GOVERNMENT OF WESTERN SAMOA

BASIC DESIGN STUDY ON THE CONSTRUCTION PROJECT FOR TERMINAL FACILITIES OF FALEOLO INTERNATIONAL AIRPORT

FINAL REPORT

JULY 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF WESTERN SAMOA
BASIC DESIGN STUDY ON THE CONSTRUCTION PROJECT FOR TERMINAL FACILITIES OF FALEOLO INTERNATIONAL AIRPORT FINAL REPORT

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PREFACE

In response to the request of the Government of Western Samoa, the Government of Japan decided to conduct a Basic Design Study on the Construction Project for Terminal Facilities of Faleolo International Airport and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Western Samoa a study team headed by Mr. M. Kashimura from March 23 to April 7, 1985, and a study team headed by Mr. M. Kikuta from June 12 to 25, 1985.

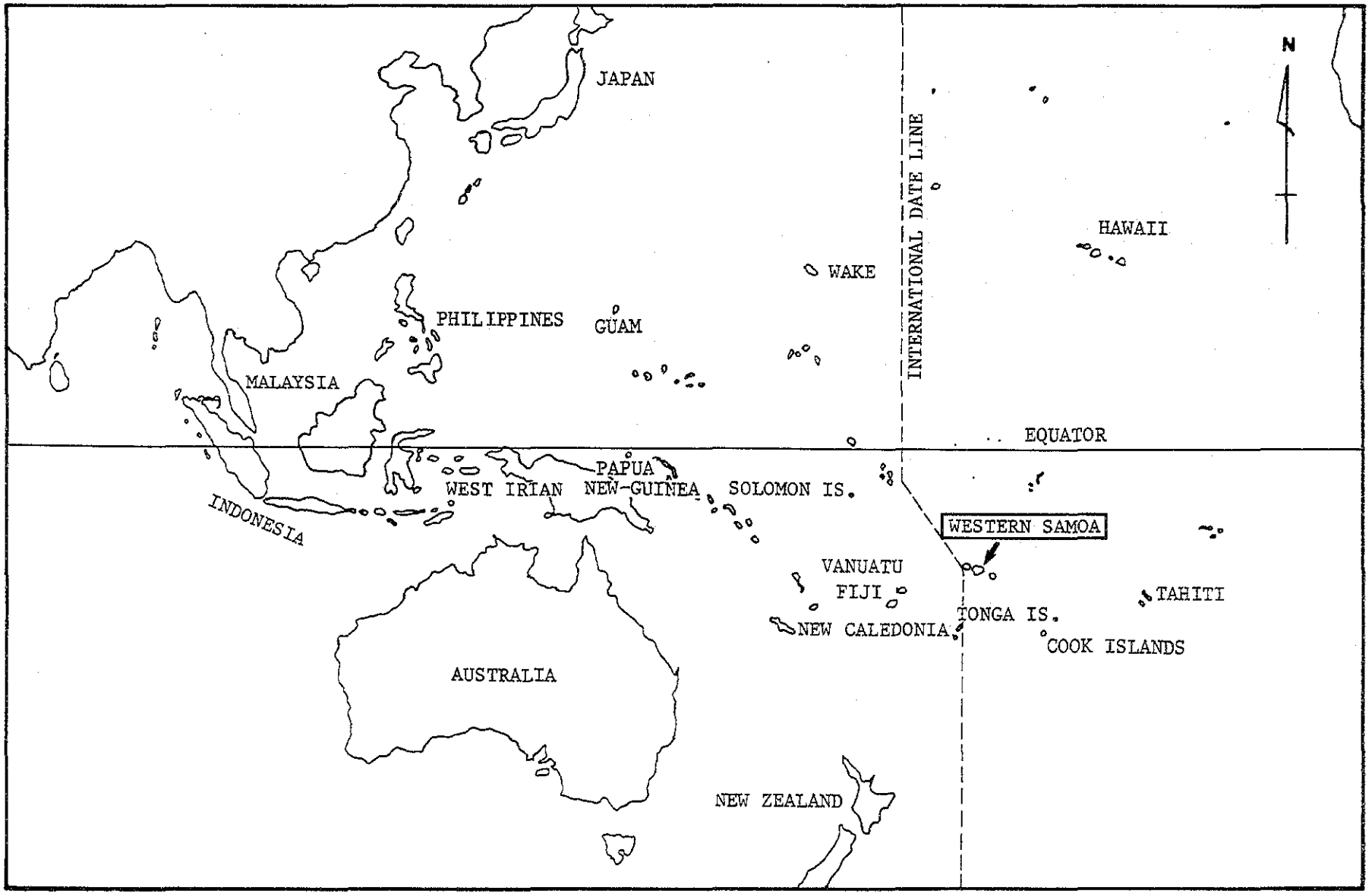
The teams had discussions on the Project with the officials concerned of the Government of Western Samoa and conducted a field survey in Apia. After the teams returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

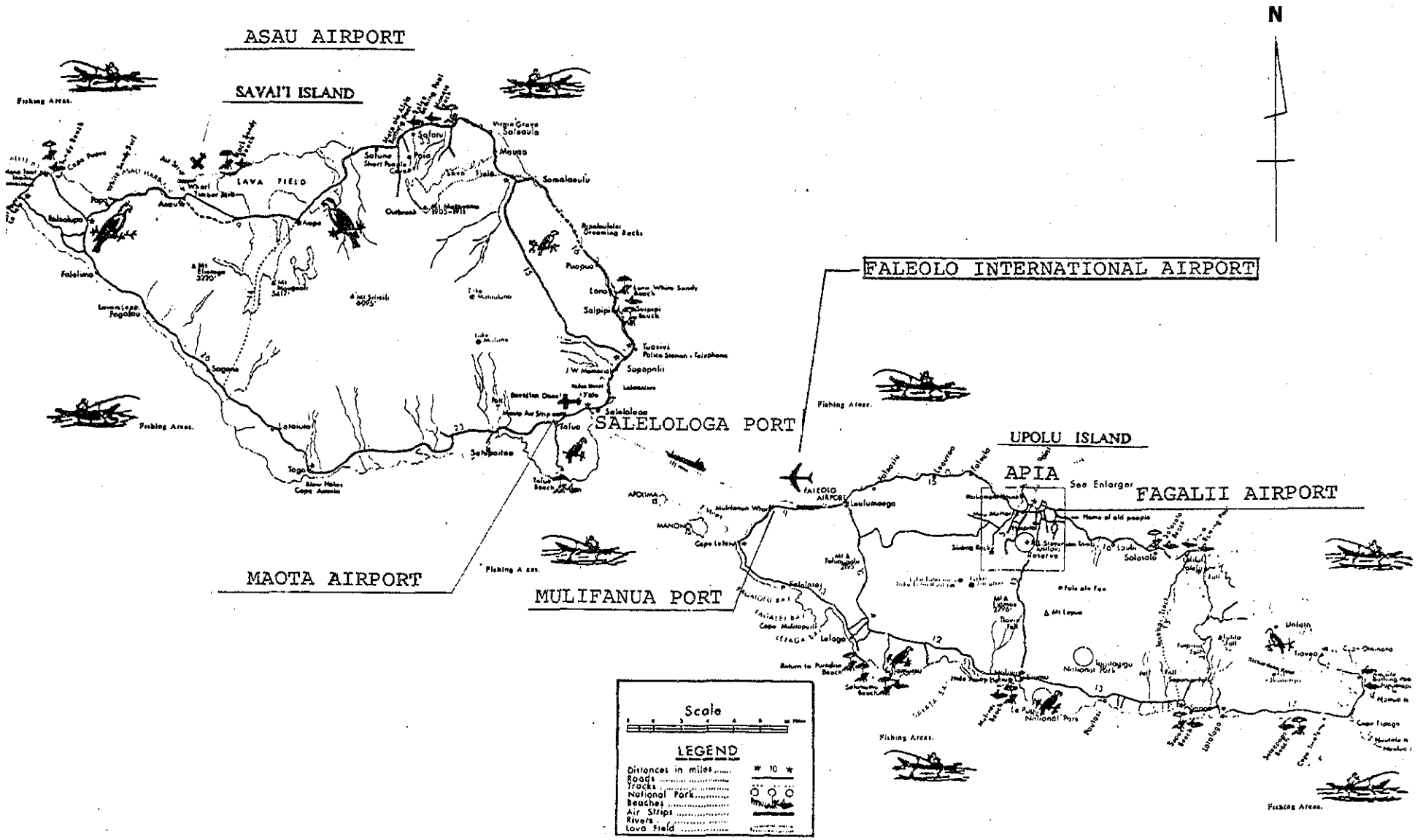
I wish to express my deep appreciation to the officials concerned of the Government of Western Samoa for their close cooperation extended to the teams.

July, 1985

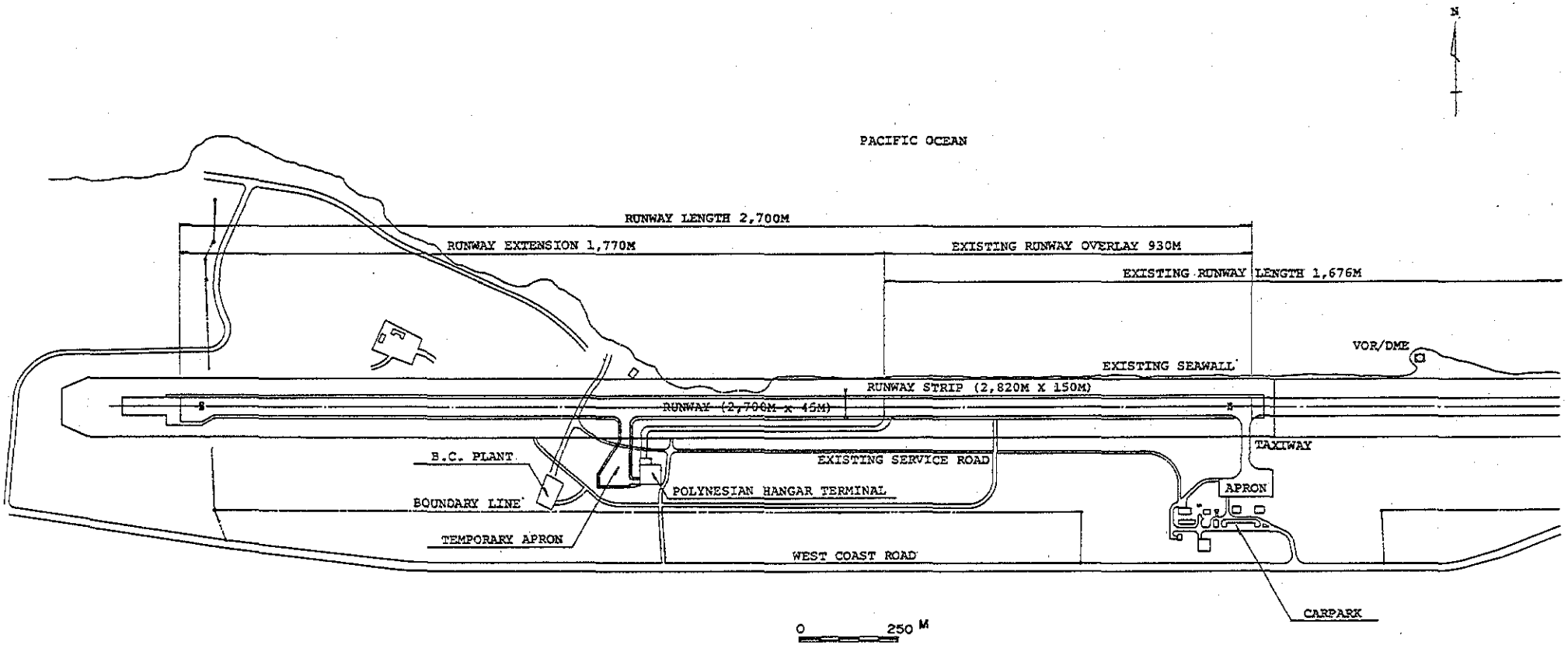
Keisuke Arita
President
Japan International Cooperation Agency



PROJECT LOCATION MAP-1



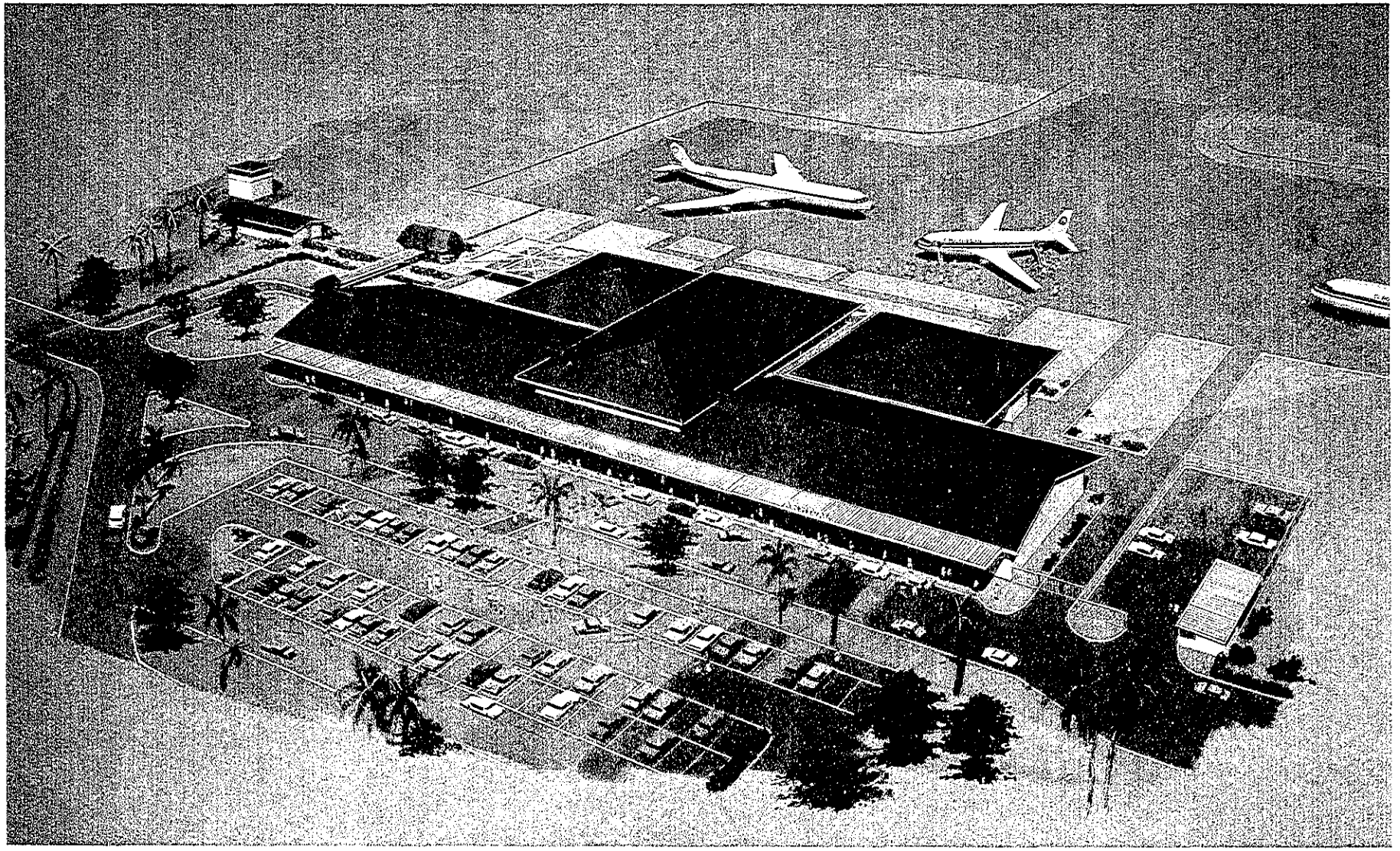
PROJECT LOCATION MAP-2



(III)

FALEOLO INTERNATIONAL AIRPORT

PROJECT LOCATION MAP - 3



PASSENGER TERMINAL OF FALEOLO INTERNATIONAL AIRPORT, WESTERN SAMOA

TABLE OF CONTENTS

SUMMARY

Western Samoa which is located in the geographical heart of Polynesia consists of two main islands, viz., Upolu and Savai'i and seven small islands. Due to the geographical characteristics, air transport plays an extremely important role in Western Samoa.

The Government of Western Samoa has listed five development objectives in Western Samoa's Fifth Development Plan (1985-1987), which aims to increase production particularly in agriculture, to move towards true economic independence and self-reliance, etc. In order to achieve these objectives, development of air transport which will open the way for the expansion of tourism and foreign investment, etc., is considered to be of vital importance and indispensable.

The Government of Western Samoa has, accordingly, been executing the development project of Faleolo International Airport in order to cope with the introduction of wide-bodied jet aircraft and the increasing air traffic. The development project includes extension of the runway, overlay of the existing runway and connecting taxiway, improvement of the aeronautical ground lights, upgrading of the power supply system, improvement of the airport drainage system, etc.

Concurrently, expansion of the passenger terminal building and car park, installation of an instrument landing system, and replacement of fire-fighting vehicles are judged to be of urgent importance in order that Faleolo International Airport will be able to function as one system composed of various airport facilities, and in order that it will efficiently meet the increasing air traffic demand.

The Government of Western Samoa requested the Government of Japan for grant aid to fund costs of terminal facilities, etc.

The Government of Japan, in response to the above request of the Government of Western Samoa, decided to conduct a basic design study on the construction project for terminal facilities of Faleolo International Airport, and entrusted the study to the Japan International Cooperation Agency (JICA). JICA dispatched a survey team to Apia from March 23 to April 7, 1985, discussed the contents of the requested grant aid with the Government of Western Samoa and carried out necessary site reconnaissance, data collection and analyses.

As a result, it was decided to establish 1993 as the planning target year and to expand and improve the existing terminal facilities so as to cope with the target traffic volume, viz., approx. 250,000 annual passengers. The passenger terminal building and car park are required to be expanded and improved to cater for wide-bodied jet aircraft such as B767 class. An instrument landing system is prerequisite and fire fighting vehicles are required to be replaced by new vehicles in order to ensure safe aircraft operation.

Cargo terminal building was excluded from the scope of the study based on the result of the discussions with the Government of Western Samoa for the reason that the anticipated freight volume can be handled by utilizing the idle building at the hangar area.

As a conclusion, it is recommended that the following be implemented in the construction project for terminal facilities of Faleolo International Airport by Japan's Grant Aid.

i) Expansion of terminal facilities
   - Expansion of existing passenger terminal building
   - Expansion of existing car park

ii) Installation of an instrument landing system

iii) Replacement of the two fire-fighting vehicles

It is estimated that 14 months will be required for the construction of the above facilities.

With the implementation of the mentioned project, safe and efficient operation of air transport will be ensured and maintained. As a result, the project will have impact on the development of the national economy of Western Samoa through opening the way for closer connections with foreign countries.

CHAPTER 1. INTRODUCTION

CHAPTER 1 INTRODUCTION

The Government of Western Samoa has listed programs and projects of the air transport sector in Western Samoa's Fifth Development Plan (1985-1987). The programs and projects are to continue the runway extension project, to expand the existing passenger terminal building, to construct a freight building, and to establish efficient administration of civil aviation matters.

The Government of Western Samoa requested the financial assistance from the Government of Japan to fund costs for terminal facilities, freight building, etc.

The requested financial assistance included the following:

i) Extension and alterations to the terminal building and ancillary facilities

ii) Provision of freight handling buildings, cool rooms, etc.

iii) Provision of instrument landing system

iv) Upgrading of fire fighting vehicles

In response to the request of the Government of Western Samoa, JICA dispatched to Apia a study team headed by Mr. M. Kashimura, Director, Regional Airport Administration Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport from March 23 to April 7, 1985. The study team discussed with the officials of the Government of Western Samoa and conducted surveys on the following items:

1) Background of the request for financial assistance

2) Scope of work to be covered by the financial assistance of Japan

3) Contents of other financial assistance already funded by foreign countries

4) Site reconnaissance and preliminary topographic survey

5) Operation and maintenance program of the airport

6) General conditions of Western Samoa

7) Existing conditions of Faleolo International Airport

8) Progress of the construction work at Faleolo International Airport

9) Traffic survey in the existing passenger terminal building

10) General construction conditions

The Minutes of Discussions on the basic design study were exchanged between the survey team and the Govenment of Western Samoa during the field survey and are attached in Appendix C for reference.

CHAPTER 2. BACKGROUND OF THE PROJECT

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2.1 General Description of Western Samoa

2.1.1 Nature and Society

In 1962, Western Samoa which had been a United Nations trusteeship under the administration of New Zealand, gained its full independence. Western Samoa is located at about 13°45'S latitude and about 172°W longitude. It lies about 2,900km northeast of New Zealand, about 1,300km east of Fiji and about 1,100km north of Tonga.

Western Samoa consists of island made up of volcanic rock and coral reefs. It abounds in fresh water. Most of the territory is suitable for cultivation. The total land area of the country is about 2,934km^2. Savai'i Island is the largest island (1,700km^2) and Upolu Island, the second largest (1,100km^2). These two islands occupy 95% of the land area of the country.

Western Samoa is in the tropical climate zone. The mean daily temperature is about 27°C, with the mean daily maximum temperature being about 30°C. During the trade wind season from May to November, the temperature is moderate and it is relatively comfortable. The rainy season lasts from December to April and hurricanes occasionally pass over the islands in this season causing damage to houses and agricultural crops. The annual amount of rainfall exceeds 3,000mm.

The population in 1984 was estimated to be 158,000, of which 99% live on Upolu and Savai'i Islands. The ratio of inhabitants of Upolu to Savai'i Islands is 7 : 3. The population of the capital, Apia in Upolu Island is approximately 33,000. About 90% of the total population are of Polynesian race.
The official languages are Samoan and English.

2.1.2 Economy

The gross domestic product (GDP) and per capita GDP of Western Samoa in 1983 was 85.4 million Tala (92 million US Dollars) and 538 Tala (579 US Dollars) in constant 1980 prices, respectively. In the GDP, the primary sector, i.e., agriculture, forestry, fisheries and subsistence income occupied about 50 percent.

The agricultural products which in order of value are cocoa, taro, copra, timber and banana accounted for 80-90 percent of the export value in 1983.

The major manufacturing industries which include lumbering, tobacco production, beer brewing, match and soap production occupied only 7 percent of the GDP.

2.2 Existing Transport Other Than Air

2.2.1 Road Transport

The main roads including the road between Apia and Faleolo Airport in Upolu Island have been almost all paved.

The south coast road between Saleologa and Asau on Savai'i Island has been completely paved, while the northeast road has a few unpaved portions. The total length of pavement of the main roads is approximately 230km, while the total length of the unpaved portions is approximately 180km.

Public buses run regularly between the main destinations on each island, and serve as an important transportation means for the islanders. Taxis, microbuses and rental cars are available in Apia City. The number of cars registered is 3,600 in Upolu Island and 400 in Savai'i Island. Approximately 2,200 of registered trucks play an important role for inland transportation of commodities. There are no railway facilities in Western Samoa.

2.2.2 Sea Transport

Main ports are Apia Port (international trade), Asau Port (lumber shipment), Salelologa Port (ferry base on Savai'i Island) and Mulifanua Port (ferry base on Upolu Island).

Since Western Samoa is an island country, transportation of such commodities as agricultural products, imported goods, general goods and movement of persons between the two main islands (11.7 nautical miles) largely depends on sea transport.

Due to the development of Savai'i Island, transport by ferries between Mulifanua Port and Salelologa Port has increased remarkably over the past few years. In 1980, the passengers and cars transported by ferries were approx. 76,800 passengers and approx. 8,160 cars respectively. After four years (1984), these numbers increased to approx. 120,600 passengers and approx. 14,400 cars.

The average annual increase of passengers and cars transported by ferries were 15,000 passengers/year and 1,700 cars/year, respectively.

2.3 Existing Air Transport

2.3.1 Airports

There are four airports in Western Samoa which include Faleolo International Airport for international and domestic services, and three airports (Fagari'i, Maota, Asau) for domestic services. Faleolo and Fagari'i airports are located on Upolu Island, and Maota and Asau airports on Savai'i Island.

The runways of the three domestic airports are made of compacted coral or grass field and small aircraft such as Nomad 22, Britten Norman Islander are operated.

2.3.2 Air Routes and Airline Companies

Figures 2.3.1 and 2 show international air routes and domestic air routes, respectively. At present, five international airline companies i.e., Polynesian Airlines (national flag carrier of Western Samoa), Air New Zealand, South Pacific Island Airways, Air Pacific and Air Nauru are operating at Faleolo International Airport. Only Polynesian Airlines serves domestic routes. Air Samoa Limited and Samoa Aviation Limited operated domestic services in the past, but were absorbed into Polynesian Airlines. Outline of airline companies is summarized hereinafter.

(1) Polynesian Airlines (PAL)

PAL is a national flag carrier of Western Samoa. PAL commenced operations in 1959 and Ansett airlines of Australia took over its management in 1982. PAL has four aircraft, viz., one each of B737-200, Nomad 24, Nomad 22 and Britten Norman Islander.

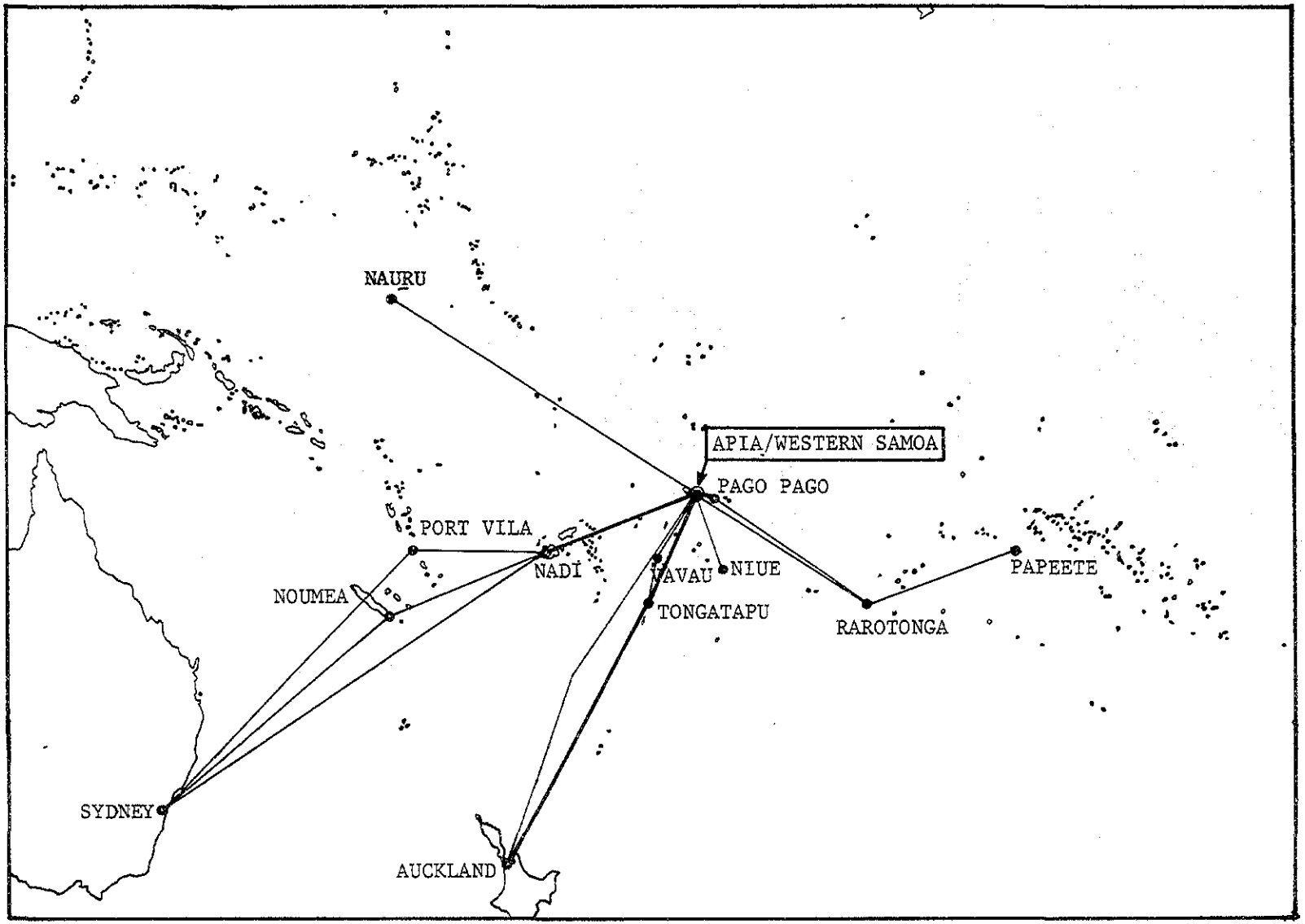
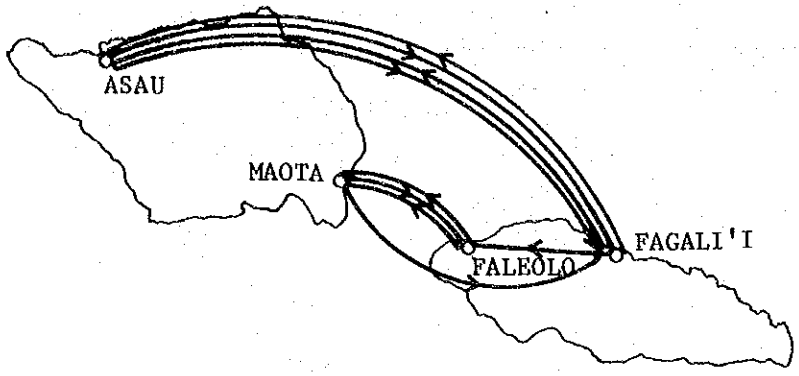
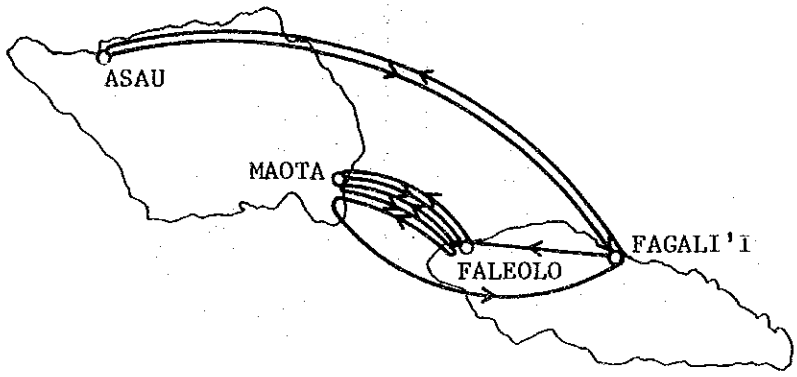


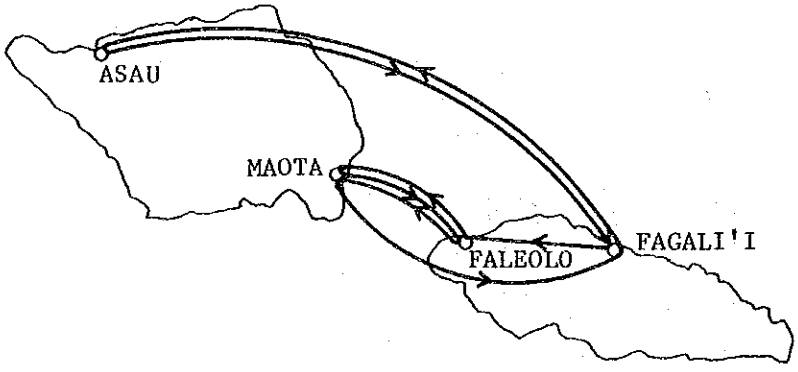
Fig.2.3.1 International Air Routes



Four flights daily on MON., WED. and FRI.



Six flights daily on TUE. and THU.



Four flights daily on SUN. and SAT.

Fig. 2.3.2 Domestic Air Routes

There is a possibility for PAL to introduce B767-200 aircraft into Apia-Auckland route during the peak seasons (Christmas and new year) after the completion of the runway extension, the aircraft to be leased from Ansett. Ansett's largest aircraft is B767-200 with 211 passenger seats at present.

Ansett has strong desire to fly to Western Samoa in relation to their investment in the hotel business.

(2) Air New Zealand

Air New Zealand which is operating B737-200 in Faleolo International Airport ordered three B767s and the first B767 will be delivered in September, 1985. There is a possibility for Air New Zealand to introduce B767s into Apia-Auckland route during peak seasons.

(3) South Pacific Island Airways (SPIA)

SPIA which is a Honolulu-based airline company has four B707s and four DHC-6s. SPIA operates DHC-6 aircraft between Apia and Pago Pago at present. There is a possibility for SPIA to introduce B707 aircraft with 151 passenger seats into Faleolo International Airport when the runway extension is completed.

(4) Air Pacific

Air Pacific which is a company based in Fuji operates B737 aircraft on Apia-Nadi route.

(5) Air Nauru

Air Nauru which is the national airline of Nauru operates B737 aircraft on Nauru-Apia route.

2.3.3 Air Traffic Volume

(1) Annual Passengers

Table 2.3.1 shows the international air passengers. No statistics of domestic passenger and freight are available.

Table 2.3.1 International Air Passengers

Year	International Migration (Sea + Air)	Air Passengers	Share of Air Passengers in International Migration
	Pass.	Pass.	%
1977	116,767	N.A	-
1978	138,162	N.A	-
1979	160,651	N.A	-
1980	167,321	120,655	72.1
1981	175,800	135,057	76.8
1982	156,719	123,480	78.8
1983	150,713	112,787	74.8
1984	166,900	125,675	75.3

(2) Aircraft Movements

Table 2.3.2 shows international aircraft movements (weekly movements as of April 1985) in Faleolo Airport and type of aircraft operated.

Table 2.3.2 Weekly Aircraft Movements

Air Route (From/to Faleolo)	Aircraft/Flights/Week	Airlines
Nadi	B737 5 Flights/Week	Polynesian Airlines
	B737 2 "	Air Pacific
Auckland	B737 4 "	Polynesian Airlines
	B737 4 "	Air New Zealand
	B737 2 "	Air Pacific
Pago Pago	B737 2 "	Polynesian Airlines
	B737 3 "	Air Nauru
	N24 78 "	Polynesian Airlines
	DHC6 58 "	South Pacific Island Airways
Others	B737 10 "	
	N24 2 "	
Total	170 Flights/Week (B737 : 32 Flights/Week)	

Note. Seating Capacity B737 : 105-113 Seats
N24 : 15 Seats
DHC6 : 16 Seats

2.4 Existing Condition of Faleolo International Airport

2.4.1 General

Faleolo Airport is Western Samoa's International Airport located 32km from Apia and connected with Apia by the main West Coast Road which was upgraded and sealed when the airport was constructed.

The first land airport development at Faleolo was the establishment of a wartime airfield by the United States Marine Corps. The military airfield consisted of a 1,525m runway constructed with scoria pavements and grass surfacing together with dispersed light enclosures and administrative and other buildings. After the war the airfield was used for civilian traffic without any major upgradings.

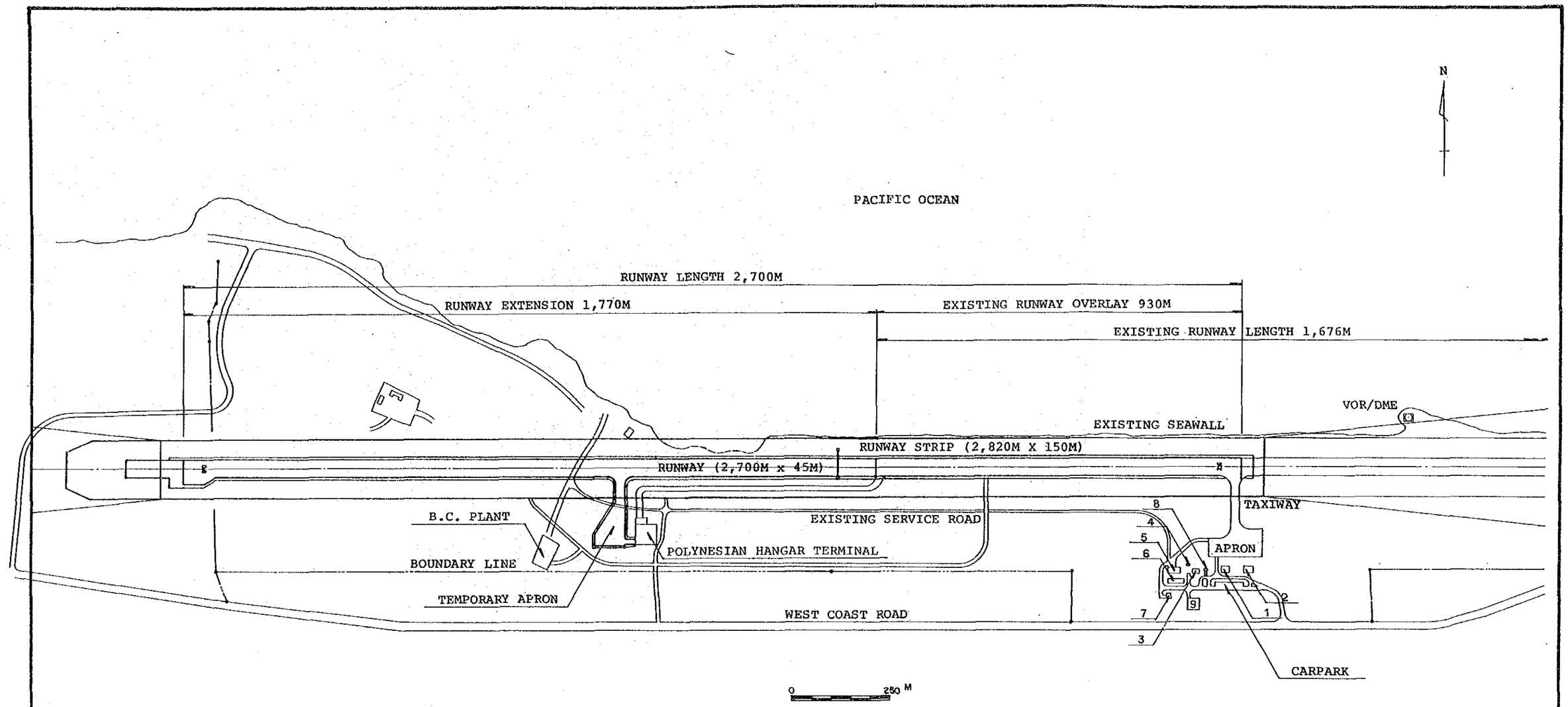
Between 1969 and 1973, the airport was reconstructed with a new runway (1,676m long) adjacent to the old grass strip, and new terminal facilities complete with all major services.

The existing runway of 1,676m length, however, imposes weight restriction even on B737-200 aircraft operating between Apia and Auckland. Given the poor condition of the runway in both length and strength, the Government of Western Samoa decided in 1983 to embark on an airport extension project in order to cope with the increasing air traffic demand and introduction of wide-bodied jet aircraft expected in the near future.

The runway extension which is to extend 1,770m to the west of the existing runway (1,676m) and to utilize 930m of the existing runway by re-surfacing has already been undertaken by the Australian Government. The total length of the extended runway will be 2,700 meters.

The existing passenger terminal building is insufficient for the present demand and will not be able to cope with changes of aircraft size and increase of air traffic demand in future. Accordingly, it is of urgent need to expand the capacity of the passenger terminal building concurrently with the runway extension.

The existing airport layout and outline of the airport facilities are shown in Figs. 2.4.1 and 2, and Table 2.4.1, respectively. The existing conditions and problems of the major facilities are summarized hereinafter.

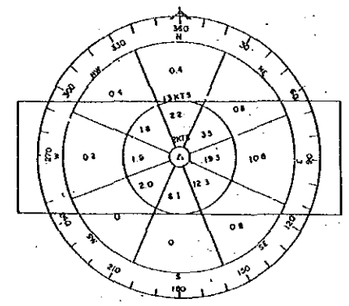


BASIC DATA TABLE	
RUNWAY DATA	
EFFECTIVE RUNWAY GRADIENT (IN %)	0.59% *
WIND COVERAGE (IN %)	20KT:99% 13KT:98%
INSTRUMENT RUNWAY	NOT APPLIED
PAVEMENT STRENGTH	PCN 50/F/A/N/T*
APPROACH SURFACES	1: 40
LIGHTING	RWYL
MARKING	ALL WEATHER
NAVIGATIONAL AIDS	VASIS

* : Figures after Runway Extension.

BASIC DATA TABLE	
AIRPORT DATA	
AIRPORT ELEVATION	2.5M
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT.13°49'S LON.172°00'W
AIRPORT AND TERMINAL NAVAIDS	VOR/DME
AIRPORT REFERENCE TEMPERATURE	

BUILDINGS	
NO.	STRUCTURE
1	DEPARTURE TERMINAL BUILDING
2	ARRIVAL TERMINAL BUILDING
3	ADMINISTRATION BUILDING
4	CONTROL TOWER
5	CRASH FIRE AND MAINTENANCE BUILDING
6	MAINTENANCE BUILDING
7	POWER CENTRE
8	V.I.P FALE
9	FUEL COMPOUND



SOURCE:
PERIOD: 1951 - 1970
20KTS CROSS WIND COVERAGE : 99 %
13KTS CROSS WIND COVERAGE : 98 %
CALM (0-2KTS) = 37.9 %

Fig. 2.4.1 Existing Layout of Faleolo International Airport

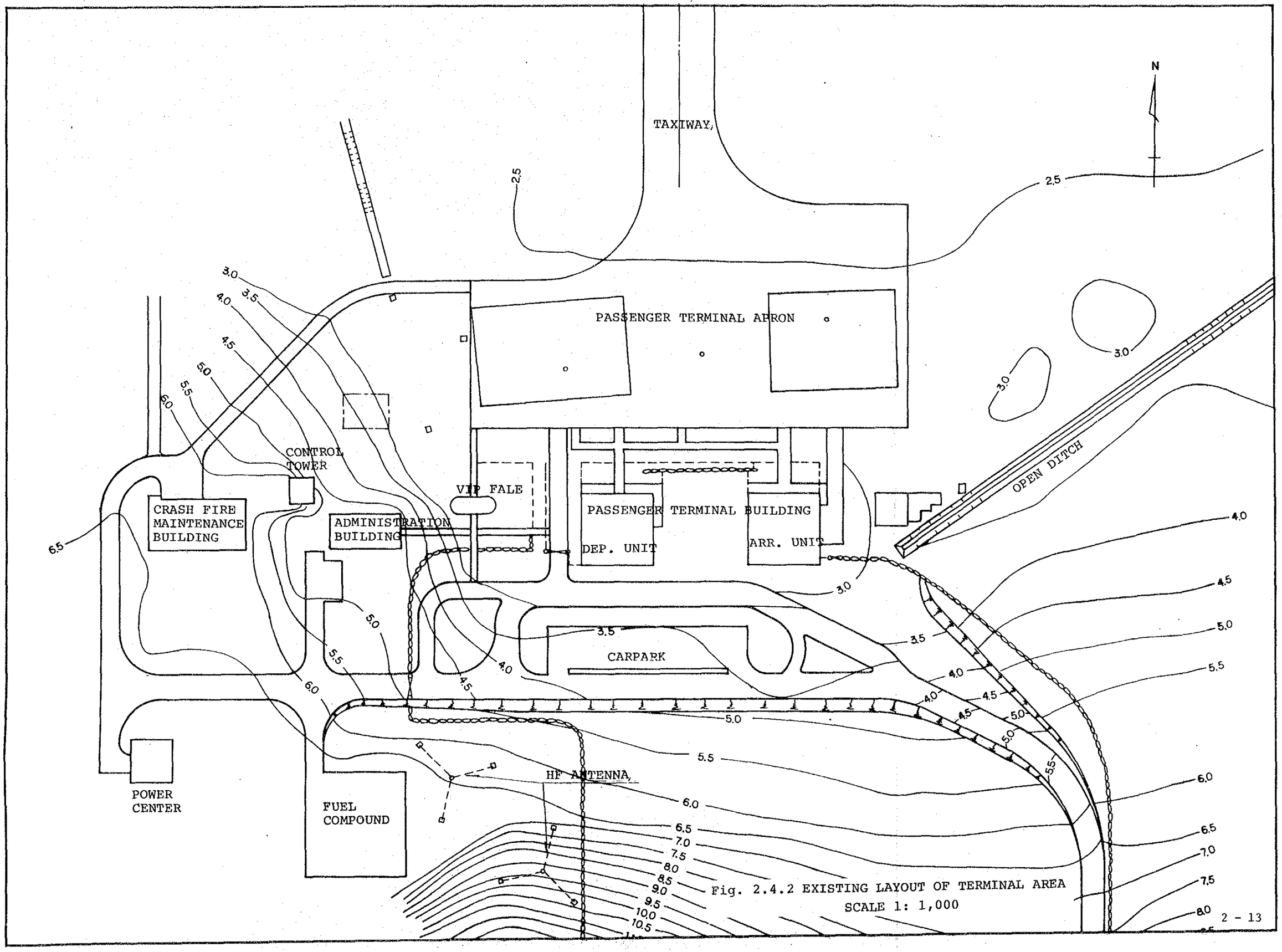


Fig. 2.4.2 EXISTING LAYOUT OF TERMINAL AREA
SCALE 1: 1,000

Table 2.4.1 Existing Airport Facilities at Faleolo International Airport (as of March 1985)

"X" indicates services provided.

Country	Name of Airport	Int/DOM ICAO CODE	Commencement of Services	Total Area of A/P	Aerodrome Ref. Point	A/P Elevation	R/W Bearing	Aerodrome Ref. Temperature	Operation Hour	Seasonal Availability
Western Samoa	Faleolo International	Int 4 C	1973	- ha	13° 49' S 172° 00' W	11 feet	089°/269°	- °C	24 H	all seasons

Note:
Reconstructed between 1969 and 1973
Operating agency : CAD

City/Town			Transportation			Wind Coverage	Minimum Meteorological Conditions	Runway	Approach Direction	Approach Procedure	Jet		Turboprop	
Name	Population	Distance to A/P	Railway	Taxi	Bus						D.H.	VIS	D.H.	VIS
Apia City Upolu Island	35 thousand 120 thousand	32 km	N.A	x	x	99% (20KT) 98% (13KT)		08/26	RWY08 RWY26	NDB/DME	470 ft	1500m*1		
								08/26	RWY08	VOR/DME	480 ft	1500m*1		

Note:
*1 Day operation.
(Night Operation 4,000 m)

Navigation Aids

Radio

	NDB	VOR	DME	TACAN	ILS	ASR	PAR	SSR	ARTS	ASDE	HF	VHF	UHF	ITS	DF	ITV	TTY	AFTN	
Existing	x	x	x									x					x		
Plan																			

Lightings

	ALS	SFL	SALS	ALB	AGL	CGL	VASIS	REIL	RWYL	RWTL	
Existing							x	x	x	x	
Plan											

	RWCL	ARWTL	ORL	DML	TWL	TWCL	TGL	ABN	WDIL	AFL	
Existing					x			x	x	x	
Plan											

Meteorological Facilities

R/W Surface sensors	x
Weather facsimile	
ART Receiver	
Radio sonde	
Weather radar	
VOLMET broadcast	

Note:
Ceilometer provided.

Basic Facilities

		Size	Pavement	Note
Runway Strip		2,254 x 150	-	Non-Instrument
Runway		1,676 x 45	Asphalt	To be extended to 2,700m
Taxiway		-	Asphalt	
Apron	Design Aircraft	No. of Stands	Pavement	Area(m^2) / Parking Configuration
	B737	3	Asphalt	10,290 / Self-maneuvering

Flight Services

Int'l /Dom	Major Air Route	Name of Airline	Type of Aircraft	No. of Flight week	Note
Int'l	Nadi	PH	B-737	5 weekly	
		FJ	B-737	2 weekly	
	Auckland	PH	B-737	4 weekly	
		TE	B-737	4 weekly	
		FJ	B-737	2 weekly	
	Pago Pago	PH	B-737	2 weekly	
		PH	N24	78 weekly	
		ON	B-737	3 weekly	
		HK	DHC-6	58 weekly	
	Others		N-737	10 weekly	
			N24	2 weekly	
Dom.	Maota/Fgalii/Asau	PH	N22	32 weekly	

Other Facilities

	Size	Structure	Note
Roads	7.2 m		
Car Park	750 m^2		33 Parking Lots
Pax.T.Building	980m^2	Steel Structure	Public Space 600m^2
Cargo T.Building	Nil		
Admin. Building	220 m^2		
Control Tower	25 m^2, H=13m		
Fire Station	465 m^2		15,800 ℓ
P.O.L.	102 kℓ		Hydrant
Power Center	132 m^2		

Statistics of Air Traffic

	1980	1981	1982	1983	1984
International Pax.	120,655	135,057	123,480	112,787	125,675
Dom. Pax.	N.A	N.A	N.A	N.A	N.A
*2 Note					
No. of Landings & Take-offs	14,421	14,282	13,614	11,706	9,461
Annual Freight Volume (tonnes)	N.A	N.A	N.A	N.A	N.A
No. of Annual Passengers					
Year	1980	1981	1982	1983	1984

*2 Note:
Include international, domestic, Non scheduled, Private club, Aerial work, Local civil, etc.

DATE △ BY

REVISION

Drawn by
Date

2.4.2 Runway and Taxiways

The existing runway dimensions are as follows :

Designation	:	08/26
Dimensions	:	1,676m x 45m
Pavement Strength	:	For B737 class
Operational Category	:	Non-Instrument

The runway extension is underway at present by the Australian aid and is scheduled to be completed in 1985.
The runway extension work includes the following :

Zone 1 Construction :
- Runway extension (1,770m) to the west of the existing ruwnay
- Construction of temporary apron (2 gate positions for B737 aircraft) and its connecting taxiway

Zone 2 Construction :
- Overlay work of the existing runway (930m long)
- Overlay work of the existing connecting taxiway

The extended runway length will be 2,700m and pavement strength is designed for B727 class aircraft. Since the subgrade CBR of more than 20 percent is obtained, the pavement is considered to have sufficient strength even for B747 class aircraft.

2.4.3 Runway Strip

The existing runway strip is 75m wide on each side of the runway center line and it is intended for non-instrument approach runway.

North side of the runway strip reaches to the sea shore.

2.4.4 Apron

The existing apron can accommodate two B737s and two DHC6s class aircraft simultaneously. The parking positions are made of concrete pavement and the periphery, of asphalt pavement. Aviation fuel is supplied to aircraft by three hydrant pits.

Uneven surfaces are observed on the apron and the drainage is very poor. Thus, rain forms many pools.

2.4.5 Passenger Terminal Building

(1) General

The existing passenger terminal building was constructed in 1971-1972, having handling capacity of 150 peak hour passengers. This terminal building consists of 2 units of buildings for arrivals and departures. Original floor area of each unit was $455m^2$ (21.3m x 21.3m) and minor expansion works were carried out later to meet the increase in number of passengers (refer to Fig. 2.4.3). The building has steel structures, the roofs of which are lightly sloped with wooden shingle roofings. Exterior of the buildings is suggestive of the traditional building style of Western Samoa. Interior of the building is designed to have effective ventilation taking the tropical weather conditions into account, and ceilings are not constructed except for limited rooms.

There is a covered-open space of approx. $600m^2$ covered by roof. This space which is designed considering the weather conditions of the region is used for greeters, well-wishers and observation deck. Baggage handling space is a steel structured building covered with slates.

Maintenance of the existing buildings is good. Structural steels are in good condition and they are expected to be used for a long period of time. Some leaks are seen at the edges of eaves of the roof.

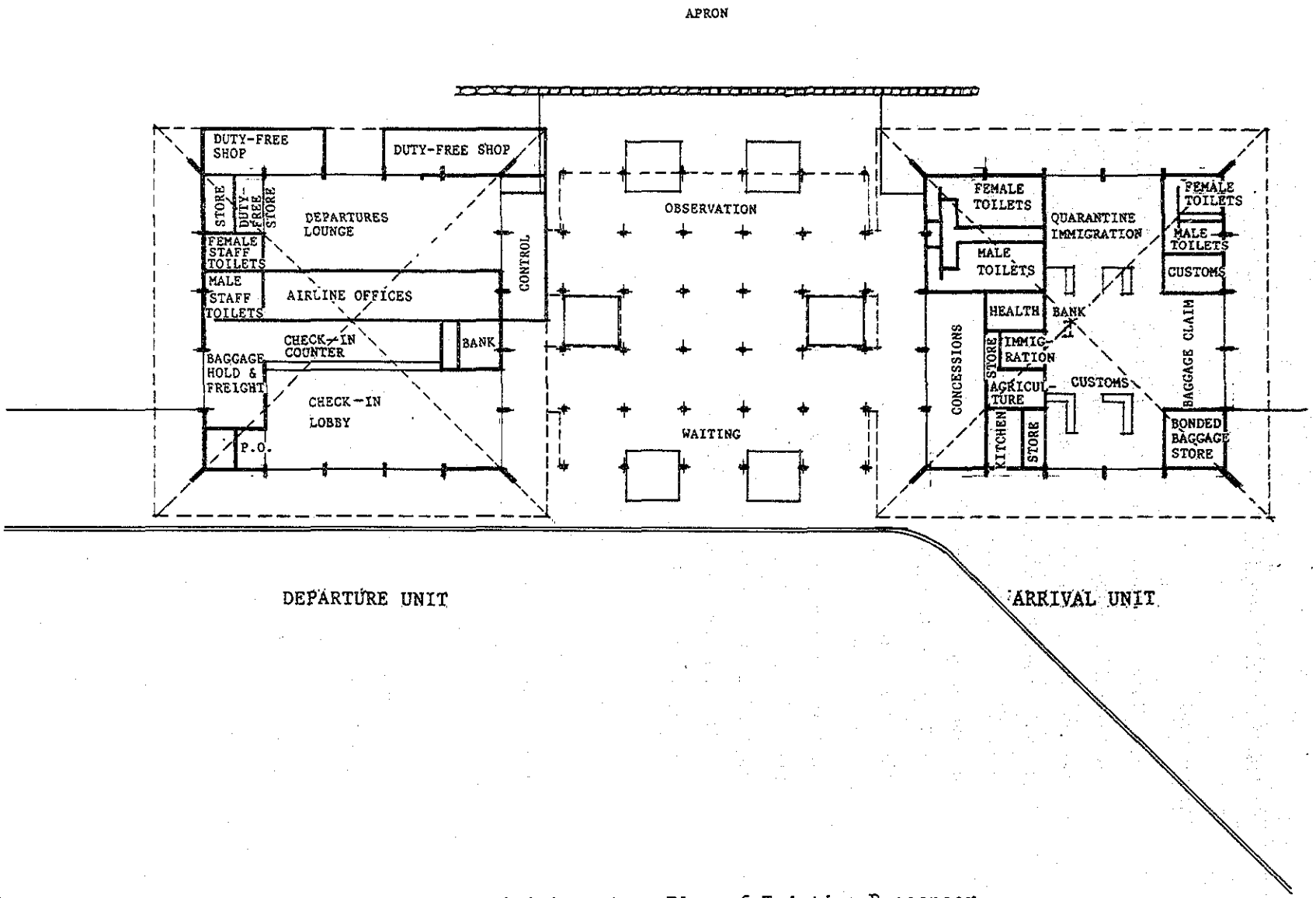


Fig. 2.4.3 Floor Plan of Existing Passenger Terminal Building

1 / 400

(2) Departure Unit

This building is more crowded than the arrival unit. In accordance with the custom of the country, passengers are accompanied with a large number of greeters (approx. 2.5 persons per passenger; data from the site survey), which causes congestion in the check-in lobby. Outbound immigration controls and security check of hand-carried baggages are carried out in a room of approx. $30m^2$(10m x 3m), where congestion is severe.

There are six check-in counters, a post office, a bank, and a cashier for payment of departure taxes in the check-in lobby.

There are four airline offices within a total floor area of approx. $63m^2$. One of those rooms was orginally designed as a V.I.P. lounge. Three rooms are occupied by Polynesian Airlines, and one by South Pacific Island Airways.

Departure lobby has a floor area of approx. $120m^2$ with 64 seats, where it is over-crowded with passengers at the time of departure of B737 (average seating capacity 110).

(3) Arrival Unit

Immigration controls, baggage claim, and customs checks are held in one space. Long eaves are constructed at the entrance of this building from the apron in order to protect passengers waiting in line from sunshine and rain during peak hours.

Movable desks are provided for immigation and customs checks, and the number of desks (1-3) to be used is decided in accordance with the number of passengers. Length of the table used for baggage claim is approx. 8m.

There is an exchange bank inside the baggage claim area.

There is a shop facing a covered-open space with a roof. A counter of approx. 12.5m length faces the covered-open space, and souvenirs and foods such as refreshments, ice cream, biscuits, etc. are sold. Take-out service of sandwiches and noodles is also available.

(4) Mechnical and Electrical Systems

a. Water Supply System

Departure terminal, arrival terminal and surrounding buildings and facilities are supplied with water from two elevated 43m^3 water tanks near the Power Center No. 1. The water pressure at a faucet in arrival terminal building was measured as 1.8kgf/cm^2. Originally these tanks were supplied by a borehole near the Fuel Compound in the site. Since this borehole has a narrow catchment area and also has a possibility of pollution by the effluent from septic tanks, these tanks are supplied at present by a 32mm PVC service pipe from the city main maintained by the Water Section of Public Works Department (PWD). Besides this service pipe, two more service pipes to the airport site are installed, one is a 75mm PVC to the Polynesian Airlines hangar area and the other a 50mm PVC to the marine training center area.

Water source of city water supply around the airport district is deep wells located across the West Coast Road opposite the Polynesian Airlines hangar and the water is distributed without any treatment. City main is installed along the mountain side of the West Coast Road.

Upgrading of city waterworks using new 500m^3 reservoir is now being planned by PWD which will be constructed in 4 or 5 years time. Meanwhile, the airport is to have its own water supply utilizing the above-mentioned existing PWD wells to avoid the interruption of water supply by electric power failure. Present pumping rates of these wells are 13.2 and 13.4 ℓ/s.

As no meters are installed on services for the airport, no water consumption data have been recorded. Water charge is calculated by the number of taps installed, or by meter readings when meters are installed. Charge by the number of taps installed is 8 Tala per tap per year with the maximum of 32 Tala, while charge by meter readings is 0.5 Tala per 1,000 gallons. 25% reduction is applied for payment within one month of becoming due for payment. In Western Samoa, at present, meters are installed for commercial facilities.

b. Drainage, Waste and Vent (DWV) System and Septic Tanks

Soil and wastewater from each building are discharged to septic tanks with digestion chamber, and the effluent is diposed through soak field.

c. Air Conditioning

Although the natural draft is mainly utilized, window-type air conditioners are installed in such enclosed rooms as Polynesian Airlines offices and the duty free shop office. Window-type coolers are installed under the elevated ceiling and exhaust heat is discharged in the open space under the roof.

d. Electrical supply System

Electricity for buildings and facilities in the terminal area is supplied from the Power Center NO. 1. Electricity to this power center is supplied with 3-phase, 3-wire, 22kV by Electrical Power Corporation (EPC) through a 22kV/415V, 100kVA transformer. Frequency is 50 Hz. EPC networks are installed along the mountain side of the West Coast Road as well as the city water main.

Airport is at the end of a 22kV spur feeder line and is subject to mains outage as well as voltage fluctuations. Power failures occur 4 to 5 times per month with duration of about 1 hour on average. The range of voltage fluctuates between 220V and 235V, and the fluctuation of frequency is negligible.

Although the existing generator capacity is 65kVA, within this year this generator is to be replaced by two (2) sets of new 125KVA generators by New Zealand aid considering the runway lighting and the terminal extension.

There is no contract demand system, and electricity charge is 0.28 Tala (25% reduction for earlier payment), there being no basic charge.

e. Telephone System

4 trunk lines are installed for the airport. 26 extension lines are connected to the PABX in the MDF room in the control tower base.

At present 24-channel UHF is under installation.

f. Fire Alarm System

Heat detector type fire alarm system is installed in closed area.

g. Fire Extinguishing System

Three portable fire extinguishers are installed, two in departure and one in arrival unit.

h. Materials

General materials used in plumbing, air-conditioning and electrical installations in terminal building are New Zealand or Australian products. Plumbing, air-conditioning and electrical materials available in town are also the same.

2.4.6 Car park

The existing car park can accommodate only 33 vehicles. In peak hours, parked cars overflow on the frontal road of the passenger terminal building. Taxis are also parked on the frontal road since no taxi-pool is provided. Thus, these parked cars on the frontal road disturb the smooth circulation of vehicles.

2.4.7 Fire Fighting Vehicles

The following four vehicles are provided for rescue and fire-fighting services at present.

- Rapid Intervention Vehicle (1 car)
- Major Vehicle (2 cars)
- Dry Chemical Unit (1 car)

The total amounts of extinguishing agents (both principal and complementary agents) are equivalent to the amounts required for Aerodrome Category 7, ICAO.

The largest aircraft presently operated at Faleolo Airport is B737-200 and the present Aerodrome Category is calculated to be 5 by the aircraft movements of consecutive three months. Thus, the existing amounts of extinguishing agents meet the present requirements.

The dry chemical unit and one (4,500ℓ water) of the two major vehicles are, however, extremely old as explained in Table 2.4.2 and no spare parts are available at present.

Table 2.4.2 Existing Conditions of Fire-Fighting Vehicles

(As of April, 1985)

Priority of Replacement	Vehicle	Outline/Capacity	Operated Years in Faleolo	Manufactured (Age)	Remarks
1	Dry Chemical Unit	International C-1600 Dry Chemical 2,000lbs (910kg)	1974 (11 years)	1969 (15 years)	- Operated in New Zealand approx. 5 years - No spare parts - No nitrogen gas for discharge is available in Apia - Aqueous foam is preferred
2	Major Vehicle (small one)	International ASW 160 Water : 1,000gal Foam (Aqueous film forming foam) = 50gal	1979 (5 years)	1949-1955 (25-30 years)	- Grant of New Zealand - Operated in New Zealand more than 20 years - Very old fire engine - No spare parts
3	Major Vehicle	Good fire engine/ Automatic Discharging Water = 2,500gal Aqueous foam = 250gal	1975 (10 years)	1975 Brand New Car	- Manual Operation is preferred (Difficult Maintenance) - Grant of New Zealand
4	Rapid Intervention Vehicle with full equipment	DODGE (Airfield Crash Truck, Manufactured by CHUBB FIRE SECURITY LTD, Middlesex, England) 220gal of pre-mixed water and foam, (discharge rate, 900ℓ/min) 50kg Carbon Dioxide	1982 (2 years)	1981-82 New	Grant of UNDP (US$120,000)

2.4.8 Financial Assistances Funded to Faleolo Airport Development

The financial assistances funded to Faleolo Airport development by foreign countries are outlined hereinafter.

(1) Australian Aid

Fund : A$4,000,000.-

Contents :

- Runway extension including site preparation and grading of runway strip and glide slope area
- Overlay of the existing runway
- Overlay of the existing taxiway
- Construction of temporary apron and its connecting taxiway

(2) New Zealand Aid

Fund : NZ$1,450,000.-

Contents :

- Improvement of aeronautical ground lights
- Upgrading of power supply system including emergency generators
- Improvement of airfield drainage system

(3) Canadian Aid

Fund : CAN$100,000.-

Contents : Ground Service Equipment, etc.

In addition, New Zealand regularly dispatches administrative and technical officials, and extends technical assistance towards administration of civil air transport and airport staff training through the New Zealand Bilateral Aid Programme.

CHAPTER 3. PROJECT DESCRIPTION

CHAPTER 3 PROJECT DESCRIPTION

3.1 Objectives

Western Samoa which is located in the geographical heart of Polynesia consists of two main islands and seven small islands. Due to the geographical characteristics, air transport plays an extremely important role in Western Samoa.

The major international air routes in Polynesian countries, however, center mainly on Fiji, American Samoa, Tahiti, etc., and wide-bodied jet aircraft are presently introduced into all these countries.

Feleolo International Airport, which is a gateway to Western Samoa is, however, insufficient in runway length and strength, and passenger terminal facilities. Thus, only short-haul international routes from/to Fiji, American Samoa, Tonga, New Zealand, etc., are presently established in Western Samoa, and the serviceability of Faleolo International Airport as a local airport will remain unchanged unless the necessary airport development is carried out to cope with introduction of wide-bodied jet aircraft.

The Government of Western Samoa wishes to provide and maintain the infrastructure and operational facilities necessary to ensure the safe, efficient and unrestricted operation of air transport, by which the Government expects to stimulate tourism, export/import, foreign investment, etc., and, as a result, to achieve Western Samoa's development objectives such as movement toward true economic independence and self-reliance, etc., listed in the Fifth Development Plan (1985-87).

Hence, the development project of Faleolo International Airport is considered to be of vital importance and indispensable.

The Government of Western Samoa has decided to embark on the development project. The project is underway at present and the Government also has a program to expand the existing apron. The project includes runway extension to 2,700m length, overlay of the existing taxiway, upgrading of aeronautical ground lights and power supply system, improvement of airfield drainage, etc.

It is, however, necessary to expand the passenger terminal building and car park, to install an instrument landing system, and to replace the fire-fighting vehicles coincidentally with the runway extension, improvement of taxiways and apron, etc., so that the airport functions as one complete system.

The existing passenger terminal building was constructed in 1972 for BAC-111 aircraft as a design aircraft. The existing passenger terminal building is insufficient for the present demand due to the current change of aircraft size and the increase of air traffic volume, and thus, it is of urgent importance to expand the capacity of the existing passenger terminal building and car park.

Installation of an instrument landing system is indispensable for wide-bodied jet aircraft anticipated after the runway extension in order to ensure safe aircraft operations.

It is considered that the development project of Faleolo International Airport will be completed when expansion of the passenger terminal building, installation of an instrument landing system and replacemet of fire-fighting vehicles are completely executed.

3.2 Evaluation of the Requested Financial Assistance

The requested financial assistance by the Government of Western Samoa covers the following :

i) Extensions and alterations to the terminal building and ancillary facilities.
ii) Provision of instrument landing system
iii) Upgrading of fire fighting vehicles
iv) Provision of cargo terminal building

3.2.1 Passenger Terminal Building and Ancillary Facilities

The existing passenger terminal building was constructed in 1972 coincidentally with BAC-111 aircraft as a design aircraft. The terminal building consists of two independent building units (departure unit and arrival unit) and the covered open area in between the two building units. Each unit has a floor area of approx. $455m^2$ and the covered open area approx. $600m^2$.

The passenger terminal building was designed to cope with 150 peak hour passengers. It is accordingly difficult to serve efficiently passengers generated by two B737 aircraft simultaneously. The congestion is extreme especially during peak seasons of Christmas and new year.

Hence, expansion of the existing passenger terminal building and car park is considered to be urgent in order to alleviate the congestion in the building and to cope with introduction of such aircraft as B767, B707, B727, etc., anticipated after the runway extension.

3.2.2 Instrument Lanidng System (ILS)

The installation of ILS at Faleolo International Airport is intended to ensure safe operations of modern aircraft (B767, A300, etc.) and large aircraft (B747, DC10, L1011, etc.), and to reduce operational routine work of flight crew.

Landing by auto-pilot using integrated flight system (flight director system) and ILS are standard procedures for both large and modern aircraft. ILS approach which is a standard procedure at international airport greatly reduces routine loads of pilots during the final approach stage when pilots are under extreme strain.

Among airports in the South Pacific Region which have a runway more than 2,500m long, there is no airport without ILS. For example, ILS is provided at international airports in South Pacific Region such as Pago Pago Airport in American Samoa, Nadi Airport in Fiji, Tahiti Airport in French Polynesia, Guam Airport in Mariana Islands, La Tontouta Airport in New Caledonia, Jacksons Airport in Papua New Guinea, etc.

Installation of ILS is considered to be one of the mandatory requirements for Faleolo International Airport in order to cater for future air traffic as a gateway to Western Samoa. Thus, it is considered urgent.

3.2.3 Fire Fighting Vehicles

The requested upgrading of fire fighting vehicles means replacement of the existing vehicles by new ones.

The total amounts of extinguishing agents carried by the existing four vehicles meet the amounts required for Aerodrome Category 7 of rescue and fire fighting services, ICAO.

The required Aerodrome Category (amounts of extinguishing agents) at present and in the planning target year (1993) are Category 5 and Category 6, respectively. Accordingly, the existing vehicles are satisfactory in terms of amounts of extinguishing agents.

The dry chemical unit and one of the major vehicles (water 4,500ℓ) have already exceeded their life expectancy and spare parts for them are no longer available. Replacement of these vehicles is considered to be necessary.

3.2.4 Cargo Terminal Building

There is no cargo terminal building at Faleolo International Airport. The major freight, which is taro at present, is handled at the side of the passenger terminal building.

The construction of a cargo terminal building should be decided upon ascertaining the increase of cargo traffic demand in future, because the presumed cargo volume (no statistics of air cargo are available) is low at present, and the existing building near the Polynesian Airline's hangar can easily be modified to a cargo shed.

3.3 Project Description

3.3.1 Review of Air Traffic Demand Forecast

(1) General

Air traffic demand forecasts are made separately for international passengers and domestic passengers. Various demand forecasts have been made so far in the previous study reports. Note*1
Since the obtained air traffic statistics and economic indices are limited, the following method is adopted:

1) International Passengers
International passengers can be divided broadly into Western Samoans and foreigners. With respect to Western Samoan international passengers, the future demand is forecast by regression analyses in which per capita GDP of Western Samoa is adopted as the explanatory variable.
As regards foreign international passengers, the future demand is forecast by regression analyses in which per capita GDP weighted by the share of passengers by nationality is adopted as the explanatory variable, since most of foreign international passengers are tourists.

Note*1. Previous study reports (only reports after 1980)

① FALEOLO AIRPORT DEVELOPMENT STUDY, TRAFFIC FORECAST. (1981)
Sir Alexander Gibb & Partners Australia
Consulting Engineers

② FALEOLO AIRPORT APPRAISAL STUDY (1982)
Prepared for and on behalf of the Australian Development Assistance Bureau, By the Department of Transport and construction

③ FALEOLO INTERNATIONAL AIRPORT EXTENSION PROJECT, EVALUATION REPORT (1984)
Pacific Corporate Services Limited, Western Samoa

2) Domestic Passengers

Since there are no past actual records on the domestic passengers, the present domestic passenger volume is estimated based on the flight schedule of Polynesian Airlines and seating capacity of aircraft. The future demand is forecast on the basis of the future annual growth rate estimated in the Previous Study. Note*2

3) Target Year

Target year of demand forecast is established to be the year 1993 (five years after completion of the construction) for this basic design and the year 2005 for evaluation on the future expansibility of terminal area.

(2) Projection of GDP

Real GDP of Western Samoa grew at an average annual rate of 2.6% from 1972 to 1978 and declined from 1979 to 1983.

For future GDP, average annual growth rate from 1985 to 2005 is estimated to be 4.0 percent taking into account the forecast of World Bank Note*3 and actual growth rate of GDPs in South Pacific region as shown in Table 3.3.1.

The projected GDP of Western Samoa is shown in Table 3.3.2.

Note *2: Faleolo Airport Development Study, Traffic Forecast.

Note *3: The Report of World Development, 1984 (World Bank)

Table 3.3.1 Projection of average annual growth rate of GDP

	1973 - 1979	1980 - 1985	1985 - 1995	Remarks
Developing Countries	5.2 %	2.8 %	4.7 - 5.5 %	World Bank
South Pacific Region				
Fiji	5.2 %			
Kiribati	4.2 %			
Solomons	3.7 %			
Vanuatu	0.6 %			
Western Samoa	2.6 %	-2.5 %	4 %	

Table 3.3.2 Projected GDP of Western Samoa

(unit in thousand Tala)

YEAR	GDP (1980 Price)	GDP (1972 Price)	Remarks
1972	66,411 *	29,454	Average annual growth rate (1972 - 1978): 2.6 % per annum
1978	77,000 *	34,151	
1979	94,564		
1980	89,322		
1981	84,248		
1982	82,885		
1983	85,405		
			Average annual growth rate (1983 - 1993): 4 % per annum
1993	125,000		
			Average annual growth rate (1993 - 2005): 4 % per annum
2005	200,000		

Source: Western Samoa's Fifth Development Plan, 1985 - 1987
Western Samoa's Fourth Development Plan, 1980 - 1984

Note*: Converted to 1980 constant price by the consumer price index.

(3) Projection of Population

The population of Western Samoa in the past 10 years (census from 1971 to 1981) is listed below. The average annual growth rate was 0.64 percent per annum.

Year	Population	Average annual growth rate	
1971	146,627	0.72% p.a.	0.64% p.a.
1976	151,983	0.57% p.a.	
1981	156,349		

In "Western Samoa's Fifth Development Plan (1985-1987)" the Government of Western Samoa estimates the population from 1981 to 1987 based on the assumptions that the average annual growth rate of 0.6 percent will remain constant.

In this study, the average annual growth rate of population is assumed to be 0.6 percent per annum and to continue to the year 2005.

(4) Annual International Passengers

International passengers can be divided broadly into Western Samoan and foreigners.

These two groups are different in purpose of travel and have shown significantly different rates of growth.

It is accordingly more appropriate to forecast them separately from each other.

a. Western Samoan International Passengers

Western Samoans travel by air mainly to visit relatives followed by recreation, business, new employment and study. Visits to relative had the largest share of 37% in 1983.

From these circumstances, Western Samoan international passenger volume can be explained by the level of economic activities i.e., per capita GDP of Western Samoa. Therefore, the future demand is forecast by regression analyses in which per capita GDP of Western Samoa is adopted as the explanatory variable.

The correlation equation for Western Samoan international passengers is as follows:

$$Pw.s = 209{,}568 \frac{GDP}{N} - 62457. \quad \gamma = 0.81$$

Pw.s : Western Samoan International Passengers (passengers)

$\frac{GDP}{N}$: GDP of Western Samoa (thousand Tala/person)

γ : Correlation Coefficient

Fig. 3.3.1 shows the projected Western Samoan international passengers in comparison with the forecasts of the previous studies.

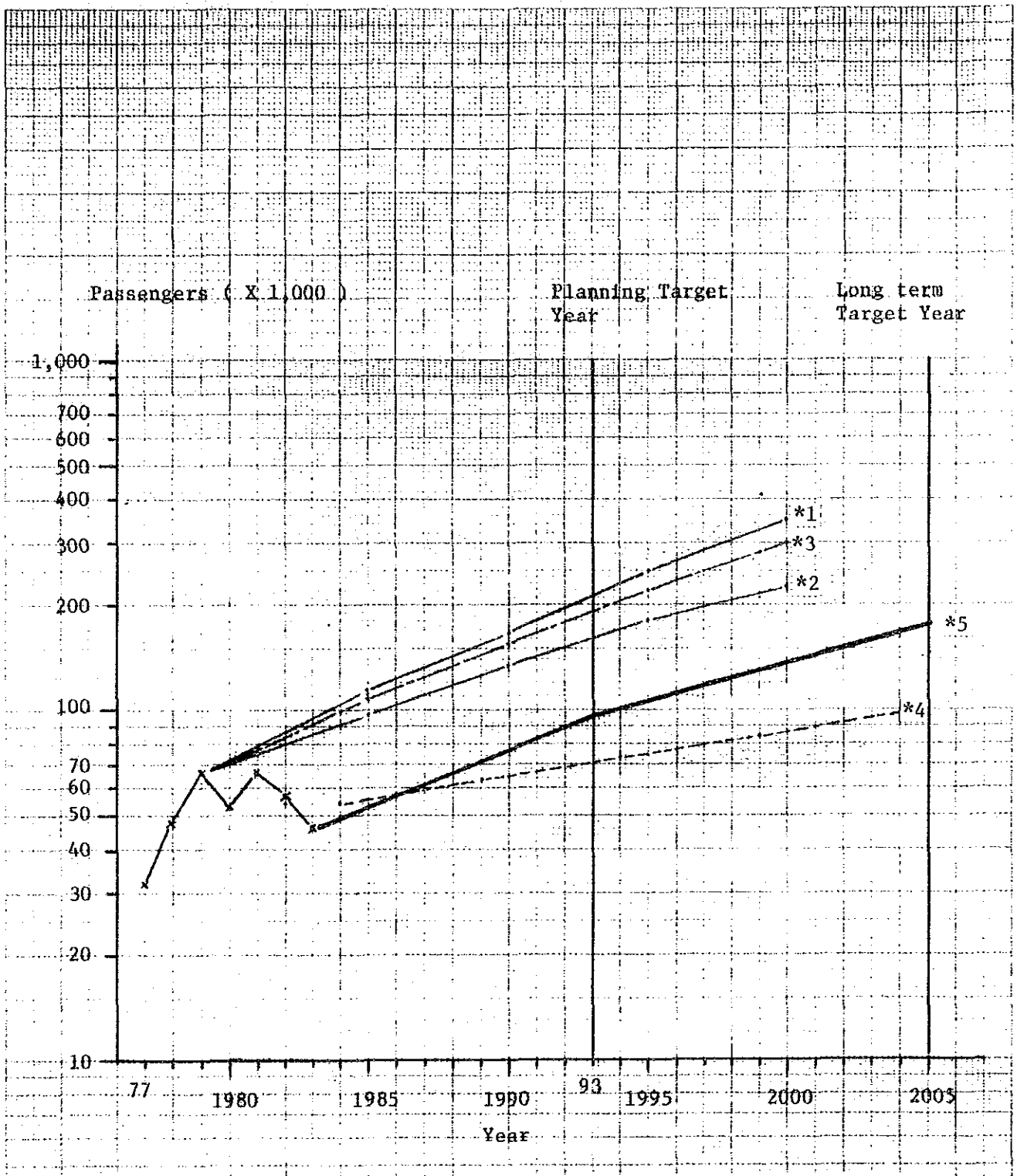


Fig. 3.3.1 INTERNATIONAL PASSENGERS (WESTERN SAMOAN) IN COMPARISON WITH THE PREVIOUS STUDY

*1 : Faleolo Airport Development Study (Best Forecast)
*2 : Ditto (Low Forecast)
*3 : Faleolo Airport Appraisal Study
*4 : Faleolo International Airport Extension Project Evaluation Report
*5 : Present Basic Design Study

b. Foreign International Passengers

Most foreigners visit Western Samoa by air on sightseeing and recreation. The share of sightseeing and recreation among foreign international passengers was more than 60% on the average in 1982 and 1983.

Foreign international passenger demand can be explained according to the level of income of foreigners.

Therefore, the future demand is forecast by regression analyses. Its explanatory variable is established to be per capita GDP weighted by the share of past foreign visitors by nationality, viz., 63% for New Zealand/Australia/Europe (UK)/U.S.A. region, 37% for South Pacific islands including American Samoa.

The correlation equation for foreign international passengers is shown as follows:

$$Pf = 20.93 \frac{GDP}{N} - 92{,}317, \quad \gamma = 0.83$$

Pf : Foreign international passengers (Passengers)

$\frac{GDP}{N}$: Weighted per capita GDP (US$/person, 1980 constant market prices)

γ : Correlation Coefficient

Fig. 3.3.2 shows the projected foreign international passengers in comparison with the forecasts of the previous studies.

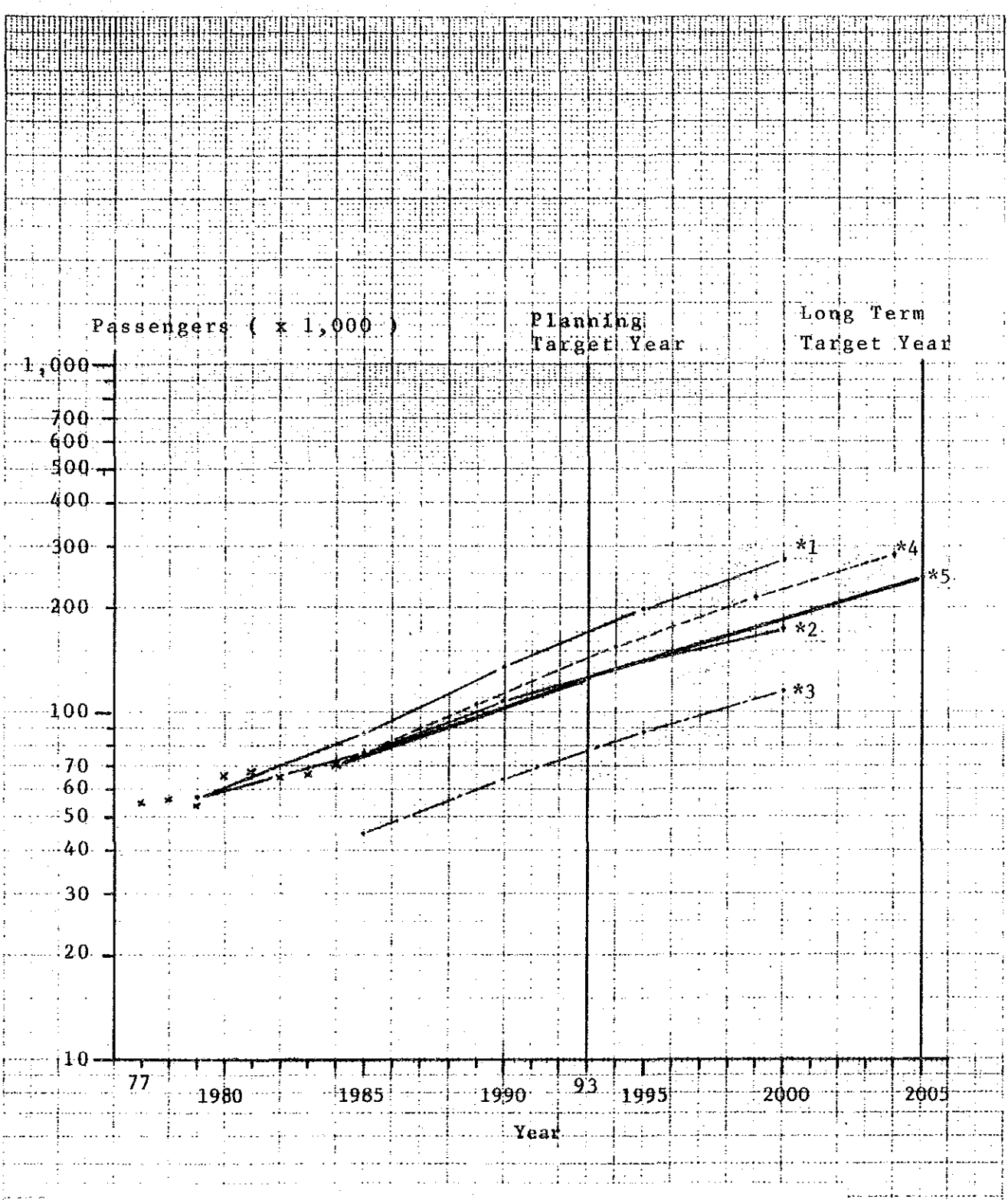


Fig. 3.3.2 INTERNATIONAL PASSENGERS (OTHER THAN WESTERN SAMOAN) IN COMPARISON WITH THE PREVIOUS STUDY

*1 : Faleolo Airport Development Study (Best Forecast)
*2 : Ditto (Low Forecast)
*3 : Faleolo Airport Appraisal Study
*4 : Faleolo International Airport Extension Project Evaluation Report
*5 : Present Basic Design Study

c. International Passengers

As a result of the present study, total international passenger demand is shown in Fig. 3.3.3. The comparison of the forecasts between this study and the previous studies is shown in Fig. 3.3.4.

(5) Annual Domestic Passengers

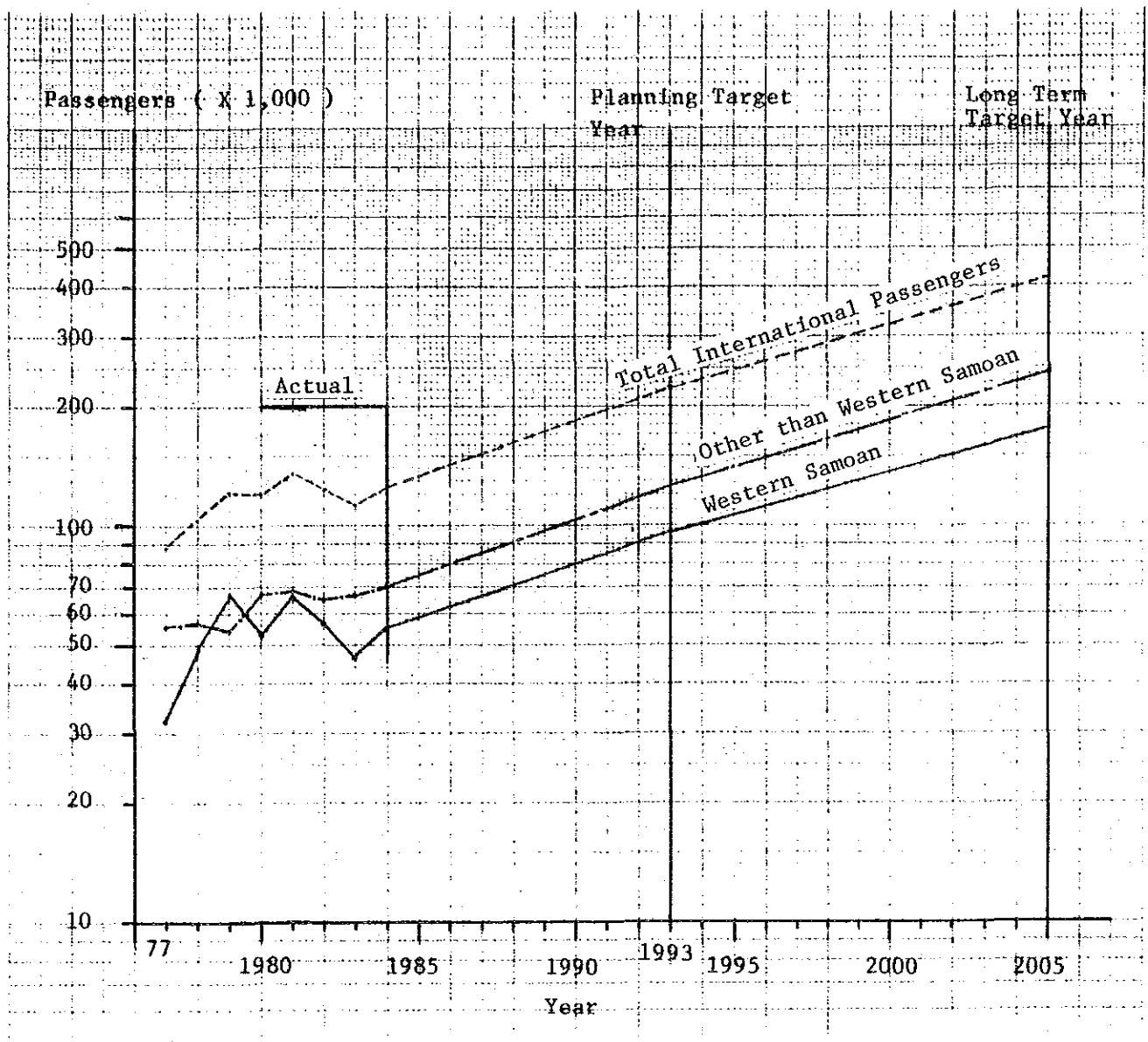
At present, domestic passengers in Faleolo airport are far fewer than international passengers. Since there are no statistics on past and present domestic passengers, present domestic passengers are estimated to be approx. 16,000 per year based on the seating capacity and aircraft movements of domestic timetable in 1984.

Domestic passengers in Faleolo Airport are assumed to be 30,000 in 1993 and 60,000 in 2005 based on the future annual growth rate of passengers in "Faleolo Airport Development Study, 1981".

1984 : 16,000
↓ Annual growth rate 8%
1993 : 30,000
↓ Annual growth rate 6.5%
2005 : 60,000

(6) Annual Passengers

As a result, the annual passenger demand for the basic design is established and summarized as shown in Fig. 3.3.5.



Unit: Passengers

Year / Category	Actual								Projected	
	1977	1978	1979	1980	1981	1982	1983	1984	1993	2005
Western Samoan	(32,389)	(48,179)	(67,339)	53,279	66,600	57,847	46,364	55,575*	96,000	176,000
Other than Western Samoan	55,838	56,271	54,113	67,376	68,457	65,633	66,423	70,100*	127,000	246,000
Total	(88,227)	(104,450)	(121,452)	120,655	135,057	123,480	112,787	125,675*	223,000	422,000
Planning Target	—								220,000	420,000

Note 1. * indicates provisional figure.

Note 2. ( ) indicates an estimated figure based on the current (1980 - 1983) share of international passengers by air and sea.

Fig. 3.3.3 Total International Passengers

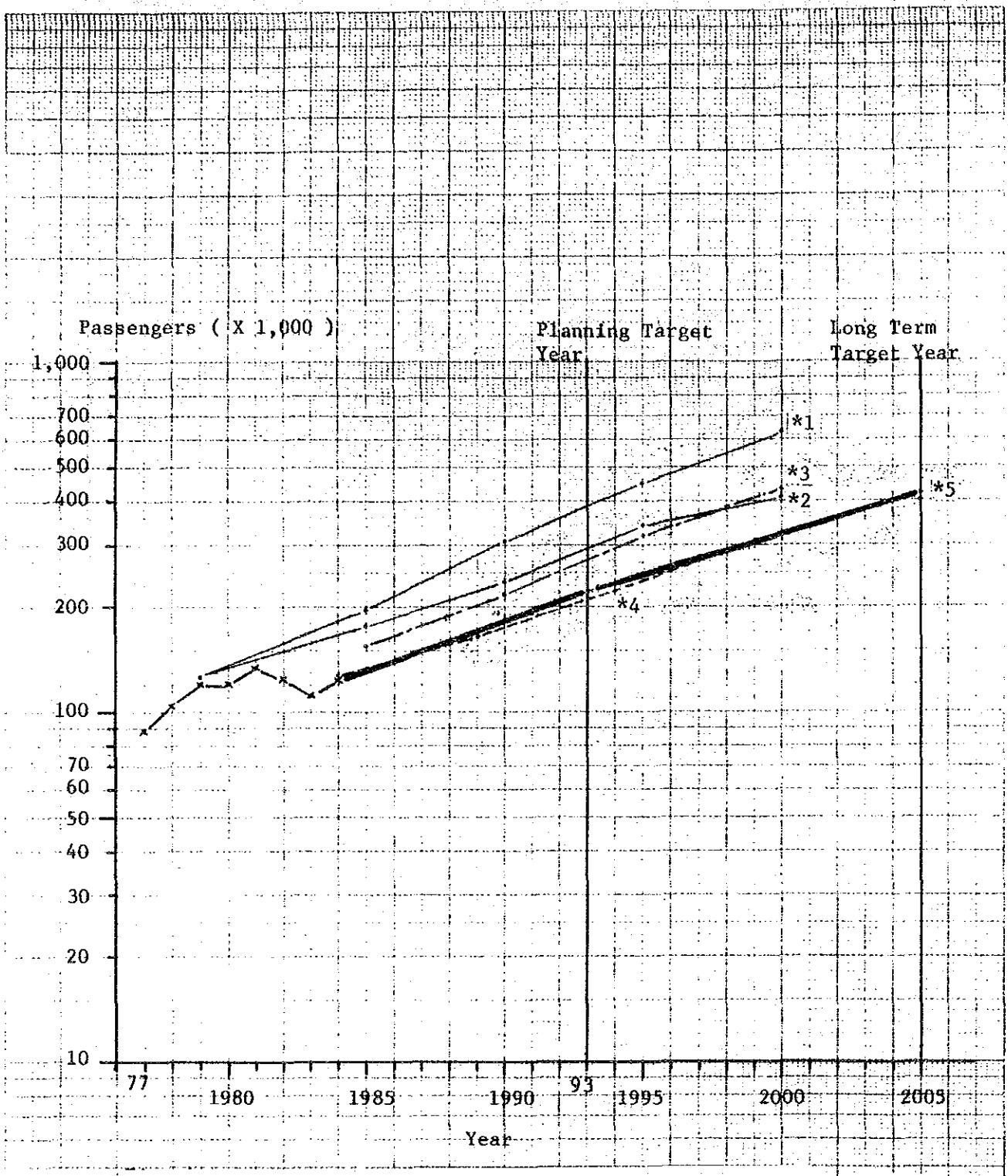
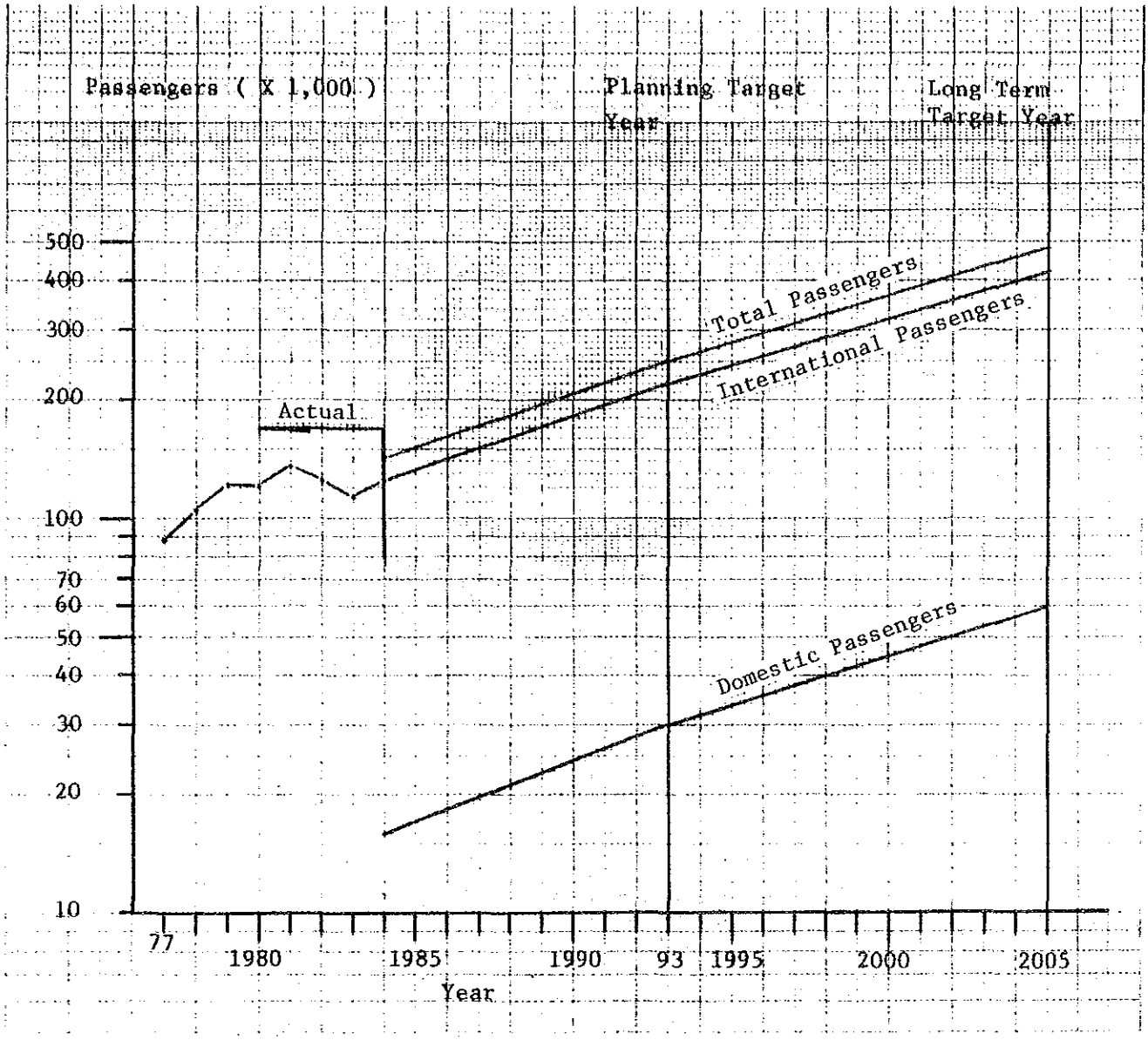


Fig. 3.3.4 TOTAL INTERNATIONAL PASSENGERS IN COMPARISON WITH THE PREVIOUS STUDY

*1 : Faleolo Airport Development Study (Best Forecast)
*2 : Ditto (Low Forecast)
*3 : Faleolo Airport Appraisal Study
*4 : Faleolo International Airport Extension Project Evaluation Report
*5 : Present Basic Design Study



Unit: Passengers

Category		Actual								Projected	
Year		1977	1978	1979	1980	1981	1982	1983	1984	1993	2005
Embarked and Disembarked	Dom.	-	-	-	-	-	-	-	16,000*	30,000	60,000
	Int'l	(88,227)	(104,450)	(121,452)	120,655	135,057	123,480	112,787	125,675**	220,000	420,000
	Total	-	-	-	-	-	-	-	141,675	250,000	480,000,
Transit		-	-	-	-	-	-	-	-	94,000	180,000

Note 1.* Domestic passenger traffic statistic is not available. This figure is assumed by the current flight schedule of Polynesian Airlines.

Note 2. ** indicates provisional figure.

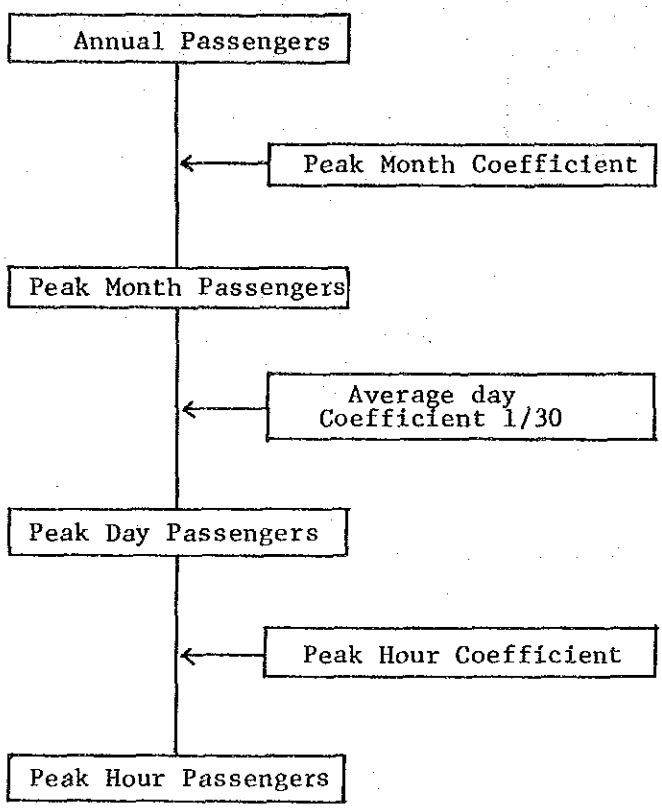
Note 3. ( ) indicates an estimated figure based on the current share of international passengers by air and sea.

Fig. 3.3.5 Planning Target Demand

(7) Peak Hour Passenger Demand

a. Methodology

Design peak hour passengers are estimated by the following flow. The design peak hour passengers are defined to be passenger volume at a peak hour on average day of the peak month.



The domestic passengers who are far fewer than the international passengers do not affect the planning requirements of passenger terminal building. Accordingly, the major study will focus on the breakdown of international passengers and the same coefficient figures will be adopted in practice for the domestic passengers.

b. Summary of Peak Hour Demand

Peak hour demand which is estimated based on the calculations explained hereinafter is summarized in Table 3.3.3.

Table 3.3.3 Summary of Air Traffic Forecast

Calender Year / Category			1993			2005		
			INT'L	DOM	TOTAL	INT'L	DOM	TOTAL
					Pass.			Pass.
Annual Passengers (Excl. Transit)			220,000	30,000	250,000	420,000	60,000	480,000
Peak Month Passengers (")			27,500	3,800	31,300	52,500	7,500	60,000
Design Day Passengers (")			910	130	1,040	1,750	250	2,000
Peak Hour Passengers (Excl. Transit, 2 Way)			270	40	310	430	60	490
Ditto (Incl. Transit, 2 Way)			390	40	430	610	60	670
Ditto (Excl. Transit, 1 Way)			190	20	210	300	40	340
Ditto (Incl. Transit, 1 Way)			270	20	290	430	40	470
Monthly Aircraft Movements (Peak Month)	I	B747	-	-	-	20	-	20
	II	DC10/L1011	-	-	-	72	-	72
	III	B767/A300	92	-	92	168	-	168
	IV	B707/B727	56	-	56	56	-	56
	V	DC9-40/B737	96	-	96	-	-	-
	VI	DHC-6/N24	456	-	456	336	-	336
	VII	STOL	-	360	360	-	540	540
Daily Aircraft Movements (Average Day of Peak Month)	I	B747	-	-	-	0.7	-	0.7
	II	DC10/L1011	-	-	-	2.6	-	2.6
	III	B767/A300	3.3	-	3.3	6.0	-	6.0
	VI	B707/B727	2.0	-	2.0	2.0	-	2.0
	V	DC9-40/B737	3.4	-	3.4	-	-	-
	VI	DHC-6/N24	16.3	-	16.3	12.0	-	12.0
	VII	STOL	-	12	12	-	18	18

c. Basic Assumption for Breakdown

i) Peak Month Coefficient

According to the monthly statistics for the seven year period from 1978 to 1984, peak month in Faleolo airport is December (Christmas season) or January (New Year), and the peak month coefficient is approx. 1/8. It is assumed that monthly peak characteristics will remain unchanged in future.

On this assumption, the peak month coefficient of 1/8 is adopted in this study.

ii) Peak Hour Coefficient

Peak hour coefficient is defined as the ratio of peak hour passengers to average day passengers.

Remarkable increase of aircraft movements in future is not anticipated because under the current airline operation schedules, aircraft are fully utilized without much idle time. It is more practical to consider that larger fleets will replace the small jets currently operated.

Hence, the peak hour coefficient is estimated based on the future flight diagram which is drawn up following the current timetable of Faleolo airport.

Figure 3.3.6 is the flow chart for the estimation of peak hour coefficient.

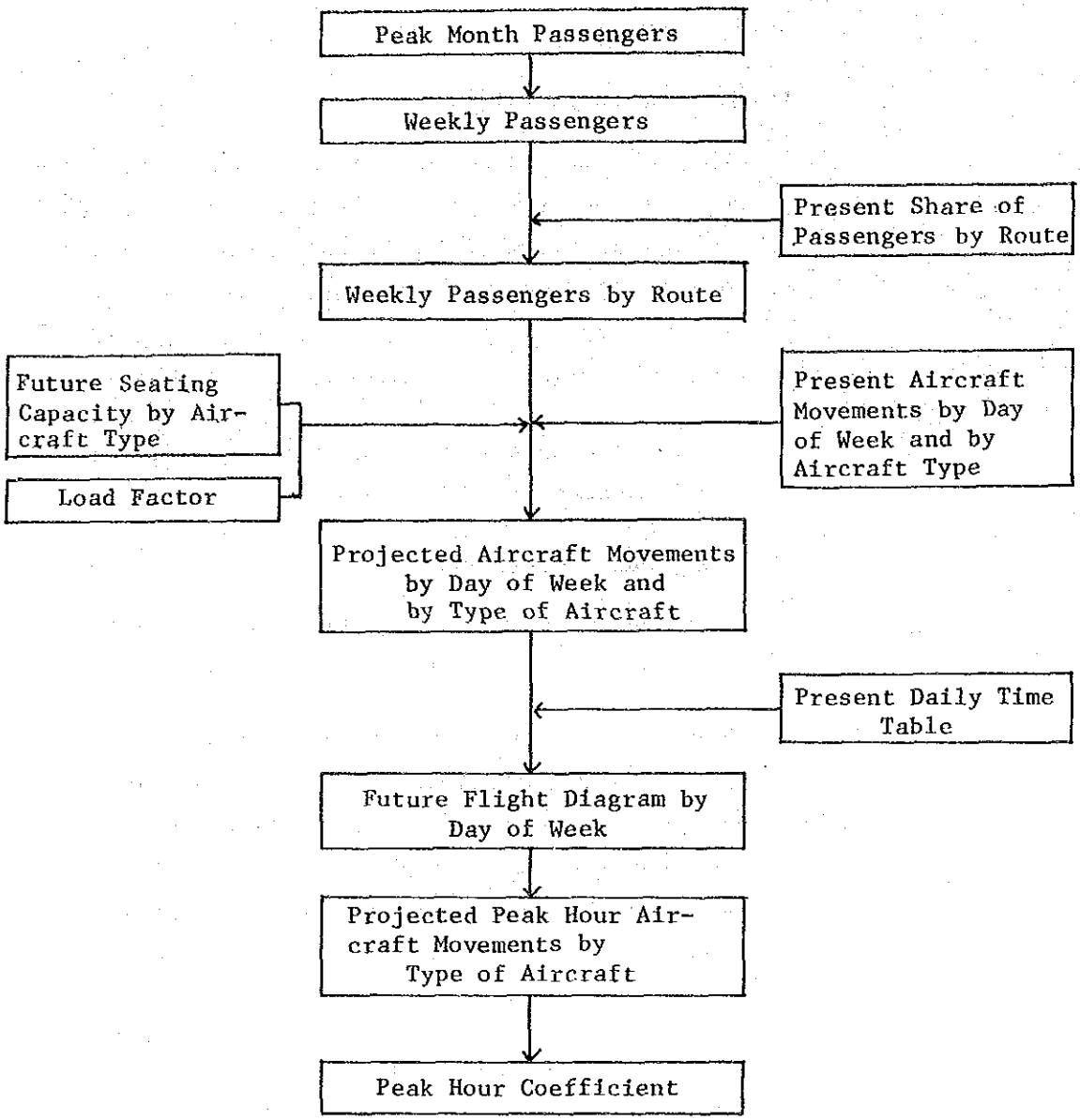


Fig. 3.3.6 Flow Chart for Estimation of Peak Hour Coefficient

① Share of Passengers by Route

Since there are no statistics on the share of passengers by route, the following route shares which were actual values in 1979 and used in the Faleolo Airport Development Study are applied on condition that they will remain unchanged in future.

APIA - NADI	10 %
APIA - TONGATAPU - AUCKLAND	25 %
APIA - PAGO PAGO	60 %
Others	5 %
	100 %

② Seating Capacity

Table 3.3.4 indicates the seating capacity of aircraft in future assumed taking into account the worldwide tendency of increase of seating capacity.

Table 3.3.4 Seating Capacity of Aircraft in Future

Category	Type of Aircraft	1985	1993	2005	Remarks
I	B747	350	400	450	
II	DC10/L1011	280	300	330	
III	B767/A300	230	250	280	
IV	DC-9-80/3757	160	175	195	B727/B707 Class
V	DC-9-40/B-737	110	130	150	
VI	DHC-6	16	20	40	
VII	STOL	10	15	20	BN2, N22 Class

③ Load Factor

Load factor is estimated to be 60% for average month and 70% for peak month as a common planning value.

④ Aircraft Movement by Day of Week and by Type of Aircraft.

Based on the present timetable, (refer to Table 3.3.5) the present aircraft owned by airlines and future plan of aircraft introduction as described in Section 2.3.2, aircraft movements by day of week and by type of aircraft in 1993 and 2005 are forecast as shown in Table 3.3.6 and APPENDIX-I respectively.

Table 3.3.5 Current Aircraft Movements (As of APR. 1985)

ROUTE	SUN	MON	TUE	WED	THU	FRI	SAT	TOTAL
APW-NAN	V : 1	V : 2	V : 1	V : 1		V : 2		V : 7
-AKL	V : 3	V : 1	V : 1		V : 2	V : 3		V : 10
-PPG	V : 2 VI : 14	VI : 20	VI : 20	V : 1 VI : 22	VI : 22	VI : 20	V : 2 VI : 20	V : 5 VI : 136
-OTHERS	VI : 2		V : 1	V : 2		V : 5	V : 2	V : 10 VI : 2
TOTAL	V : 6 VI : 16	V : 3 VI : 20	V : 3 VI : 20	V : 4 VI : 22	V : 2 VI : 20	V : 10 VI : 20	V : 4 VI : 20	V : 32 VI : 138
	22	23	23	26	22	30	24	170

LEGEND

V : 2	
Aircraft Category	Daily Movement

Table 3.3.6 Future Aircraft Movements (Year : 1993)

Route	Annual Pax. *1	Weekly Pax.	SUN	MON	TUE	WED	THU	FRI	SAT	Total	Load Factor
APW-NAN	31,000	980	V : 1	V : 2	V : 1	V : 1		V : 2	III : 2	III : 2 V : 7	70%
-AKL	79,000	2,480	III : 2 V : 1	III : 2 V : 1	III : 2 V : 1	III : 2	III : 2 V : 2	III : 2 V : 1		III : 12 V : 6	66%
-PPG	188,000	5,880	III : 2 IV : 2 V : 2 VI : 12	III : 1 IV : 2 VI : 16	III : 1 IV : 2 VI : 16	III : 2 IV : 2 V : 1 VI : 18	III : 1 IV : 2 VI : 18	III : 2 IV : 2 VI : 16	IV : 2 V : 2 VI : 18	III : 9 IV : 14 V : 5	77%
Others	16,000	490			V : 3	V : 1		V : 2		V : 6	63%
Total	314,000	9,830	III : 4 IV : 2 V : 4 VI : 12	III : 3 IV : 2 V : 3 VI : 16	III : 3 IV : 2 V : 5 VI : 16	III : 4 IV : 2 V : 3 VI : 18	III : 3 IV : 2 V : 2 VI : 18	III : 4 IV : 2 V : 5 VI : 16	III : 2 IV : 2 V : 2 VI : 18	III : 23 IV : 14 V : 24 VI : 114	69%
			22	24	26	27	25	27	24	275	

Remarks *1 : Including Transit Passengers

LEGEND

III : 2	
Aircraft Category	Daily Movement

⑤ Peak Hour Coefficient

Figs. 3.3.9 and 10 show the future flight diagrams at Faleolo airport, which are estimated based on Table 3.3.6 and present timetable as shown in Figs. 3.3.7 and 8. In these diagrams, stay time of aircraft for loading and unloading is established as follows:

B-747, DC-10 ..... 90 minutes
B-767, B-707 ..... 75 minutes
B-737 ..... 60 minutes
DHC-6 class ..... 15 minutes

As a result of these analyses, peak hour coefficient is estimated to be 0.30 in 1993 and 0.25 in 2005.

⑥ Heavy Direction Ratio during Peak Hour

Heavy direction ratio is defined as the ratio of the passenger volume of the heavier direction (arrival or departure) divided by total peak hour passengers. This ratio is estimated to be 70% from the future flight diagrams.

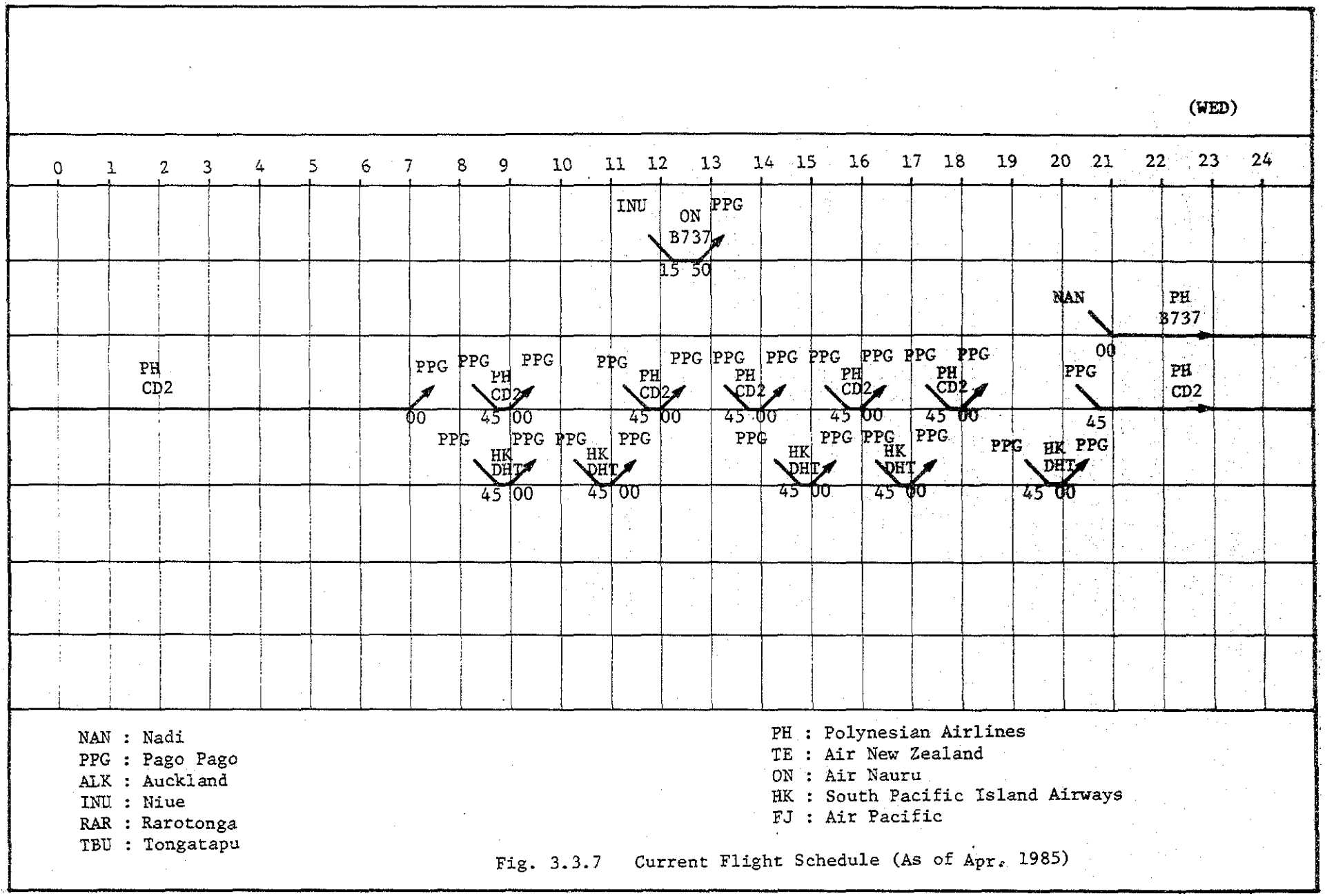
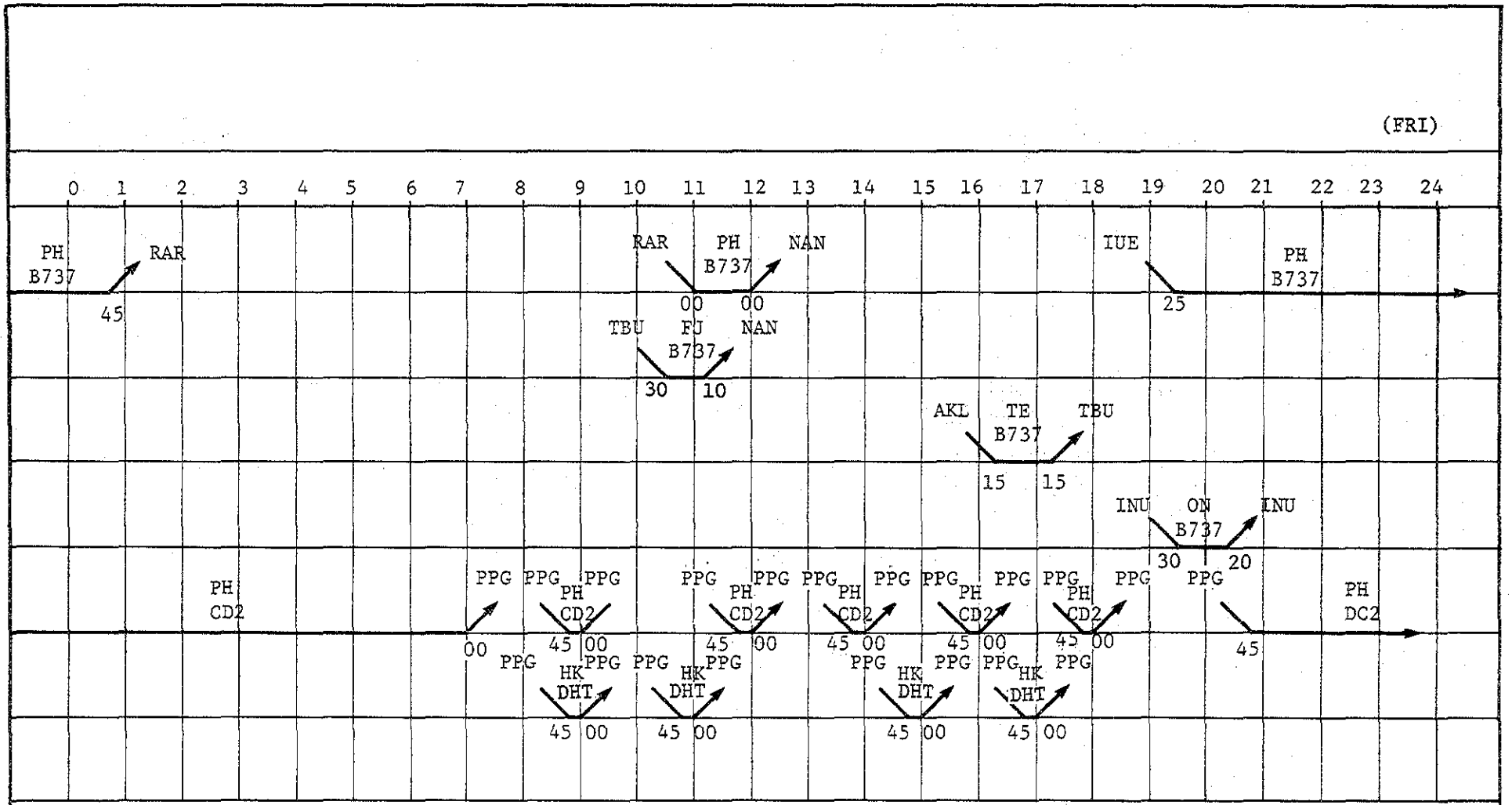


Fig. 3.3.7 Current Flight Schedule (As of Apr. 1985)



NAN : Nadi
PPG : Pago Pago
ALK : Auckland
INU : Niue
RAR : Rarotonga
TBU : Tongatapu

PH : Polynesian Airlines
TE : Air New Zealand
ON : Air Nauru
HK : South Pacific Island Airways
FJ : Air Pacific

Fig. 3.3.8 Current Flight Schedule (As of Apr. 1985)

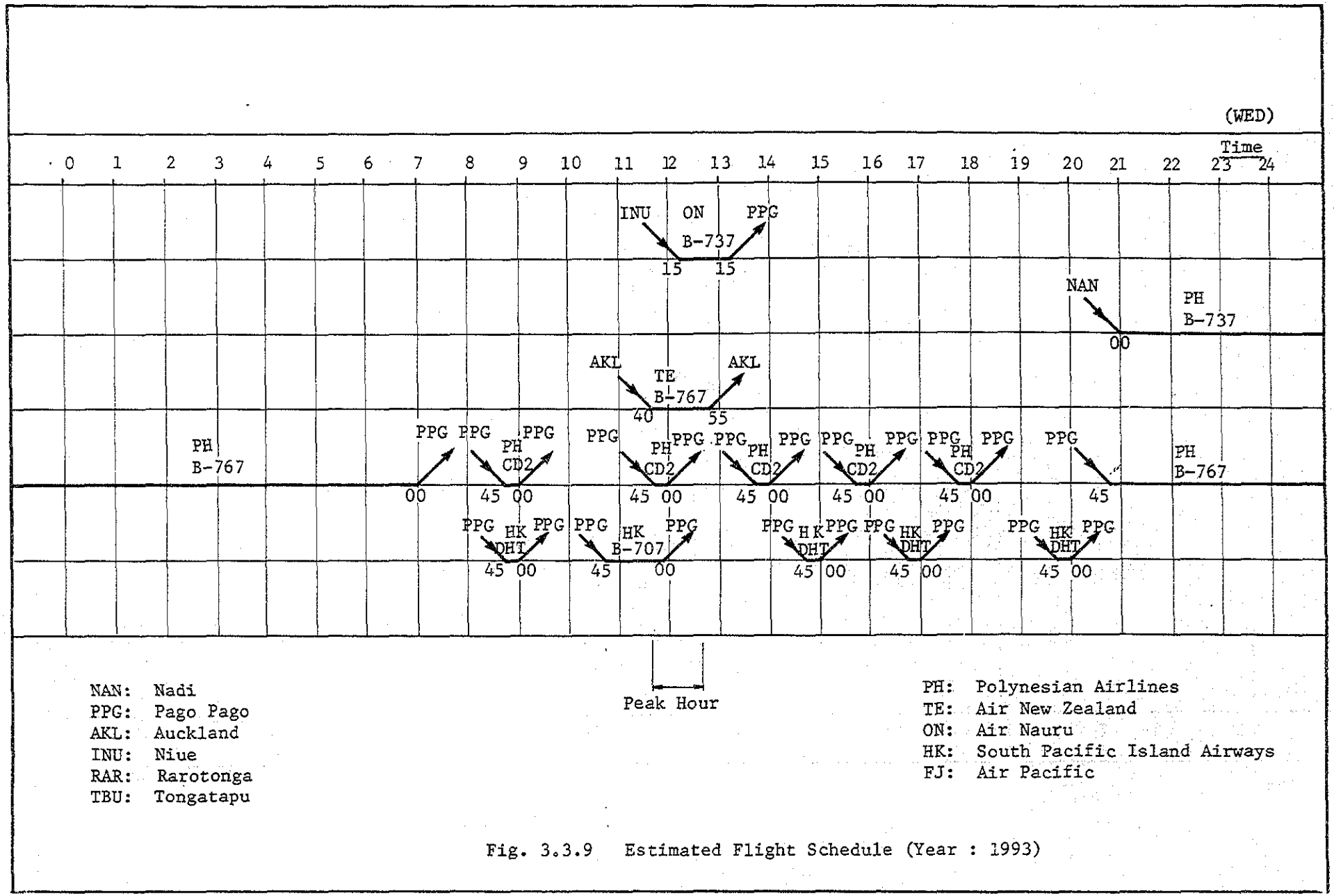


Fig. 3.3.9 Estimated Flight Schedule (Year : 1993)

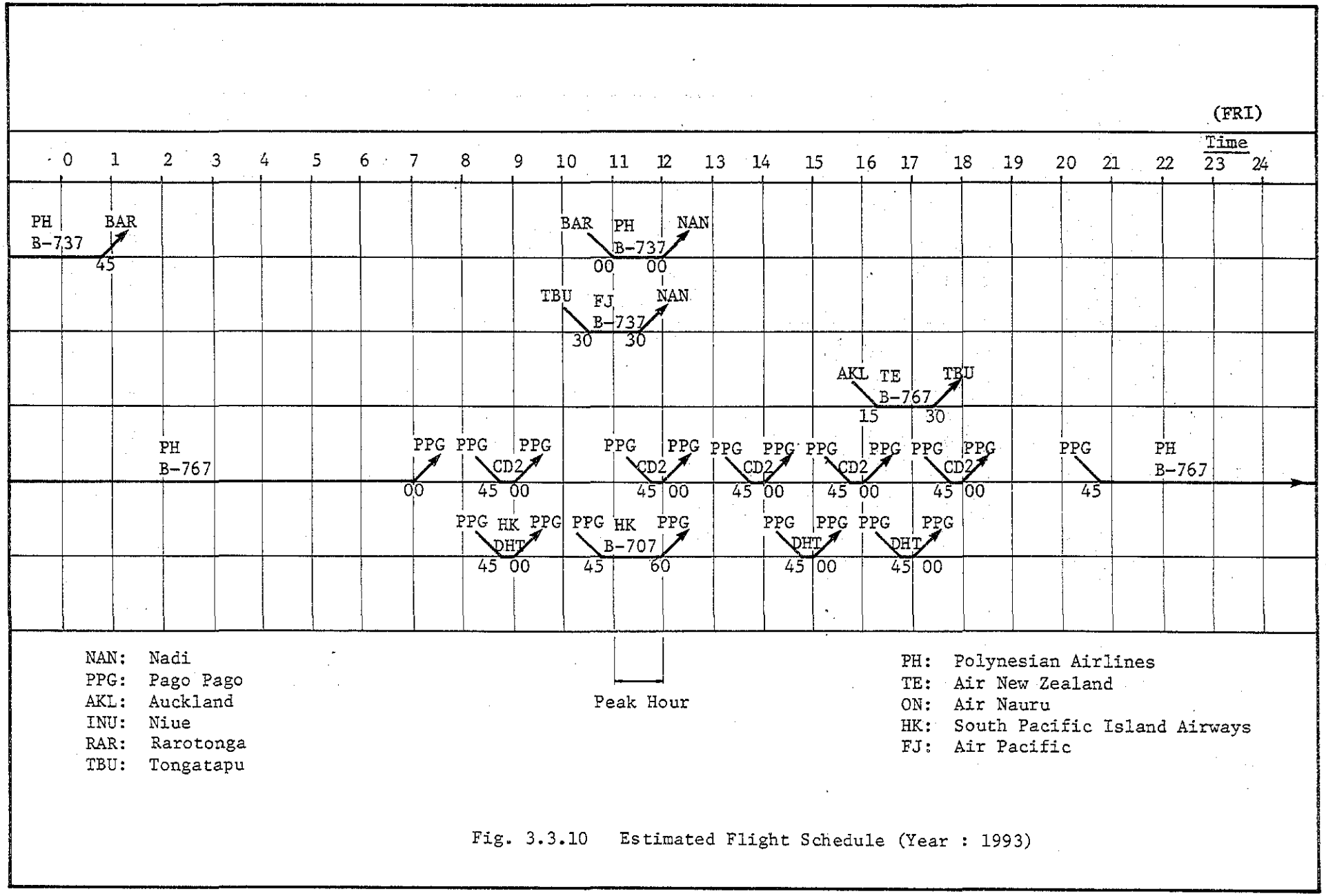


Fig. 3.3.10 Estimated Flight Schedule (Year : 1993)

3.3.2 Review of Airport Facilities Requirements

(1) General

Airport facilities requirements for passenger terminal building, etc., are reviewed and summarized for the planning target year (1993) and the year 2005 in Table 3.3.7.

Table 3.3.7 Airport Facilities Requirements

Facility	Year 1993	Year 2005
Apron	3 gate positions B767 : 1 position B707 : 1 " B737 : 1 "	3 gate positions B747 : 1 position B767 : 2 positions
Passenger Terminal Building (Total Floor Area : m^2)	3,000m^2 *1	4,600m^2 *1
Car Park	95 Cars	150 Cars
ILS	Installed (Localizer, Glide Slope, DME)	-
Fire Fighting Vehicle Aerodrome Category Minimum Number of Vehicles	6 Rapid Intervention Vehicle : 1 Major Vehicle : 2	7 Same as left

Note *1 : Excluding floor area for transit passengers. Ratio of greeters per passenger is not considered.

(2) Passenger Terminal Building

In general, each peak hour passenger requires a floor area of approx. 100 sq.ft or 9.3sq.m in passenger terminal building according to IATA.
Although this unit space for a passenger varies with the scale of passenger traffic to be handled, transit passenger ratio, concept of terminal building, required office space, greeter ratio to one passenger, etc., the total floor area required in the future is roughly estimated as indicated below in order to visualize the future scale of the terminal building against the existing building.

Year	1993	2005
Both-way peak hour passengers excluding transit passengers	310 pass.	490 pass.
Floor area of passenger terminal building	3,000m^2	4600m^2

(3) Apron

According to the future flight diagram, maximum combinations of simultaneously parked aircraft on apron in 1993 and 2005 are as follows:

Number of parked aircraft

1993

Case 1 ..... B767, B707 DHC-6
Case 2 ..... B707, B737 B737

2005

Case 1 ..... DC10, B767, B707
Case 2 ..... DC10, B767, B767
Case 3 ..... B747, DHC-6, DHC-6

Number of aircraft stands is planned as follows for year 1993 and 2005 taking account of the size of aircraft and interchangeability of aircraft stands.

Number of aircraft stands

1993

B767 ..... 1 position
B707 ..... 1 "
B737 ..... 1 "

2005

B747 ..... 1 position
B767 ..... 2 positions

Abnormal congestion in the apron postions due to delay of aircraft schedule is considered to be alleviated by the temporary apron which is under contruction.

Small aircraft for domestic services are planned to be parked on the grass beside the apron as is done at present.

(4) Car Park

The following formula is used to calculate the required number of parking spaces.

$$V = P \times C$$

where, V: Required number of parking spaces
P: Number of peak hour passengers (Departure and arrival passengers excluding transit passengers)
C: Number of parking spaces per peak hour passengers

The site survey resulted in C = 0.3 (40 parked cars per 132 passengers) for all cars including taxies and buses.

Hence, on the assumption that this tendency will continue in the future, the required number of car parking spaces is estimated as follows:

Year	Number of peak hour passengers	Required number of parking spaces
1993	310	95
2005	490	150

(5) Instrument Landing System (ILS)

ILS will be a mandatory navigation aid when modern (B767, A300, etc.) and large aircraft (B747, DC10, L1011, etc.) are introduced.

In the planning target year, the design aircraft is established to be B767 and it is highly possible that B767 aircraft will be introduced during peak seasons as soon as the runway extension is completed.

Accordingly, installation of ILS is considered to be mandatory.

ILS is normally composed of localizer, glide slope, middle marker and outer marker facilities. A terminal DME (Distance Measuring Equipment) is required instead of outer marker and middle marker, because the location of outer marker is offshore and there is a world-wide tendency to replace middle marker by DME.

ILS for Faleolo International Airport will consist of localizer, glide slope and terminal DME.

(6) Fire-Fighting Vehicles

The required number of fire-fighting vehicles is calculated by the aircraft movements for the busiest consecutive 3 months of the year, in compliance with the ICAO Annex-14 and ICAO Airport Services Manual part I. Airport category in 1993 and 2005 is 6 and 7 respectively based on the aircraft movements shown in Table 3.3.3. The facility requirements for fire-fighting services are shown in Table 3.3.8.

Table 3.3.8 Requirements for Fire Fighting Services

ITEM \ YEAR	1993	2005
AIRPORT CATEGORY	6	7
Extinguishing Agents		
Water for Aqueous Film Forming Foam Production	7,900ℓ	12,100ℓ
Dry Chemical Powders, or	225kg	225kg
CO_2	450kg	450kg
Minimum vehicles		
Rapid Intervention Vehicle	1 car	1 car
Major Vehicles	2 cars	2 cars

3.3.3 Project Implementation and Management Agency

The executive agency for the implementation of this project will be the Public Works Department, the Government of Western Samoa. After completion of the project, administration, operation and maintenance of airport facilities will be implemented by the Western Samoa Airport Authority.

3.3.4 Present Condition of Project Site

(1) Passenger Terminal Building

The vicinity of the existing passenger terminal building is shown in Fig. 2.4.2.
The direction of the expansion of passenger terminal building is planned to be east and south of the existing building. Therefore, relocation works of the following facilities (by the Government of Western Samoa) are required.

1) Catering shed and storage

2) Sewage facility for aircraft use.

(2) Road and Car Park

The site for expansion of car park between proposed terminal building and West Coast Road lies on relatively steeply inclined terrain which rises approx. 6m toward West Coast Road. This site is on Government property and there are some coconut trees owned by the Government.
The geological features of this site are considered to be volcanic judging from the situation of earthwork being carried out at the rear of the site at present.

(3) ILS

a. Localizer Site

Localizer site is planned to be located east of the threshold of the extended runway. There is no obstruction in the area which will cause localizer course bend. Parked aircraft and expanded terminal building are not considered to affect the localizer course.

b. Glide Slope Site

The glide slope site is located on the touch-down area and north of the extended runway. Site preparation work is being carried out at present with Australian aid.

Before installation work of ILS, the site preparation is scheduled to be completed in compliance with ILS critical area requirement. The surrounding coconut trees are not considered to cause any glide slope course bend.

3.3.5 Outline of Facilities and Equipment

(1) Passenger Terminal Building

The passenger terminal building is planned to be expanded toward south utilizing the existing passenger terminal building which consists of arrival and departure units along the apron.

The passenger terminal building is designed to meet the forecast traffic volume (310 both-way passengers) in year 1993.

The proposed terminal building is the frontal, one-storeyed, and steel structure building with floor area of approx. 3,000m^2 and covered open area of approx. 1,000m^2.

Natural ventilation is positively adopted for large spaces in order to ensure ease of maintenance. External walls are planned to be made of concrete blocks, and partition walls, of wooden frames in order to easily cope with the change of demand or function in future.

(2) Road and Car Park

Proposed car parking area is about 12,000m^2 including green zone. Its capacity is 100 lots, comprising 85 lots for public car park and 15 lots for taxi and bus pool.

Internal road of the car park provides for 3 lanes in front of the terminal building, 2 lanes for circulating traffic and 1 lane for others.

The pavement for the road and car park will be asphalt concrete with 5 cm thick surface and 20 cm thick aggregate and crushed stone base course.

(3) ILS

Components of ILS and their outlines are as follows :

i) Localizer ..... 1 set

Single frequency type - dual transmitters (to meet ICAO precision approach category I), and log periodic (LPO) antenna

ii) Glide Path .... 1 set

Null reference type antenna and single frequency type - dual transmitters ; (to meet ICAO precision approach category I)

iii) DME ..... 1 set

DME for terminal use/dual transmitters

iv) Control and monitor equipment ....1 set

v) Control console for tower .... 1 set

(4) Fire-Fighting Vehicles

Outlines of fire-fighting vehicles are as follows:

i) 250 kg dry chemical vehicle ..... 1 vehicle

Dry chemical = 250 Kg

Nitrogen = 40ℓ x 2 units

ii) 4,500ℓ Major vehicle ..... 1 vehicle

Water Tank = 4,500 ℓ

Foam Liquid Tank = 500 ℓ

Main Water Pump = 4,000 ℓ/min
(Discharge rate)

3.3.6 Airport Management

The Western Samoa Airport Authority is scheduled to operate and maintain the expanded airport.

The Western Samoa Airport Authority is a new organization to be established in June 1985, in line with the programs listed in Western Samoa's Fifth Development Plan (1985-87) in order to cope with the expanded airport.

The Western Samoa Airport Authority will take over all the responsibilities of the existing Civil Aviation Division.

Since the new organization is scheduled to be substantially expanded, operation and maintenance of the expanded facilities including the passenger terminal building and car park, instrument landing system and fire fighting vehicles are considered to be performed without problem.

Fig. 3.3.11 shows the organization chart of Western Samoa Airport Authority.

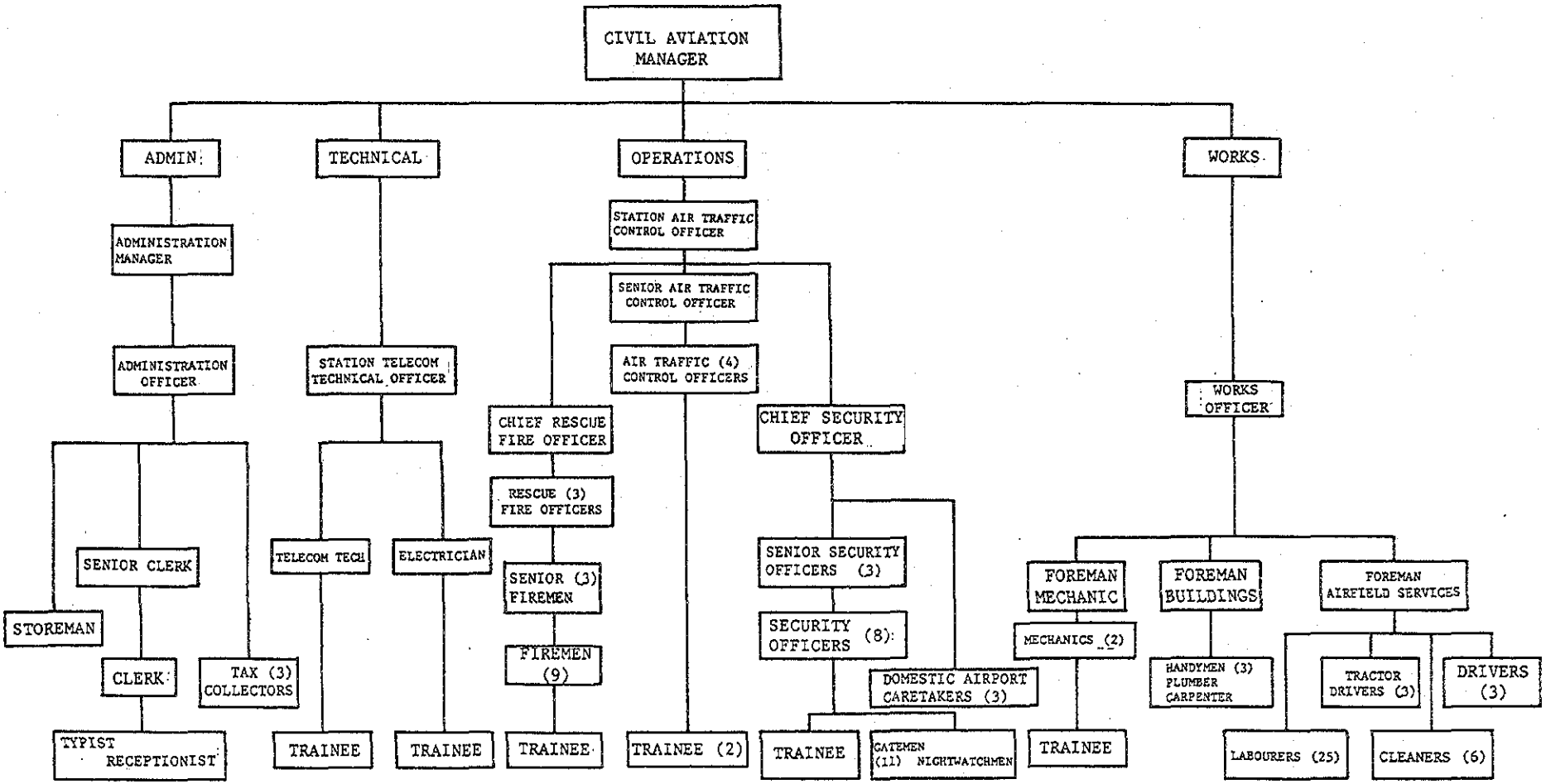


Fig. 3.3.11 Organization Chart of Western Samoa Airport Authority

CHAPTER 4. BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Basis of Basic Design

The basic design will be carried out based on the following bases of design which is consolidated by the airport facilities requirements, problems on the existing facilities, and request on the passenger terminal building by the Government of Western Samoa.

(1) Passenger Terminal Building and Car Park

i) The passenger terminal building consists of various functional facilities for serving passengers and handling baggage. The passenger terminal building will be planned so that the terminal building as a combination of various functions can serve passengers and handle baggage efficiently.

ii) The terminal building will be designed to have high expandability and flexibility so as to easily cope with unexpected change of demand in future.

iii) Material and equipment of local origin or procurable in Western Samoa, will be used as much as possbile considering ease of maintenance. Less-maintenance design policy will also be undertaken.

iv) Given the heavy rainfall, high humidity and temperatures, and salty wind conditions, necessary countermeasure plan will be considered for ventilation of the building and salt corrosion, etc.

(2) Instrument Landing System

Although ILS should meet the performance requirements specified in Annex-10, ICAO, the system will be simply designed in order to make its maintenance as easy as possible.

(3) Fire Fighting Vehicles

Replacement plan of the fire fighting vehicles will be made by selection of adequate vehicles based on the long term replacement program.

4.2 Design Criteria

(1) Passenger Terminal Building

The passenger terminal building is basically designed in accordance with Western Samoan Code。
Where no Western Samoan Code is available, New Zealand Standard (NZS), Japanese Architectural Standard Specification (JASS), Japan Industrial Standard (JIS), etc。, will be used.

(2) Instrument Landing System

ILS is designed in accordance with performance requirements specified in Annex-10, ICAO.

(3) Fire Fighting Vehicles

Fire fighting vehicles are planned in compliance with the international standard and recommended practices of Annex-14 and Airport Services Manual, ICAO.

4.3 Basic Design

4.3.1 Layout Plan of Terminal Area

(1) Principles of Terminal Facilities Development

Principal purpose of this study is the development of the existing passenger terminal building to meet the future demand. Therfore, expansion of terminal facilities is made by the maximum use of the existing facilities in the existing terminal area. The existing terminal area is considered to be capable of expanding to meet the requirement anticipated in 2005 (3 aircraft movements per hour one way and 490 passengers per hour two way) without any restriction to the demands.

(2) Layout Plan of Apron

The apron will be expanded toward the east taking into account the existence of VIP fale and administration building, etc.,on the west of the existing apron, and the flatter terrain on the east.

Aircraft parking configuration on the apron is determined taking the following items into account.

1) Aircraft parking configuration in 1993 is same self-maneuvering as present. However, nose-in is expected to be introduced gradually with growth in aircraft size in the future.

ii) Aircraft parked on the apron should not protrude upon the transitional surface of 1/7 in slope.

iii) Required pavement area is planned to be as minimal as possible.

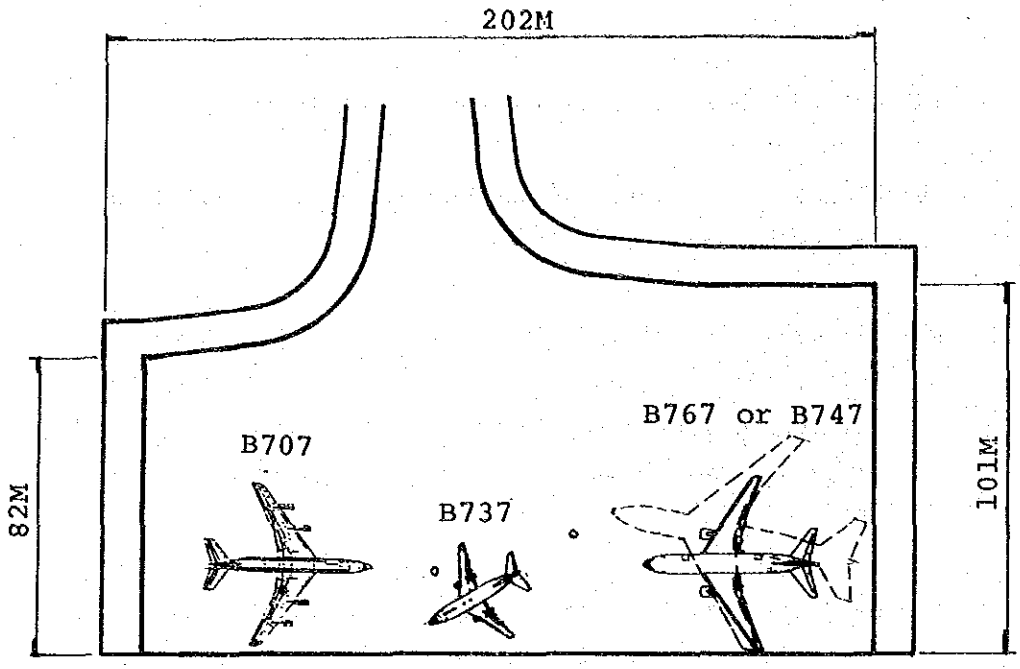
iv) Existing hydrant pits are used effectively.

v) Minimum clearances between the aircraft is based on the recommendation of ICAO.

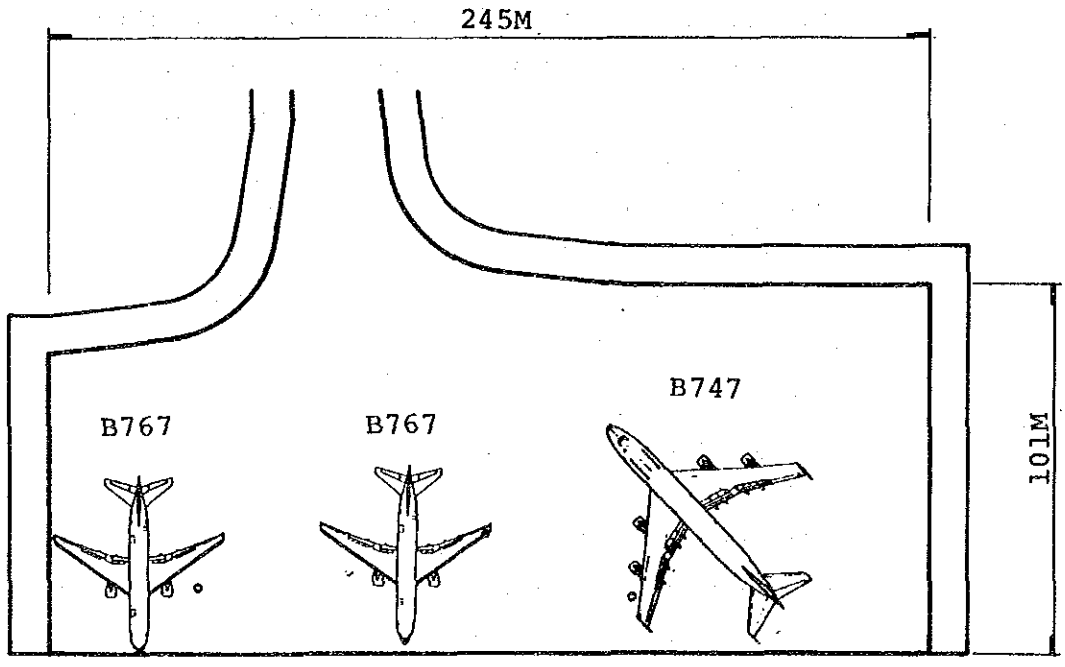
vi) Allowable jet blast velocity for the observation area in the terminal and passenger walkway alongside the terminal building should be less than 35 mile/hr. according to the ICAO Aerodrome Design Manual.

Proposed aircraft parking configuration together with the size of apron is shown in Fig. 4.3.1. In 1993 which is the target year for basic design, B747s are not expected to be introduced as scheduled flights in view of the anticipated demand. However, B747s may fly into Faleolo Airport as chartered flights. Therefore, the apron is desirable to accommodate B747 by adding only 10m width to the east edge of the apron required for B767, B737 and B707. In this case, new hydrant pits are installed for the common use of B767 and B747.
Furthermore, the apron will prefferably be constructed in the same depth (101m) as required in 2005 taking into account the construction easeness and replacement of taxiway edge lights etc.

In 2005, one stand for B747 and 2 for B767 will be required. B767s will park in nose-in position in front of terminal building taking the influence of jet blast into account while B747 will be in angle-out position by self-maneuvering, because B747s will protrude upon the transitional surface unless the apron is expanded by 45m toward the south.



Year : 1993



Year : 2005

Fig. 4.3.1 Aircraft Parking Configuration

(3) Passenger Terminal Building

The detailed layout plan of the passenger terminal building is described in Section 4.3.2. The expansion is planned toward the south or the existing car park, considering the smooth flow of passengers & baggage, and the characteristics of the existing terminal area.

In order to cope with the demand after 1993, required floor area will be provided by the expansion of the building to both sides of east and west.

(4) Car Park

Public car park will be provided in front of the passenger terminal building, considering minimum walking distance for passengers and well-wishers and keeping existing HF antenna intact. Taxi pool is located on the east side of public car park so that taxis can easily pick up passengers from terminal building. Bus pool which accommodates micro buses for tourist is located adjacent to the taxi pool.
Parking space for rented cars, which will be constructed by the Government of Western Samoa, will be located east of passenger terminal building for the convenience of users.