12.	TABUBIL	5,986	862	0	0	3,911	104	0
13.	DARU	203	0	0	0	4,814	0	0
14.	KAVIENG	0	0	0	2,060	0	0	0
15.	TARI	0	0	0	0	10	12,301	0
16.	VANIMO	0	0	0	0	81	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	198	21	0	0	0	9	0
20.	MENDI	10,815	0	0	16	7	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	51,598	28,917	29,275	28,734	14,387	24,398	16,376

Origin	Destination	22	23	24
1.	PORT.M	2,893	0	587,559
2.	LAE	0	0	253,357
3.	RABAU	0	250	167,816
4.	MT. HAGEN	0	0	188,289
5.	GOROKA	0	0	96,732
6.	MADANG	0	0	69,848
7.	KIETA	7	0	74,226
8.	WEWAK	0	0	55,048
9.	POPON.	10	0	42,407
10.	HOSKINS	0	0	42,151
11.	GURNEY	2,716	0	51,364
12.	TABUBIL	0	0	32,515
13.	DARU	0	0	30,226
14.	KAVIENG	0	0	33,027
15.	TARI	0	0	51,599
16.	VANIMO	0	0	28,917
17.	CHIMBU	0	0	29,275
18.	MANUS	0	0	28,734
19.	KIUNGA	0	0	14,387
20.	MENDI	0	0	24,398
21.	MISIMA	15	0	16,375
22.	LOUSUIA	0	0	5,640
23.	BUKA	0	0	250
24.	TOTAL	5,641	250	1,924,140



OD Matrix of Air Passengers for Key Airports (2010)

(Without)		1	2	3	4	5	6	7
Origin	Destination							
1.	PORT.M	0	163,441	66,320	118,791	66,467	24,333	45,022
2.	LAE	162,283	0	44,115	43,107	20,893	14,401	5,033
3.	RABAU	72,394	42,098	0	0	0	2,404	43,029
4.	MT. HAGEN	122,040	42,201	44	0	21,402	17,600	0
5.	GOROKA	71,239	21,479	0	20,797	0	10,576	0
6.	MADANG	25,891	14,747	1,682	14,865	11,077	0	16
7.	KIETA	45,354	3,809	41,239	0	54	183	0
8.	WEWAK	12,736	10,901	585	13,458	2,025	7,293	0
9.	POPON.	41,489	11,216	0	0	0	0	0
10.	HOSKINS	12,617	13,570	25,941	0	0	0	2,088
11.	GURNEY	47,072	2,729	0	0	0	0	0
12.	TABUBIL	8,532	451	15	15,857	81	581	0
13.	DARU	33,217	0	0	0	0	0	0
14.	KAVIENG	6,075	3,073	29,610	0	31	1,887	414
15.	TARI	26,443	0	0	21,638	58	220	0
16.	VANIMO	11,229	0	0	8,757	310	66	0
17.	CHIMBU	30,554	0	0	13	7,482	2,728	0
18.	MANUS	9,864	5,758	14,569	0	0	5,088	370
19.	KIUNGA	3,932	139	0	2,720	0	78	0
20.	MENDI	14,284	5	48	3,227	104	11	0
21.	MISIMA	11,582	0	0	0	0	0	0
22.	LOUSUIA	3,862	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	772,690	335,617	224,415	263,229	129,983	87,443	95,971

		8	9	10	11	12	13	14
Origin	Destination							
1.	PORT.M	13,022	43,211	13,699	59,740	8,975	33,541	7,642
2.	LAE	10,667	9,041	15,484	2,483	544	0	899
3.	RABAU	207	11	22,993	0	0	0	30,021
4.	MT. HAGEN	12,182	121	0	0	15,959	0	0
5.	GOROKA	1,696	61	0	0	24	0	0
6.	MADANG	7,429	0	23	0	734	0	1,611
7.	KIETA	448	0	1,894	0	0	0	1,238
8.	WEWAK	0	0	0	0	875	0	595
9.	POPON.	0	0	0	2,764	0	0	0
10.	HOSKINS	0	274	0	42	0	0	680
11.	GURNEY	0	2,817	29	0	0	0	0
12.	TABUBIL	893	0	0	0	0	1,196	0
13.	DARU	0	0	0	0	1,735	0	0
14.	KAVIENG	591	0	1,063	83	0	0	0
15.	TARI	107	0	0	0	8,844	326	0
16.	VANIMO	18,825	0	0	0	501	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	1,298	0	26	0	0	0	3,149
19.	KIUNGA	91	0	0	0	3,145	6,229	0
20.	MENDI	0	0	0	0	69	27	0
21.	MISIMA	0	0	0	12,279	0	0	0
22.	LOUSUIA	0	0	0	3,457	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	67,455	55,536	55,211	70,847	41,405	41,320	45,835

OD Matrix of Air Passengers for Key Airports (2010)

(Without)		15	16	17	18	19	20	21
Origin	Destination							
1.	PORT.M	31,625	11,977	33,493	11,634	3,719	13,171	9,281
2.	LAE	133	0	0	6,311	114	109	0
3.	RABAUL	0	0	0	11,008	0	0	0
4.	MT. HAGEN	18,321	8,707	42	0	2,300	2,310	0
5.	GOROKA	0	403	3,694	0	15	0	0
6.	MADANG	647	0	3,416	5,235	75	0	0
7.	KIETA	0	0	31	1,622	0	0	87
8.	WEWAK	0	17,512	45	1,279	149	0	0
9.	POPON.	0	0	54	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	14513
12.	TABUBIL	8,417	1,163	0	0	4,089	129	0
13.	DARU	320	0	0	0	6,047	0	0
14.	KAVIENG	0	0	0	3,008	0	0	0
15.	TARI	0	0	0	0	13	17,983	0
16.	VANIMO	0	0	0	0	101	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	260	27	0	0	0	10	0
20.	MENDI	15,908	0	0	23	8	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	75,633	39,788	40,775	40,121	16,631	33,713	23,882

Origin	Destination	22	23	24
1.	PORT.M	3,590	0	772,690
2.	LAE	0	0	335,617
3.	RABAUL	0	250	224,414
4.	MT. HAGEN	0	0	163,229
5.	GOROKA	0	0	129,983
6.	MADANG	0	0	87,448
7.	KIETA	9	0	95,970
8.	WEWAK	0	0	67,455
9.	POPON.	13	0	55,537
10.	HOSKINS	0	0	55,211
11.	GURNEY	3,687	0	70,847
12.	TABUBIL	0	0	41,405
13.	DARU	0	0	41,320
14.	KAVIENG	0	0	45,835
15.	TARI	0	0	75,634
16.	VANIMO	0	0	39,788
17.	CHIMBU	0	0	40,776
18.	MANUS	0	0	40,121
19.	KIUNGA	0	0	16,631
20.	MENDI	0	0	33,714
21.	MISIMA	21	0	23,881
22.	LOUSUIA	0	0	7,320
23.	BUKA	0	0	250
24.	TOTAL	7,320	250	2,565,070

Attachment 8-6 Air Cargo in PNG (1)

(Unit: Tons)

	1983	1984	1985	1986	1987	1988	1989	Component Ratio (%)	Annual Growth Rate (%)
<b>Airports</b>									
<b>International</b>									
Chartered	1,679	2,510	2,467	2,920	2,817	3,359	3,557	11.7	13.3
Scheduled	20	1	3	-	-	-	1	-	-
Sub total	1,699	2,511	2,470	2,920	2,817	3,359	3,558	11.7	13.1
<b>Domestic</b>									
Port Moresby	4,884	10,028	11,334	12,038	12,150	9,760	9,189	30.2	11.1
Nadzab (Lae)	5,689	4,727	3,974	5,173	4,642	4,680	4,227	13.9	-4.8
Rabaul	756	1,169	1,028	1,243	1,250	1,404	1,455	4.8	11.5
Mt. Hagen	1,165	1,058	903	1,395	1,472	1,999	1,856	6.1	8.0
Goroka	1,369	1,537	1,706	1,195	1,154	1,515	1,404	4.6	0.4
Madang	1,445	1,487	1,548	1,511	1,478	1,260	1,122	3.7	-4.2
Kieta	801	822	726	766	836	926	809	2.7	0.2
Wewak	372	741	801	600	633	1,003	978	3.2	17.5
Popondetta	835	677	552	476	451	499	413	1.4	-11.1
Hoskins	321	360	402	288	344	425	432	1.4	5.1

Note: Component ratios were calculated for the year of 1989.

Air Cargo in PNG (2)

(Unit: Tons)

Airports	1983	1984	1985	1986	1987	1988	1989	Component Ratio (%)	Annual Growth Rate (%)
Gurney	227	245	264	318	319	363	418	1.4	10.7
Tabubil	138	1,240	1,455	1,000	931	1,374	1,634	5.4	51.0
Daru	298	251	214	228	215	221	284	0.9	-5.5
Kavieng	124	127	131	142	143	158	224	0.7	10.4
Tari	75	93	63	85	110	580	124	0.4	8.7
Vanimo	509	854	1,266	734	565	618	814	2.7	8.1
Chimbu (Kundiawa)	159	178	200	178	220	419	198	0.7	3.7
Manus	72	66	61	89	79	110	126	0.4	9.8
Kiunga	1,117	1,283	1,973	377	368	605	682	2.2	-7.9
Mendi	232	231	231	208	204	877	293	1.0	-4.0
Misima	12	26	17	19	19	119	153	0.5	52.8
Lousia	19	17	16	15	13	38	32	0.1	9.1
Buka	53	97	203	91	84	0	0	0.0	-
Sub total	20,672	27,314	29,068	28,169	27,680	28,953	26,867	88.3	4.5
Total	22,371	29,825	31,538	31,089	30,497	32,312	30,425	100.0	5.3

Attachment 8-7 OD Matrix of Air Passengers for Key Airports (1995)

(With)

Origin	Destination	1	2	3	4	5	6	7
1.	PORT.M	0	76,181	35,324	44,179	29,947	14,953	22,126
2.	LAE	75,310	0	19,701	13,576	7,914	7,350	2,069
3.	RABAU	38,137	18,680	0	0	0	1,390	20,069
4.	MT. HAGEN	45,008	13,239	16	0	6,558	6,963	0
5.	GOROKA	31,680	8,068	0	6,346	0	5,141	0
6.	MADANG	15,722	7,473	972	5,866	5,394	0	8
7.	KIETA	22,248	1,570	19,407	0	21	100	0
8.	WEWAK	8,932	6,345	389	6,025	1,129	5,792	0
9.	POPON.	19,669	4,479	0	0	0	0	0
10.	HOSKINS	6,112	5,527	12,071	0	0	0	896
11.	GURNEY	19,096	938	0	0	0	0	0
12.	TABUBIL	5,366	236	9	6,496	41	409	0
13.	DARU	12,170	0	0	0	0	0	0
14.	KAVIENG	2,302	988	10,876	0	10	771	138
15.	TARI	8018	0	0	4874	15	70	0
16.	VANIMO	4,034	0	0	2,222	92	25	0
17.	CHIMBU	11,143	0	0	3	2,266	1,069	0
18.	MANUS	3,607	1,790	5,171	0	0	1,997	119
19.	KIUNGA	3,086	91	0	1,347	0	70	0
20.	MENDI	6,818	2	22	1,064	41	6	0
21.	MISIMA	3,748	0	0	0	0	0	0
22.	LOUSUIA	2,081	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	344,288	145,606	104,206	91,997	53,428	46,106	45,425

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	9,197	20,389	6,708	19,968	5,732	12,230	2,905
2.	LAE	6,224	3,579	6,347	841	288	0	289
3.	RABAU	137	5	10,697	0	0	0	10,944
4.	MT. HAGEN	5,444	38	0	0	6,572	0	0
5.	GOROKA	940	23	0	0	12	0	0
6.	MADANG	5,869	0	12	0	518	0	652
7.	KIETA	281	0	820	0	0	0	414
8.	WEWAK	0	0	0	0	719	0	274
9.	POPON.	0	0	0	952	0	0	0
10.	HOSKINS	0	113	0	15	0	0	226
11.	GURNEY	0	975	11	0	0	0	0
12.	TABUBIL	728	0	0	0	0	484	0
13.	DARU	0	0	0	0	715	0	0
14.	KAVIENG	273	0	356	24	0	0	0
15.	TARI	38	0	0	0	2,940	70	0
16.	VANIMO	8,253	0	0	0	202	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	576	0	8	0	0	0	828
19.	KIUNGA	95	0	0	0	2,910	3,077	0
20.	MENDI	0	0	0	0	37	9	0
21.	MISIMA	0	0	0	3,085	0	0	0
22.	LOUSUIA	0	0	0	1,339	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	38,055	25,122	24,959	26,224	20,645	15,870	16,533

OD Matrix of Air Passengers for Key Airports (1995)

(With)

Origin	Destination	15	16	17	18	19	20	21
1.	PORT.M	9,517	4,350	12,031	4,288	2,828	6,421	3,064
2.	LAE	34	0	0	1,969	72	54	0
3.	RABAU	0	0	0	3,896	0	0	0
4.	MT. HAGEN	4,068	2,215	11	0	1,096	770	0
5.	GOROKA	0	120	1,089	0	9	0	0
6.	MADANG	202	0	1,304	2,048	65	0	0
7.	KIETA	0	0	10	526	0	0	25
8.	WEWAK	0	7,712	20	568	150	0	0
9.	POPON.	0	0	17	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	3751
12.	TABUBIL	2,739	467	0	0	3,601	70	0
13.	DARU	69	0	0	0	2,916	0	0
14.	KAVIENG	0	0	0	795	0	0	0
15.	TARI	0	0	0	0	5	5,073	0
16.	VANIMO	0	0	0	0	48	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	99	13	0	0	0	7	0
20.	MENDI	4,375	0	0	8	5	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	21,102	14,877	14,481	14,097	10,794	12,385	6,840

Origin	Destination	22	23	24
1.	PORT.M	1,950	0	344,289
2.	LAE	0	0	145,606
3.	RABAU	0	250	104,206
4.	MT. HAGEN	0	0	91,997
5.	GOROKA	0	0	53,427
6.	MADANG	0	0	46,106
7.	KIETA	9	0	45,425
8.	WEWAK	0	0	38,055
9.	POPON.	4	0	25,122
10.	HOSKINS	0	0	24,959
11.	GURNEY	1,454	0	26,224
12.	TABUBIL	0	0	20,645
13.	DARU	0	0	15,870
14.	KAVIENG	0	0	16,533
15.	TARI	0	0	21,102
16.	VANIMO	0	0	14,877
17.	CHIMBU	0	0	14,482
18.	MANUS	0	0	14,097
19.	KIUNGA	0	0	10,794
20.	MENDI	0	0	12,385
21.	MISIMA	6	0	6,839
22.	LOUSUIA	0	0	3,420
23.	BUKA	0	0	250
24.	TOTAL	3,420	250	1,096,710

OD Matrix of Air Passengers for Key Airports (2000)

(With)

Origin	Destination	1	2	3	4	5	6	7
1.	PORT.M	0	96,161	39,970	61,048	38,165	16,765	27,732
2.	LAE	95,290	0	25,089	21,000	11,336	9,316	2,922
3.	RABAU	43,424	23,878	0	0	0	1,585	25,490
4.	MT. HAGEN	62,437	20,509	22	0	10,219	9,729	0
5.	GOROKA	40,650	11,606	0	9,916	0	6,617	0
6.	MADANG	17,724	9,500	1,108	8,206	6,931	0	11
7.	KIETA	27,915	2,214	24,526	0	31	125	0
8.	WEWAK	9,518	7,642	419	8,013	1,376	6,152	0
9.	POPON.	24,742	6,325	0	0	0	0	0
10.	HOSKINS	7,629	7,754	15,172	0	0	0	1,249
11.	GURNEY	25,630	1,408	0	0	0	0	0
12.	TABUBIL	5,936	295	10	8,917	51	452	0
13.	DARU	17,007	0	0	0	0	0	0
14.	KAVIENG	3,207	1,539	15,202	0	15	1,080	215
15.	TARI	12,215	0	0	8,751	25	108	0
16.	VANIMO	5,614	0	0	3,726	144	36	0
17.	CHIMBU	15,675	0	0	5	3,581	1,514	0
18.	MANUS	5,053	2,802	7,267	0	0	2,817	186
19.	KIUNGA	3,227	107	0	1,756	0	73	0
20.	MENDI	8,487	3	27	1,609	57	7	0
21.	MISIMA	5,548	0	0	0	0	0	0
22.	LOUSUIA	2,466	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	439,397	191,742	129,060	132,948	71,933	56,375	57,805

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	9,772	25,730	8,313	26,936	6,310	17,127	4,042
2.	LAE	7,492	5,082	8,861	1,272	358	0	450
3.	RABAU	148	6	13,432	0	0	0	15,374
4.	MT. HAGEN	7,248	59	0	0	9,016	0	0
5.	GOROKA	1,150	33	0	0	15	0	0
6.	MADANG	6,250	0	15	0	573	0	918
7.	KIETA	334	0	1,137	0	0	0	643
8.	WEWAK	0	0	0	0	751	0	367
9.	POPON.	0	0	0	1,434	0	0	0
10.	HOSKINS	0	158	0	22	0	0	349
11.	GURNEY	0	1,467	16	0	0	0	0
12.	TABUBIL	761	0	0	0	0	672	0
13.	DARU	0	0	0	0	986	0	0
14.	KAVIENG	365	0	546	39	0	0	0
15.	TARI	56	0	0	0	4,449	129	0
16.	VANIMO	10,998	0	0	0	277	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	774	0	13	0	0	0	1,410
19.	KIUNGA	94	0	0	0	2,979	4,050	0
20.	MENDI	0	0	0	0	45	13	0
21.	MISIMA	0	0	0	5,320	0	0	0
22.	LOUSUIA	0	0	0	1,908	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	45,441	32,536	32,333	36,931	25,761	21,991	23,553

OD Matrix of Air Passengers for Key Airports (2000)

(With)

Origin	Destination	15	16	17	18	19	20	21
1.	PORT.M	14,579	6,030	17,069	5,965	2,991	7,915	4,477
2.	LAE	58	0	0	3,068	86	62	0
3.	RABAU	0	0	0	5,471	0	0	0
4.	MT. HAGEN	7,367	3,714	18	0	1,451	1,158	0
5.	GOROKA	0	188	1,747	0	11	0	0
6.	MADANG	315	0	1,872	2,884	68	0	0
7.	KIETA	0	0	16	817	0	0	41
8.	WEWAK	0	10,267	27	760	150	0	0
9.	POPON.	0	0	26	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	6360
12.	TABUBIL	4,187	642	0	0	3,751	86	0
13.	DARU	127	0	0	0	3,871	0	0
14.	KAVIENG	0	0	0	1,345	0	0	0
15.	TARI	0	0	0	0	7	8,272	0
16.	VANIMO	0	0	0	0	63	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	145	17	0	0	0	8	0
20.	MENDI	7,234	0	0	12	6	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	34,012	20,858	20,775	20,322	12,455	17,500	10,878

Origin	Destination	22	23	24
1.	PORT.M	2,299	0	439,397
2.	LAE	0	0	191,742
3.	RABAU	0	250	129,059
4.	MT. HAGEN	0	0	132,948
5.	GOROKA	0	0	71,932
6.	MADANG	0	0	56,375
7.	KIETA	6	0	57,804
8.	WEWAK	0	0	45,441
9.	POPON.	8	0	32,536
10.	HOSKINS	0	0	32,333
11.	GURNEY	2,051	0	36,931
12.	TABUBIL	0	0	25,761
13.	DARU	0	0	21,991
14.	KAVIENG	0	0	23,553
15.	TARI	0	0	34,013
16.	VANIMO	0	0	20,858
17.	CHIMBU	0	0	20,775
18.	MANUS	0	0	20,322
19.	KIUNGA	0	0	12,455
20.	MENDI	0	0	17,501
21.	MISIMA	10	0	10,878
22.	LOUSUIA	0	0	4,374
23.	BUKA	0	0	250
24.	TOTAL	4,374	250	1,439,230



OD Matrix of Air Passengers for Key Airports (2005)

(With)

Origin	Destination	1	2	3	4	5	6	7
1.	PORT.M	0	123,239	51,268	84,560	49,674	19,659	34,462
2.	LAE	122,234	0	34,092	30,709	15,623	11,628	3,855
3.	RABAUL	55,854	32,505	0	0	0	1,987	33,734
4.	MT. HAGEN	86,712	30,040	32	0	15,142	13,250	0
5.	GOROKA	53,145	16,050	0	14,716	0	8,433	0
6.	MADANG	20,865	11,891	1,390	11,186	8,827	0	13
7.	KIETA	34,726	2,922	32,402	0	41	151	0
8.	WEWAK	10,676	9,234	503	10,476	1,675	6,655	0
9.	POPON.	31,719	8,587	0	0	0	0	0
10.	HOSKINS	9,510	10,248	20,070	0	0	0	1,602
11.	GURNEY	34,540	2,005	0	0	0	0	0
12.	TABUBIL	6,905	365	12	12,003	65	509	0
13.	DARU	23748	0	0	0	0	0	0
14.	KAVIENG	4,301	2,181	21,513	0	22	1,419	297
15.	TARI	17,991	0	0	14,230	40	157	0
16.	VANIMO	7859	0	0	5861	216	49	0
17.	CHIMBU	21,867	0	0	9	5,330	2,070	0
18.	MANUS	6,948	4,065	10,525	0	0	3,798	264
19.	KIUNGA	3,475	123	0	2,213	0	75	0
20.	MENDI	10,823	4	37	2,324	79	9	0
21.	MISIMA	7,999	0	0	0	0	0	0
22.	LOUSUIA	3,021	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	574,919	253,357	172,092	188,289	96,733	69,849	74,226

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	10,942	33,043	10,357	36,425	7,302	23,956	5,421
2.	LAE	8,949	6,916	11,716	1,819	442	0	639
3.	RABAUL	178	9	17,808	0	0	0	21,808
4.	MT. HAGEN	9,487	87	0	0	12,114	0	0
5.	GOROKA	1,404	46	0	0	19	0	0
6.	MADANG	6,777	0	18	0	645	0	1,211
7.	KIETA	385	0	1,458	0	0	0	890
8.	WEWAK	0	0	0	0	803	0	463
9.	POPON.	0	0	0	2,052	0	0	0
10.	HOSKINS	0	210	0	30	0	0	482
11.	GURNEY	0	2,095	22	0	0	0	0
12.	TABUBIL	817	0	0	0	0	911	0
13.	DARU	0	0	0	0	1,329	0	0
14.	KAVIENG	460	0	755	58	0	0	0
15.	TARI	79	0	0	0	6,376	214	0
16.	VANIMO	14,476	0	0	0	375	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	1,002	0	18	0	0	0	2,114
19.	KIUNGA	92	0	0	0	3,054	5,125	0
20.	MENDI	0	0	0	0	56	20	0
21.	MISIMA	0	0	0	8,361	0	0	0
22.	LOUSUIA	0	0	0	2,619	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	55,048	42,407	421,151	51,364	32,515	30,226	33,027

OD Matrix of Air Passengers for Key Airports (2005)

(With)

Origin	Destination	15	16	17	18	19	20	21
1.	PORT.M	21,533	8,415	23,942	9,217	3,256	10,029	6,412
2.	LAE	90	0	0	4,462	100	83	0
3.	RABAU	0	0	0	7,959	0	0	0
4.	MT. HAGEN	12,038	5,839	28	0	1,852	1,668	0
5.	GOROKA	0	281	2,624	0	13	0	0
6.	MADANG	461	0	2,583	3,910	72	0	0
7.	KIETA	0	0	23	1,160	0	0	61
8.	WEWAK	0	13,490	35	988	149	0	0
9.	POPON.	0	0	39	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	9903
12.	TABUBIL	6,044	870	0	0	3,908	105	0
13.	DARU	210	0	0	0	4,939	0	0
14.	KAVIENG	0	0	0	2,021	0	0	0
15.	TARI	0	0	0	0	10	12,504	0
16.	VANIMO	0	0	0	0	81	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	199	22	0	0	0	9	0
20.	MENDI	11,023	0	0	17	7	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	51,598	28,917	29,275	28,734	14,387	24,398	16,376

Origin	Destination	22	23	24
1.	PORT.M	2,808	0	574,919
2.	LAE	0	0	253,357
3.	RABAU	0	250	172,091
4.	MT. HAGEN	0	0	188,289
5.	GOROKA	0	0	96,732
6.	MADANG	0	0	69,848
7.	KIETA	7	0	74,226
8.	WEWAK	0	0	55,048
9.	POPON.	11	0	42,407
10.	HOSKINS	0	0	42,151
11.	GURNEY	2,799	0	51,364
12.	TABUBIL	0	0	32,515
13.	DARU	0	0	30,226
14.	KAVIENG	0	0	33,027
15.	TARI	0	0	51,599
16.	VANIMO	0	0	28,917
17.	CHIMBU	0	0	29,275
18.	MANUS	0	0	28,734
19.	KIUNGA	0	0	14,387
20.	MENDI	0	0	24,398
21.	MISIMA	15	0	16,375
22.	LOUSUIA	0	0	5,641
23.	BUKA	0	0	250
24.	TOTAL	5,641	250	1,915,780

### OD Matrix of Air Passengers for Key Airports (2010)

(With)

Origin	Destination	1	2	3	4	5	6	7
1.	PORT.M	0	159,073	66,071	116,072	64,910	23,443	43,375
2.	LAE	157,913	0	46,076	44,057	21,397	14,614	5,098
3.	RABAUL	72,157	43,996	0	0	0	2,501	44,634
4.	MT. HAGEN	119,289	43,152	46	0	21,937	17,880	0
5.	GOROKA	69,714	22,044	0	21,351	0	10,785	0
6.	MADANG	24,967	14,980	1,750	15,108	11,281	0	16
7.	KIETA	43,745	3,864	42,806	0	55	184	0
8.	WEWAK	12,215	11,031	607	13,626	2,055	7,327	0
9.	POPON.	40,949	11,621	0	0	0	0	0
10.	HOSKINS	12,011	13,583	25,562	0	0	0	2,071
11.	GURNEY	46,430	2,819	0	0	0	0	0
12.	TABUBIL	8,197	457	15	16,064	82	584	0
13.	DARU	32,993	0	0	0	0	0	0
14.	KAVIENG	5,764	3,056	30,048	0	31	1,863	408
15.	TARI	25,743	0	0	21,985	59	222	0
16.	VANIMO	10,912	0	0	8,913	316	66	0
17.	CHIMBU	30,205	0	0	13	7,754	2,803	0
18.	MANUS	9,489	5,799	14,964	0	0	5,087	369
19.	KIUNGA	7,353	140	0	2,741	0	78	0
20.	MENDI	13,915	5	50	3,299	107	11	0
21.	MISIMA	11,262	0	0	0	0	0	0
22.	LOUSUIA	3,750	0	0	0	0	0	0
23.	BUKA	2	0	248	0	0	0	0
24.	TOTAL	755,375	335,617	229,244	263,229	129,983	87,448	95,971

Origin	Destination	8	9	10	11	12	13	14
1.	PORT.M	12,498	42,721	13,071	49,092	8,627	33,328	7,261
2.	LAE	10,799	9,381	15,531	2,565	551	0	895
3.	RABAUL	215	12	23,608	0	0	0	30,518
4.	MT. HAGEN	12,347	126	0	0	16,181	0	0
5.	GOROKA	1,726	63	0	0	24	0	0
6.	MADANG	7,476	0	22	0	739	0	1,594
7.	KIETA	450	0	1,886	0	0	0	1,223
8.	WEWAK	0	0	0	0	877	0	586
9.	POPON.	0	0	0	2,896	0	0	0
10.	HOSKINS	0	278	0	42	0	0	664
11.	GURNEY	0	2,955	30	0	0	0	0
12.	TABUBIL	895	0	0	0	0	1,234	0
13.	DARU	0	0	0	0	1,790	0	0
14.	KAVIENG	582	0	1,038	83	0	0	0
15.	TARI	108	0	0	0	8,902	337	0
16.	VANIMO	18,974	0	0	0	505	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	1,294	0	26	0	0	0	3,093
19.	KIUNGA	91	0	0	0	3,139	6,392	0
20.	MENDI	0	0	0	0	69	28	0
21.	MISIMA	0	0	0	12,599	0	0	0
22.	LOUSUIA	0	0	0	3,570	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	67,455	55,536	55,211	70,847	41,405	41,319	45,835

### OD Matrix of Air Passengers for Key Airports (2010)

(With)

Destination		15	16	17	18	19	20	21
Origin								
1.	PORT.M	30,883	11,649	33,224	11,236	3,551	12,833	8,979
2.	LAE	135	0	0	6,379	115	112	0
3.	RABAU	0	0	0	11,353	0	0	0
4.	MT. HAGEN	18,674	8,872	43	0	2,319	2,363	0
5.	GOROKA	0	412	3,848	0	15	0	0
6.	MADANG	655	0	3,525	5,260	76	0	0
7.	KIETA	0	0	32	1,628	0	0	88
8.	WEWAK	0	17,656	46	1,280	149	0	0
9.	POPON.	0	0	57	0	0	0	0
10.	HOSKINS	0	0	0	0	0	0	0
11.	GURNEY	0	0	0	0	0	0	14815
12.	TABUBIL	8,494	1,173	0	0	4,079	131	0
13.	DARU	332	0	0	0	6,204	0	0
14.	KAVIENG	0	0	0	2,962	0	0	0
15.	TARI	0	0	0	0	13	18,264	0
16.	VANIMO	0	0	0	0	102	0	0
17.	CHIMBU	0	0	0	0	0	0	0
18.	MANUS	0	0	0	0	0	0	0
19.	KIUNGA	261	27	0	0	0	10	0
20.	MENDI	16,198	0	0	23	8	0	0
21.	MISIMA	0	0	0	0	0	0	0
22.	LOUSUIA	0	0	0	0	0	0	0
23.	BUKA	0	0	0	0	0	0	0
24.	TOTAL	75,633	39,788	40,775	40,121	16,631	33,713	23,882

Destination		22	23	24
Origin				
1.	PORT.M	3,478	0	755,375
2.	LAE	0	0	335,617
3.	RABAU	0	250	229,243
4.	MT. HAGEN	0	0	263,229
5.	GOROKA	0	0	129,983
6.	MADANG	0	0	87,448
7.	KIETA	9	0	95,970
8.	WEWAK	0	0	67,455
9.	POPON.	14	0	55,537
10.	HOSKINS	0	0	55,211
11.	GURNEY	3,798	0	70,847
12.	TABUBIL	0	0	41,405
13.	DARU	0	0	41,320
14.	KAVIENG	0	0	45,835
15.	TARI	0	0	75,634
16.	VANIMO	0	0	39,788
17.	CHIMBU	0	0	40,776
18.	MANUS	0	0	40,121
19.	KIUNGA	0	0	16,631
20.	MENDI	0	0	33,714
21.	MISIMA	21	0	23,881
22.	LOUSUIA	0	0	7,320
23.	BUKA	0	0	250
24.	TOTAL	7,320	250	2,552,590

## Attachment 9-1

### Runway Length

#### 1. Analysis on Runway Length

The Runway length is calculated by analyzing the relation of aerodrome data and aircraft data, while the relation between take-off weight and air-routes for each type of aircraft are based on the manufacturers' manual tables.

##### 1) Aerodrome data

Aerodrome Elevation	:	13.85 m MSL
Aerodrome Reference Temperature	:	31.0°C
Temperature in Standard Atmosphere at Aerodrome Elevation	:	*14.91°C
Average longitudinal slope of runway	:	0.42% (R/W : 2200 m)
* 15.0 - (13.85 x 0.0065) = 14.91	:	0.30% (R/W : 3000 m)

2) Aircraft Characteristics : Refer to Table A9.1-1

#### 2. Required Runway Length Corrected by Elevation, Temperature and Runway Slope

Basic Take-off Runway Length : A

(1) By aerodrome Elevation :  $A + (A \times 0.07 \frac{13.85}{300}) = 1.003232 \cdot A$

(2) By Aerodrome Elevation Temperature :  
 $1.003232 \cdot A [1.003232 \cdot A \times (31.0 - 14.91) \times 0.01] = 1.1646 \cdot A$

(3) By Slope of Runway :  
 $1.1646 \cdot A + (1.1646 \cdot A \times 0.42 \times 0.1) = 1.214$  (RWY : 2200 m)  
 $1.1646 \cdot A + (1.1646 \cdot A \times 0.30 \times 0.1) = 1.199 \cdot A$  (RWY : 3000 m)

Corrected Runway Length : 1.21·A and 1.20·A

#### 3. Required Runway Length is Corrected by the Relation of Aircraft and Air-Routes

An assumed maximum stage length is estimated to be 3,611 km, which is the of between Tokua and Sydney in year 2000, and an assumed maximum stage length of 5,112 km is estimated to be that of between Tokua and Singapore in year 2010. (798 km via POM)

Fuel reserve is assumed as 10% of stage fuel, 200 NM diversion, and 0.5 hour approach and landing.

Table A9.1-1 Aircraft Characteristics

Characteristic	Unit	B747-200B (JT9D-70)	B747-SP (JT9D-7F)	A-300B2 (CF6-50C)	A310-300 (JT9D-7R4E)	A310-200 (JT9D-7R4C)	B767-200 (CF6-80A2)	B737-200 (JT8D-15)	MD87 (JT8D-217C)
Maximum Ramp Weight	Pounds (Kilograms)	823,000 (373,600)	666,000 (302,400)	315,040 (142,900)	332,680 (150,900)	292,990 (132,900)	312,000 (141,520)	116,000 (52,660)	150,500 (68,266)
Maximum Take-off Weight	Pounds (Kilograms)	820,000 (372,300)	660,000 (299,600)	313,056 (142,000)	330,690 (150,000)	291,005 (132,000)	310,000 (14,610)	115,500 (52,440)	149,500 (67,812)
Maximum Landing Weight	Pounds (Kilograms)	564,000 (256,000)	450,000 (204,300)	299,820 (136,000)	271,166 (123,000)	261,243 (118,500)	270,000 (122,420)	103,000(b) (46,760)	130,000 (58,967)
Zero-Fuel Weight	Pounds (Kilograms)	526,500 (239,000)	410,000 (186,100)	277,780 (126,000)	249,120 (113,000)	239,200 (108,500)	248,000 (112,490)	95,000 (43,130)	112,000 (50,802)
Operating Empty Weight (Spec.)	Pounds (Kilograms)	376,600 (171,000)	315,200 (143,100)	190,200 (86,275)	169,124 (76,714)	169,470 (76,869)	173,710 (78,790)	60,170 (27,320)	74,880 (33,965)
Maximum Structural Payload	Pounds (Kilograms)	149,900 (68,000)	94,800 (43,000)	87,580 (39,725)	7,996 (36,286)	69,730 (31,631)	74,290 (33,690)	34,830 (15,810)	37,120 (16,837)
Maximum Seating Capacity	Passengers	385	281	269	243	237	216	130	139
Maximum Cargo Volume-Below Deck	Cubic Feet (Cubic Meters)	5,250 (149)	3,500 (99.1)	4,944 (140.0)	2,795 (79.2)	3,813 (1,080)	3,070 (87.0)	875 (24.8)	695 (19.7)
Maximum Cargo Volume-Main Deck	Cubic Feet (Cubic Meters)	1,000 (28.3)	400 (11.3)	-	-	-	-	-	-
Usable Fuel Capacity	U.S. Gallons (Liters)	51,090 (193,400)	47,210 (178,700)	11,623 (44,000)	16,139 (61,090)	14,530 (55,000)	16,700 (63,216)	5,151 (19,500)	6,981 (26,423)

Note : (b) Max. Flap setting is 40°

Table A9.1-2 Runway Length Requirement by Aircraft

	Model	Engine	Take-off Weight	Take-off Runway Length		Landing Max. Weight	Landing Runway Length	
				Basic RWY	Adjusted RWY (Flaps)		Wet RWY (Flaps)	Dry RWY (Flaps)
Singapore	B747-200B	JJ9D-70	697,400	2,240	2,690	564,000	2,660 (25°)	2,350 (25°)
	A310-300	JJ9D-7R4E	(a) 330,600	2,400	2,880	271,200	1,740 (40°)	1,510 (40°)
Honolulu	B747-200B	JT9D-70	736,000	2,510	3,010	564,000	2,660 (25°)	2,350 (25°)
	B747-SP	JT9D7F	620,300	1,950	2,340	450,000	1,950 (30°)	1,680 (30°)
Sydney	A310-300	JT9D-7R4E	328,900	2,240	2,700	271,200	1,740 (40°)	1,510 (40°)
	B767-200	CF6-80A2	(a) 310,000	1,750	2,110	270,000	1,720 (25°)	1,530 (25°)
Cairns	MD-87	JT8D-217C	(a) 149,500	2,250	2,720	130,000	1,770 (28°)	1,520 (28°)
	A300-B2	CF6-50C	(a) 313,000	1,590	1,930 (15°)	299,800	2,060 (25°)	1,790 (25°)
	B737-200	JT8D-15	(a) 115,500	2,000	2,420 (POSS)	103,000	1,800 (15°)	1,570 (15°)
	MD-87	JT8D-217C	136,200	1,730	2,090	130,000	1,770 (28°)	1,520 (28°)
Via Port Moresby	A310-200	JT9D-7R4C	290,600	1,620	1,960	261,200	1,660 (40°)	1,440 (40°)
	B747-200B	JT9D-70	573,500	1,530	1,860	547,400	2,100 (30°)	1,830 (30°)
	B747-SP	JT9D-7F	457,000	1,830	2,220	430,900	1,870 (30°)	1,630 (30°)
	A310-300	JT9D-7R4E	278,000	1,490	1,810	262,100	1,700 (40°)	1,480 (40°)
	A310-200	JT9D-7R4C	268,100	1,370	1,660	252,200	1,640 (40°)	1,430 (40°)
	A300-B2	CF6-50C	306,700	1,500	1,820 (15°)	290,800	1,980 (25°)	1,720 (25°)
	B767-200	CF6-80A2	276,900	1,410	1,710	261,000	1,710 (25°)	1,480 (25°)
	MD-87	JT8D-217C	124,000	1,440	1,750	117,200	1,650 (28°)	1,440 (28°)
	B737-2000	(Advanced) JT8D-15	107,000	1,530	1,860 (POS15)	100,200	1,760 (15°)	1,540 (15°)
	B737-200	JT8D-9	107,000	2,050	2,490 (POSS)	100,200	1,930 (25°)	1,670 (25°)

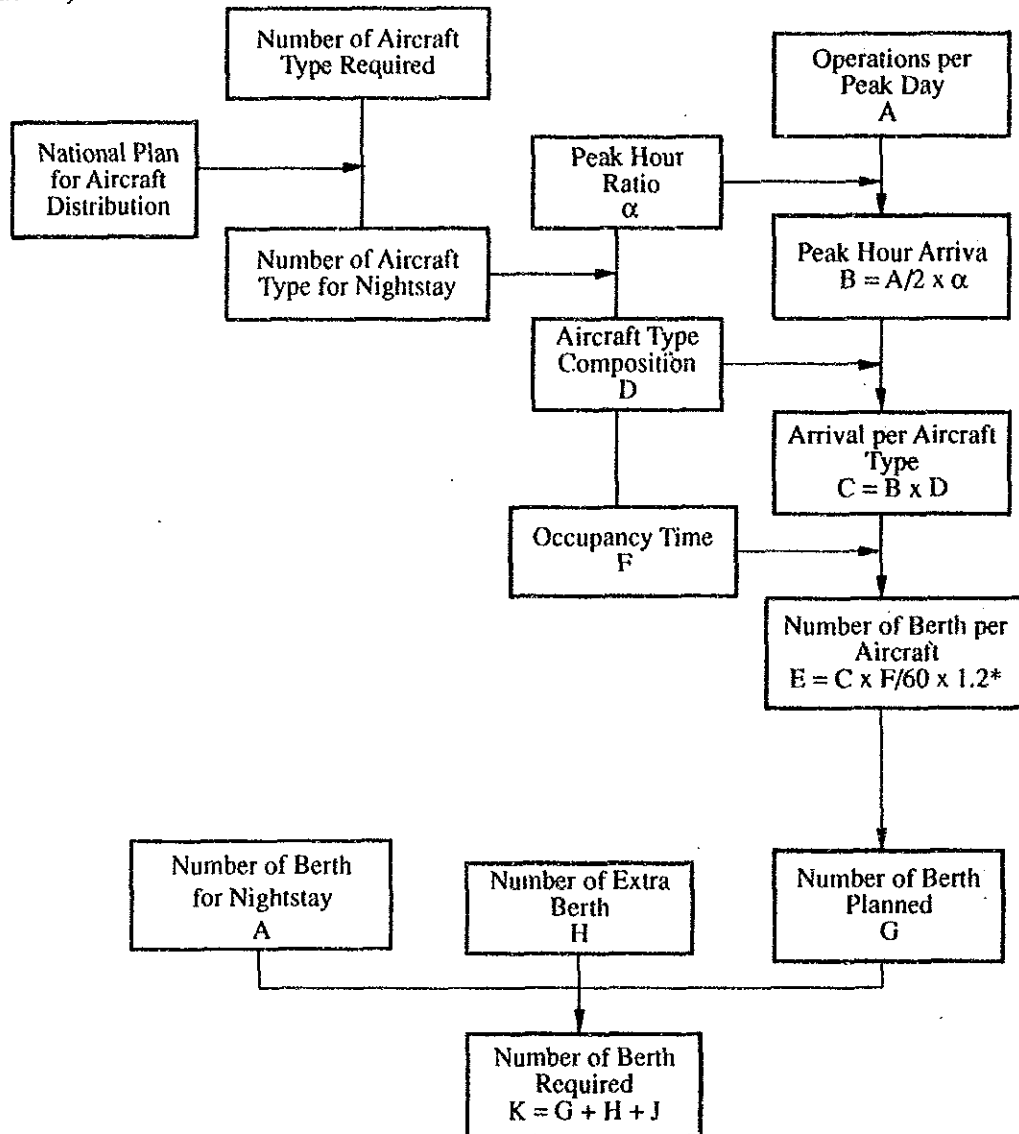
Notes : Weight in Pounds, Runway Length in Metre.

(a) Payload limited by Maximum Take-off Weight.

Estimate of Loading Aprons and Apron Berth

1. Facility Design Criteria

The diagram below is the criteria adaptable to the apron projection for Tokua Airport, which has been developed by the methodology of JCAB (Japan Civil Aviation Bureau).



Note: 1. 2\*: To secure 20% extra berth for biased operations at a peak-hour, or for unavoidable factors such as prolonged parking time due to a ship change or mechanical trouble.

H: To provide one (1) additional berth per 10 aircraft for the maximum sized aircraft, to cope with such unforeseeable situations as long delay, diversion, malfunction of aircraft, etc.



## 2. Peak Month Ratio (PMR)

The air passengers at the existing Rabaul Airport are rather concentrated in December and January, according to the latest data. It could be because of the seasonal traffic demands which seem to be caused by the movements of foreign tourists, PNG emigrants and religious followers. The actual ratio of the number of peak-month passengers in these months to the annual passengers at the airport was found to be 26.7% in January 1990.

Basic Month Factor :  $1/12 = 0.08333$ , hence  
 Peak Month Ratio :  $0.08333 \times 1.267 = 0.1056$  for the year 1990

While, it is estimated that the ratio mentioned above (26.7%) will reduce to 20.0% in 2000 and 15.0% in 2010.

## 3. Peak Day Ratio (PDR)

Basic Day Factor :  $1/30.44 = 0.033$

\* 30.44 is average number of days in a month for 4 years:  
 $[365 \text{ days} \times 3 \text{ (years)} + 366 \text{ days}] \div [12 \text{ (months)} \times 4 \text{ (years)}]$

The premium rate of peak day passengers is assumed to be 10% of the average daily passengers in the peak-month. The ratios of peak-month and peak-day passengers to the annual passengers are assumed as shown in Table below.

Ratios of Peak-Month and Peak-Day

Year	Peak-Month Ratio (PMR)	Peak-Day Ratio (PDR)*
1990	0.1056 (0.8333 x 1.267)	0.00386 (1/259)
2000	0.0999 (0.8333 x 1.20)	0.00370 (1/270)
2010	0.0958 (0.8333 x 1.15)	0.00357 (1/280)

\* PDR to the annual passengers is obtained by the following formula:

$$\text{PDR} = \text{PMR} \times 1.10 + 30.44 \text{ (average days in a month)}$$

## 4. Peak-Hour Ratio (PHR)

A formula to calculate PHR has not yet been concretely found at Rabaul Airport because of insufficient data. But, according to the time tables of only the major

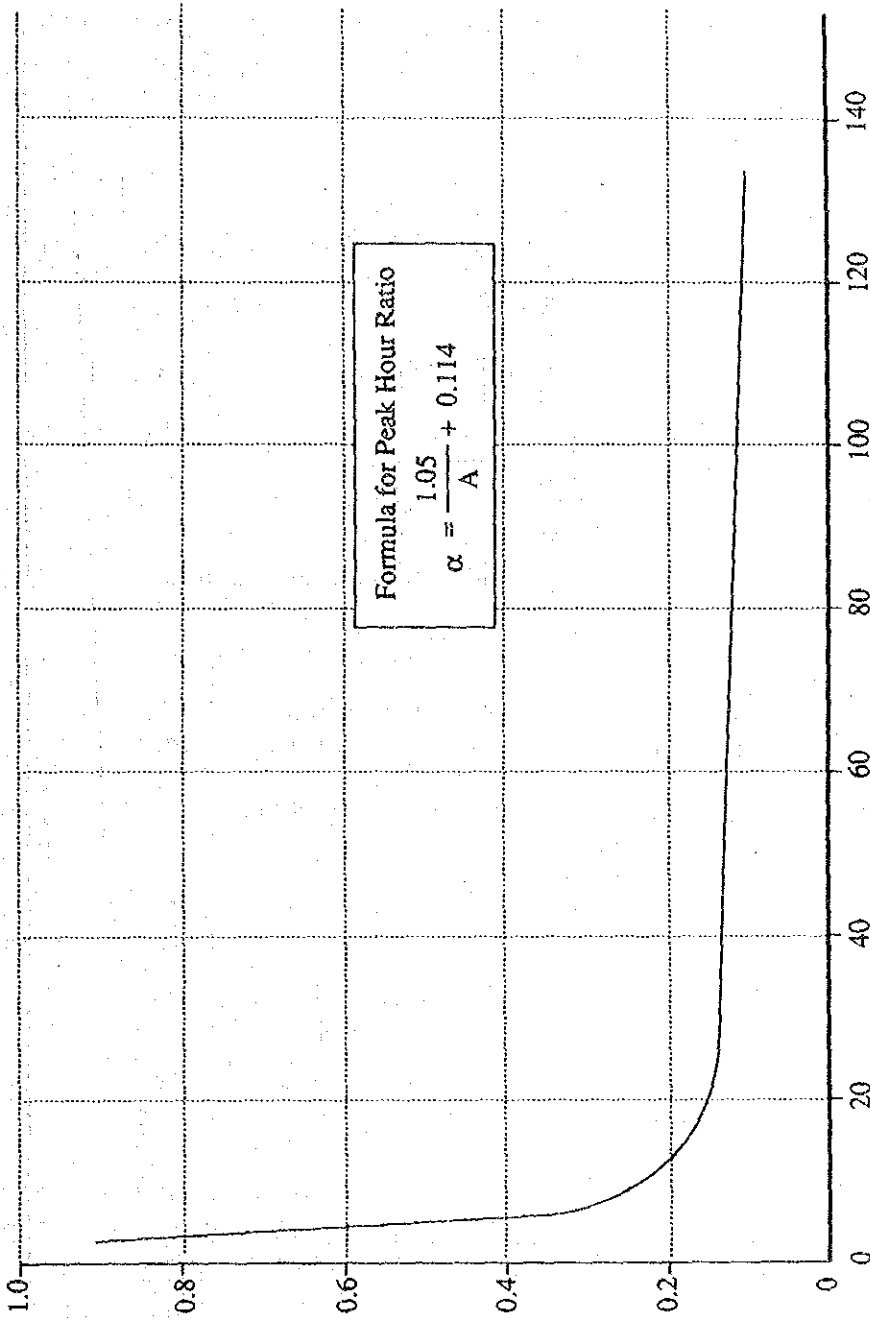
airlines, Air Niugini and Talair, 4 flights per hour period of 12:00 ~ 13:00 out of 13 flights per day were found, which reflects PHR be about 30% ( $4 \div 13$ ).

However, there are some other flights operated by minor airlines which are taken as general aviations, for which an apron is to be provided separately from the major one. Thus, PHR for major operations is considered to be not affected by the operations of general aviations, though it would affect ATC operations.

The tendency is that there are 4 flights per hour period of 12:00 ~ 13:00 in an average week day, Monday through Sunday. It has been peculiarly experienced in the world aviation field that the correlation, between peak-hour operation and the total operations in the day that the peak-hour operations have occurred, has coefficiently become smaller in line with aircraft type becoming larger. Thus, PHR is estimated to prevail 20% ~ 25% in this study. PHR will be accordingly set up as 27% for the year 1995, 25% for 2000 and 20% for 2010.

The attached 2 graphic sheets are presented to introduce how to figure out the Peak-Hour Concentrated Ratios for international and domestic operations by using graphs. These were derived from the formula set in Japan to apply generally to a facility requirement of an airport development. However, these cannot be applied to the case in PNG at present. It is recommended to develop these kinds of graph derived from a peak-hour ratio, when a correlation between peak-hour operation and day operation is found in future.

[International Operations]  
 $\alpha$  (Peak Hour Ratio)

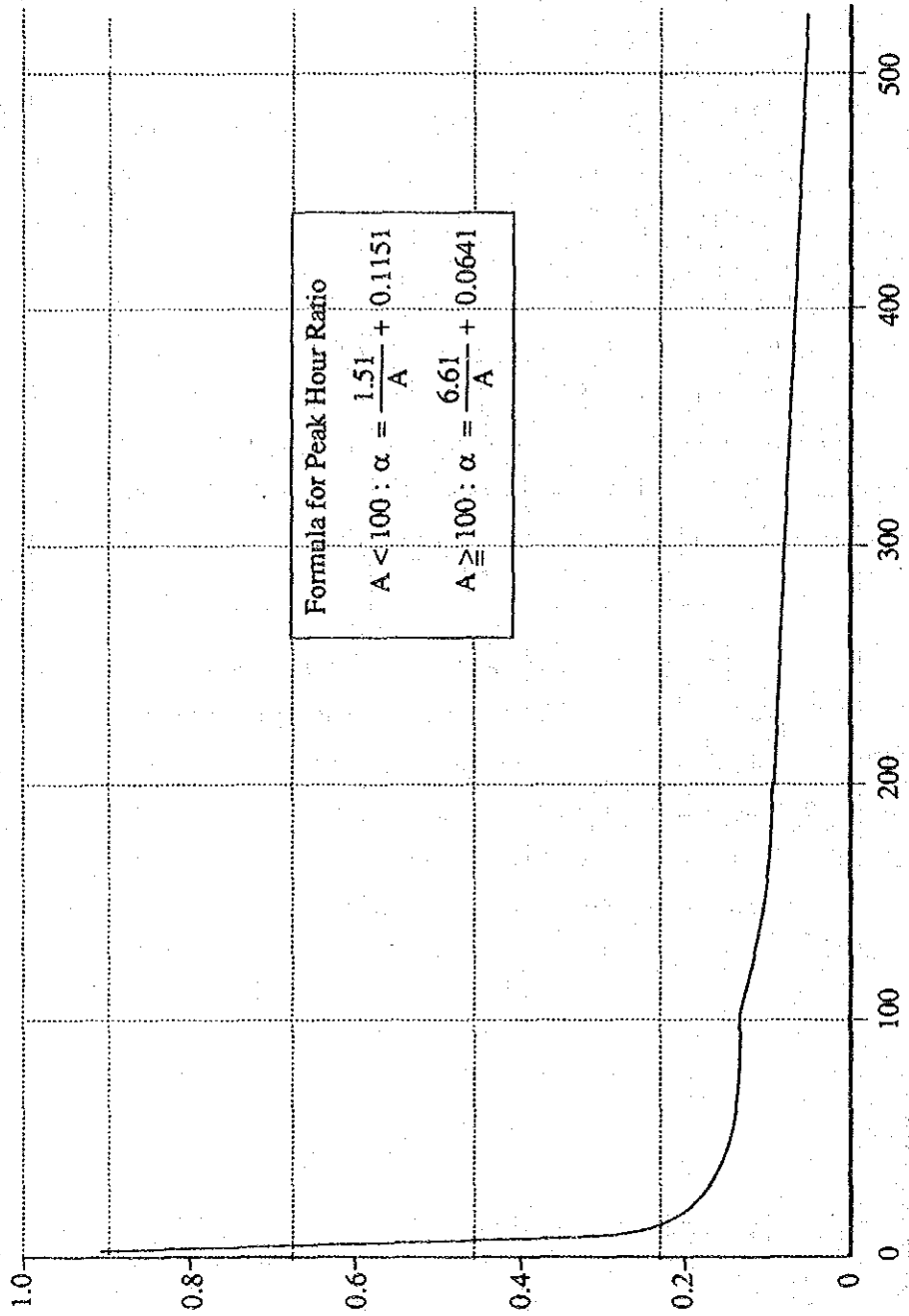


Formula for Peak Hour Ratio

$$\alpha = \frac{1.05}{A} + 0.114$$

A (Number of Take-offs and Landings per Day)

[Domestic Operations]  
 $\alpha$  (Peak Hour Ratio)



A (Number of Take-offs and Landings per Day)

## 5. Estimate of Apron Berth for 2000

For the basis of data the requirement of apron berths for the estimated annual passengers of 278,000 in the year 2000 has been calculated as follows:

### 5.1 Basic Parameter

The basic parameter applied herein is summarized as follows:

- a) Peak Day Factor : 1/270 (0.003704)
- b) Peak Hour Factor : 0.25
- c) Load Factor (L.F.) : Domestic 60%  
International 50%

### 5.2 Operations (Arrival and Departure) per Aircraft

Passenger Composition with A/C Type Q (Seat)	Annual Passenger P Total x Q	Annual Operation $\delta$ P/seat/L.F	Peak Day Factor $\beta$ Day/month	Peak Day Operation A $\delta \times \beta$	Peak Hour Factor $\alpha$ Hour/day	Peak Hour Operation R A x $\alpha$
[International]						
A310 5.4% (210)	15,000	143	1/270	1 (0.53)	0.25	0.3
B737 1.8% (90)	5,000	111	1/270	1 (0.41)	0.25	0.3
[Domestic]						
B737 46.4% (90)	129,000	2,389	1/270	8 (8.85)	0.25	2.0
DHC 13.9% (36)	38,700	1,759	1/270	6 (6.51)	0.25	1.5
G.A 32.5% (13)	90,300	11,287	1/270	42 (41.80)	0.25	10.5
<b>Total</b>	<b>278,000</b>	<b>15,689</b>		<b>58 (58.10)</b>	<b>0.25</b>	<b>14.6</b>

### 5.3 Required Number of Apron Berths (Peak Hour) for International and Domestic Carriers

Aircraft Type International & Domestic	Peak Hour Arrival B = R/2	Occupancy Time (min.) F	No. of Berth per Aircraft E = BxF/60x1.2	Planned No. of Berth	Extra Berth H	Required No. of Berth K
A310	0.15	70	0.21	1	0	1
B737	1.15	45	1.03	1	0	1
DHC8	0.75	45	0.67	1	0	1
G.A.	5.25	30	3.15	3	0	3
Total :				6	0	6

### 6. Estimate of Apron Berth for 2010

On the basis of data, the required apron berths for the estimated annual passengers of 497,000 in the year 2010 has been calculated as follows:

#### 6.1 Basic Parameter

The basic parameter applied herein is summarized as follows:

- a) Peak Day Factor : 1/280 (0.003571)
- b) Peak Hour Factor : 0.20
- c) Load Factor (L.F.) : Domestic 60%  
International 50%