BASIC DESIGN STUDY ON THE PROJECT FOR CONSTRUCTING THE TERMINAL BUILDING OF BAUERFIELD INTERNATIONAL AIRPORT IN REPUBLIC OF VANUATU

SEPTEMBER 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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SEPTEM

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PREFACE

In response to the request of the Government of the Republic of Vanuatu, the Government of Japan decided to conduct a Basic Design Study on the Project for Constructing the Terminal Building of Bauerfield International Airport (hereinafter referred to as the Study) and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as JICA). JICA sent to the Republic of Vanuatu a study team (hereinafter referred to as the team) headed by Mr. M. Watanabe from June 12 to July 5, 1988, and from September 8 to 21, 1988.

The team had discussions on the Project with the officials concerned of the Government of the Republic of Vanuatu and conducted a field survey in Port Vila. After the team returned to Japan, further studies were made and this report has been prepared.

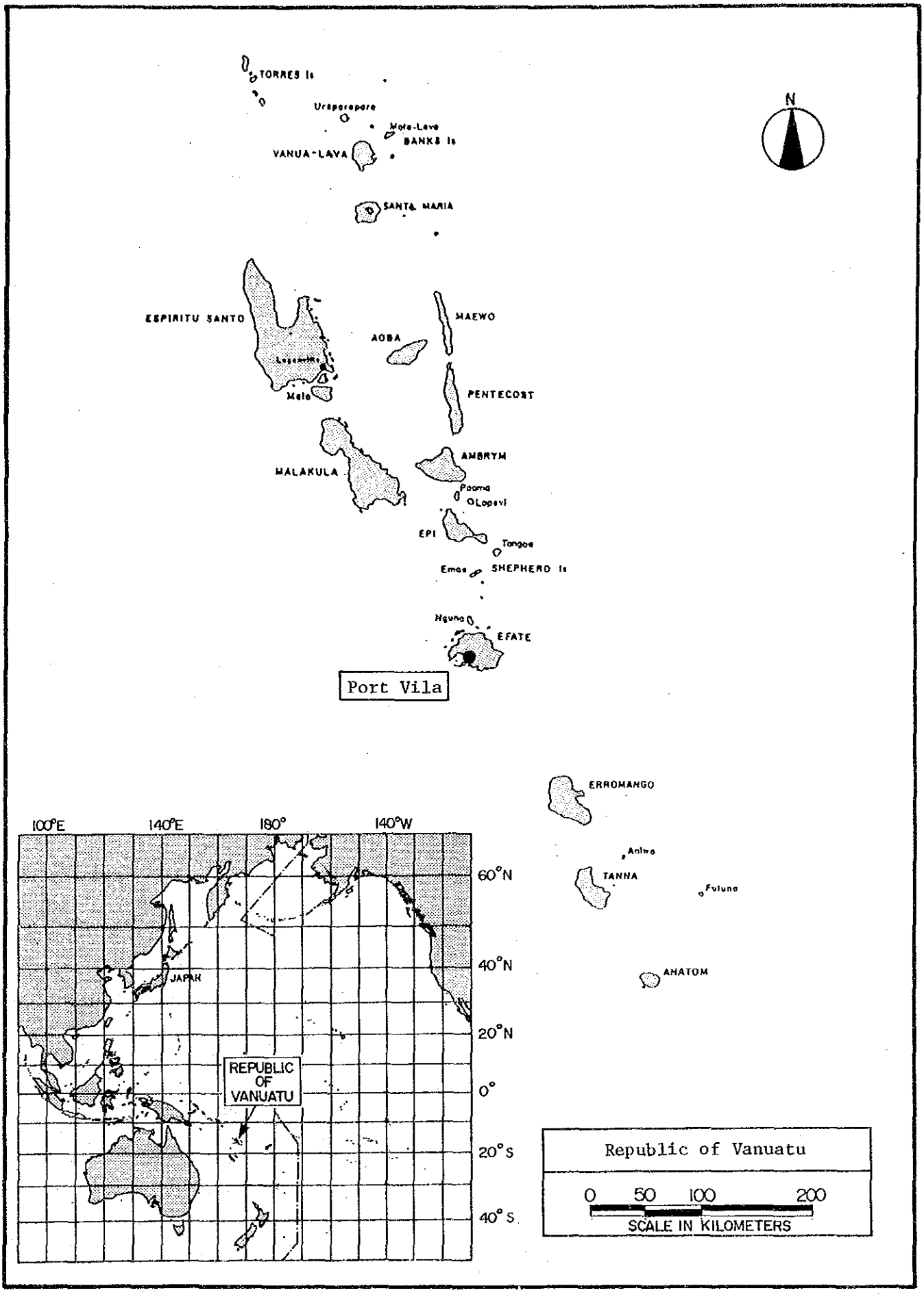
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Vanuatu for their close cooperation extended to the team.

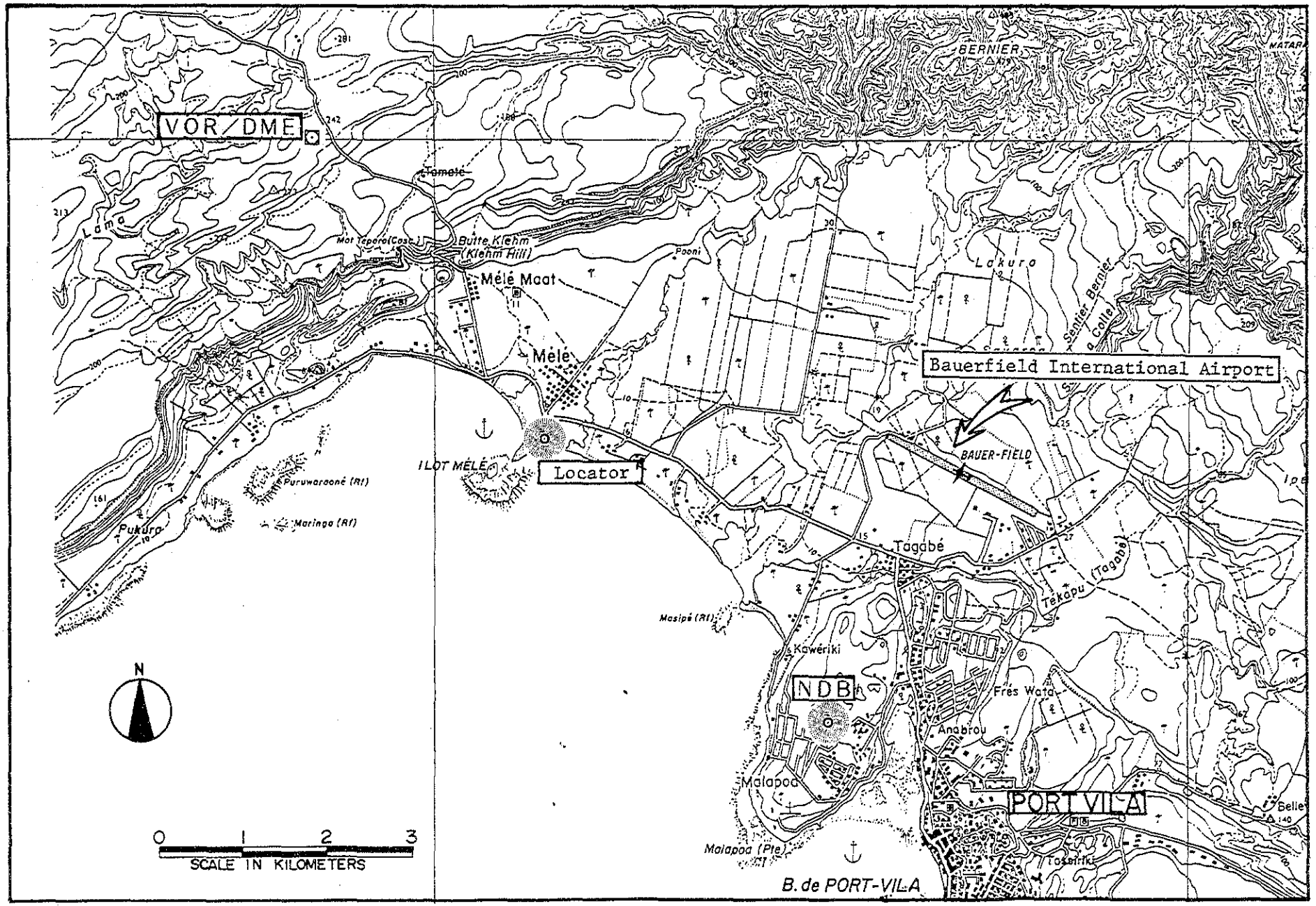
September, 1988

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency



Project Location Map (1)



Project Location Map (2)

International Passenger Terminal Building of
Bauerfield International Airport, Republic of Vanuatu

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SUMMARY

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The Republic of Vanuatu, which is located approx. 970 kilometers west of Fiji, 500 kilometers north of New Caledonia, 1,280 kilometers southeast of the Solomon Islands and 2,500 kilometers northeast of Sydney in the South Pacific Ocean, consists of approx. 80 islands. Due to these geographical characteristics, air transport plays extremely important role in Vanuatu.

The Government of Vanuatu has listed the restoration and extension of its international air services, and improvement of one of its international airports in order to avoid the bottleneck hindering the development of tourism as integral parts of Vanuatu's Second National Development Plan (1987-1991). 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 indispensable.

The Government of Vanuatu has, accordingly, been carrying out development projects at Bauerfield International Airport, which is the only international airport which can accommodate jet aircraft, in order to cope with the introduction of wide-bodied jet aircraft such as the Boeing-767 and increasing air traffic. These development projects include extension and overlay of the runway, expansion of the terminal facilities, construction of an air navigation centre, improvement of the air navigation facilities, etc.

Concurrently, construction of a new international passenger terminal building and renovation of the existing terminal for domestic services, expansion of the apron, road and car park, renewal of Conventional VOR/DME (VHF Omnidirectional Radio Range/Distance Measuring Equipment) and Locator (Non-Directional Radio Beacon) are judged to be urgent so that Bauerfield International Airport will be able to function as one system composed of various airport facilities, and meet the increasing air traffic demand with efficiency and safety.

The Government of Vanuatu requested grant aid from the Government of Japan for the construction of a terminal building together with its

associated facilities at Bauerfield International Airport.
The Government of Japan, in response to the above request from the Government of Vanuatu, decided to conduct a Basic Design Study on the Project for Constructing the Terminal Building of Bauerfield International Airport, and entrusted the Study to the Japan International Cooperation Agency (JICA). JICA dispatched a Study Team to Vanuatu from June 13 to July 5, 1988, which discussed the contents of the requested grant aid with the Government of Vanuatu and carried out the necessary site reconnaissance, data collection and analysis.

The existing facilities of Bauerfield International Airport have the following deficiencies:

- As the existing terminal building of Bauerfield Intertional Airport was planned to cope with one Boeing 737 class aircraft, it is insufficient in size to operate the present Boeing 727.

- If a Boeing 767 parks on the existing apron, its vertical tail infringes upon the transitional surface.

- The existing radio air navigation facilities (VOR/DME and Locator) are superannuated.

In order to resolve the above deficiencies, it was decided to establish 1995 as the planned target year and to expand and improve the existing terminal facilities to cope with the target traffic volume of 240,000 passengers annually (international 140,000, domestic 100,000). The passenger terminal building, apron and car park must be expanded and improved to accommodate wide-bodied jet aircraft of the Boeing 767 class based on the present 150 meter runway strip. VOR/DME and Locator must be replaced in order to ensure safe aircraft operation.

In conclusion, it is recommended that the following be implemented in the Project for Constructing the Terminal Building of Bauerfield International Airport with Japanese grant aid.

The first stage

- Construction of an international passenger terminal building
- Replacement of VOR/DME and Locator

The second stage

- Renovation of the existing terminal for domestic services
- Expansion of the apron, road and car park

The Australian Government has been assiting in the development of Bauerfield International Airport, and planned to extend the runway by 600 m with ancillary works necessary for introduction of Boeing 767 class aircraft.

After the Exchange of Notes between the Governments of Vanuatu and Japan, approx. four (4) months will be required for the conclusion of a consultant contract, detailed design, tender documentation, tendering and conclusion of a construction contract. The period required for the construction works is approx. sixteen (16) months for terminal building works, seven (7) months for the expansion of the apron, road and car park, and nine (9) months for the replacement of VOR/DME and Locator from the conclusion of construction contracts.

The executing agency of the Project is the Ministry of Civil Aviation, Communications, Energy and Tourism of the Government of Vanuatu. Operation and maintenance of the facilities to be completed will be undertaken by the Civil Aviation Department, whose airport operations organization is judged to be appropriate. It is also expected that the revenues from airport charges will sufficiently cover the operation and maintenance costs of the airport.

The development of Bauerfield International Airport to accommodate wide-bodied aircraft of the Boeing 767 class will realize mass rapid transport for Vanuatu, remove the bottleneck hindering tourism development and promote the economic self-reliance of the nation. Therefore, it is judged significant that this Project be implemented under the grant aid program of the Government of Japan.

CHAPTER 1. INTRODUCTION

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The Government of the Republic of Vanuatu has listed the following objectives of the air transport sector in the Second National Development Plan (hereinafter referred to as DP2).

- Restore and expand international air services.
- Upgrade international airport infrastructures to ensure, in particular, that they are not a hindrance to tourism development.

The Government of the Republic of Vanuatu requested financial assistance from the Government of Japan to fund the development of the terminal facilities of Bauerfield International Airport.

The requested financial assistance included the following:

i) Construction of a new international passenger terminal building, renovation of the existing terminal building for domestic services, and ancillary facilities

ii) Expansion of the apron

iii) Replacement of air navigation facilities such as C-VOR/DME

In response to the request of the Government of Vanuatu, the Government of Japan dispatched to Port Vila a Preliminary Study Team headed by Mr. H. Matsumoto, Deputy Director of the International Air Transport Division, International Transport and Tourism Bureau, Ministry of Transport for two weeks from the end of February, 1988. The Preliminary Study Team discussed matters officials of the Government of Vanuatu, and conducted site surveys. The Preliminary Study Team also held discussions with officials from the UNDP, EEC, and the Government of Australia. It was apparent that the UNDP, EEC and Australia are actively studying the airport's development. The necessity for immediate expansion of the existing terminal building, the inadequacy of the existing apron and the need for replacement of the existing radio air navigation equipment were also confirmed. Based on this preliminary

study mission, the Government of Japan decided to conduct a Basic Design Study, and JICA dispatched to Port Vila the Basic Design Study Team headed by Mr. M. Watanabe, Deputy Director of the Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport from June 12 to July 5, 1988. The study team met with officials of the Government of Vanuatu and through both discussions and outside research established the following :

1) Background of the request for financial assistance
2) Summary of financial assistance from other countries
3) Current operation and maintenance program at the airport
4) General information on the Republic of Vanuatu
5) Specific details of proposed development plans for Bauerfield International Airport

The Study Team also conducted the following surveys :

1) Preliminary topographic survey
2) Site reconnaissance and an inventory of facilities at the airport
3) Traffic counts in the existing passenger terminal building and car park
4) Construction conditions reconnaissance such as the availability of materials and site characteristics

Through this research, the scope of work to be covered by Japanese financial assistance was established.

The Minutes of Discussions on the Basic Design Study were exchanged between the Study Team and the Government of Vanuatu on June 25, 1988.

Based on the field survey, the Study Team examined in detail the request of the Government of Vanuatu and carried out the basic design work in Japan. The Study Team prepared the draft final report, and were dispatched to Port Vila from September 8 to 21, 1988 to explain the report. Through the discussions between the Government of Vanuatu and the Study Team, basic agreement on the draft final report was reached, and their respective representatives signed the Minutes of Discussions

on September 16, 1988.

During this second field survey, a discussion was also held with a study team from the Government of Australia which visited Vanuatu for a field survey for a runway extension project at Bauerfield. The scope of the projects with Australian and Japanese assistance and their respective implementation schedules, etc., were confirmed between the Government of Vanuatu, the Australian study team and the JICA Study Team.

This final report is prepared by summarising the above activities and by incorporating the necessary studies and corrections executed in Japan.

A list of the Study Team, its daily activities during the field surveys, a list of the persons who took part in the discussions or were interviewed, and a copy of the minutes of the meetings are attached in the Appendix for reference.

CHAPTER 2. BACKGROUND OF THE PROJECT

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2.1 Nature, Society and Economy

1) Nature

The Republic of Vanuatu was established in 1980 after the Anglo-French Condominium Administration. The Republic consists of 80 islands which form a "Y" shaped archipelago, lying between latitude 13 and 23 degrees south and longitude 166 and 172 degrees east.

The land area is approximately 12,190 square kilometers. Efate, where Port Vila, the capital of Vanuatu, is located, is situated in the central part of the archipelago and has an area of 887 square kilometers. The geological formation of the islands varies from high mountains and plateaux to rolling hills and low plains with coastal terraces along the coral reefs. Three of the islands have active volcanoes.

The climate varies from tropical in the north to subtropical in the south with a mean annual rainfall of 2,360 mm at the capital, Port Vila. Variation in the temperature is relatively small; the temperature rarely exceeds 32 degrees centigrade and infrequently drops below 17 degrees centigrade. Tropical cyclones periodically destroy a considerable amount of the nation's economic and infrastructural assets. The cyclone in February 1987 was most devastating, causing damage to properties and assets in Port Vila and the southern islands of the Tafea regions. In the cyclon season, from November 1987 to April 1988, the country was hit by three major tropical cyclones which inflicted severe damage to agricultural crops and rural dwellings.

2) Population

The population of Vanuatu totalled about 111,251 in 1979 and 144,880 (estimate) in 1987.

The population density is sparse; 11.5 persons per square kilometer. Much of the population is concentrated in the capital city, Port Vila, whose total population and density are 14,180 and 615 persons per square kilometer, respectively.

3) Economic Background

From the viewpoint of natural resources, the Republic of Vanuatu has the potential for future development in tourist industries, agriculture, forestry plantations and fisheries. However, the resources have not been fully utilized for production due to the shortage of financing and manpower.

The major problem in the development of the economy is insufficiencies in the infrastructure, such as transportation facilities.

The economic index of Vanuatu is as follows :

(1) GDP (VT 1 million price in 1983)

1983	1984	1985	1986	1987
10,150	10,846	10,966	10,751	10,821

(2) Price Index (CPI, Port Vila, 1976=VT 100)

1982	1983	1984	1985	1986	1987
183.0	191.3	204.2	210.8	222.8	259.5

(3) Rate of Exchange

1 US$ = 102.63 Vatu (June 1988)

4) Industry

The main economic activities in Vanuatu are tourism and agriculture which has been developed by the copra plantations.

The major components of Gross Domestic Product (GDP) in 1987 were agriculture, and trade, hotels and restaurants which accounted for about 23.9 and 33.3 percent respectively.

The total GDP increased gradually before independence, but dropped suddenly due to the political confusion. Tourism and agriculture, in particular, were damaged severely when external financial assistance was suspended for a time. However, the government and other service sectors renewed their activities upon the recovery of external financial assistance and the tourism industry.

Future development of the tourism industry is very important for achievement of national economic self-reliance. Development of the international airport is indispensable for tourism development.

5) Trade and Balance of Payments

Exports from Vanuatu are limited to primary products. Copra, beef products, cocoa, and timber are the major products for export. Copra accounts for 50 percent of the total value of these exports. Although copra production and exports have not been exceptional since independence, due to political confusion and the stagnant copra prices on the international market, they are recovering as the copra prices rise.

Principal imports are food, drinks, building materials, petroleum, oil, machinery, transport equipment, and consumer goods.

The total value of imports is much larger than that of exports, and the balance of visible trade has shown an increasing deficit.

Studying the balance of payments, it has been proven that the foreign exchange earnings of the tourism industry and external financial assistance cover the large deficit of visible trade.

The revenue coming from foreign countries consists of a few major items, such as technical support and grants, etc.

2.2 Present Transport Other than Air

1) Land Transport

During the First National Development Plan (hereinafter referred to as DP1) period (1982-1986), the increase of roads was remarkable. It is estimated that the total length of roads in Vanuatu was 1,318 kilometers as of 1986. However, the country remains poorly served, particularly outside Efate and Espiritu Santo, largely as a result of high construction and maintenance costs and the sparsely spread population.

In Vanuatu, roads range in standards from cleared earth tracks to single and double track coral surfaced roads. There are few sealed roads, and they are almost exclusively confined to the urban areas of Port Vila and Luganville.

The total registered vehicle fleet during 1985 was 4,854. About 84% of the vehicles are concentrated on Efate (63.9%) and Santo/Malo (20%) where combined vehicle density is relatively high at one per 12.9 people. Excluding Efate and Santo/Malo, vehicle density is low with only one vehicle per 112 people.

Public passenger services are provided in the urban centres of Port Vila and Luganville by privately owned and operated mini-bus and taxi companies. There are no fixed timetables for buses which run seven days a week. Fares, routes and stopping points are regulated by the Ministry of Home Affairs and administered by the Municipal Councils. Less formal transport services are provided in some of the other LGC areas.

2) Marine Transport

There are two international and 19 inter-island wharves in Vanuatu. Table 2.2.1 sets out the external trade over the four year period 1982-1985.

The inter-island shipping network is classified into three shipping areas, each with a different level of service, as follows:

i. Core area - that area extending from Efate in the south to Espiritu Santo in the north, and including the west coasts of Pentecost, Epi, Ambrym and Maewo. Within this "inland sea" area, services average slightly more than one per week;

ii. Fringe area - the fringe area includes west Espiritu Santo and Malakula, and the east coasts of Pentecost, Maewo and Ambrym with average shipping frequency of no more than one trading vessel every six weeks;

iii. Outer area - this area, which includes the northern and southern-most parts of the group, Banks, Torres, and Tafea, where the frequency of trading vessel calls can be less than once every six weeks.

Although the frequency of service of marine transport is less than that of air transport, it plays important role in cargo transport.

The inter-island shipping fleet is divided between the private and public sectors. The government currently has a fleet of eight vessels including one barge, two tugboats, a patrol boat and a touring vessel. This government fleet not only serves in marine transport but also meets special requirements, such as hydrographic surveys, search and rescue during emergencies, and pilotage.

Table 2.2.1 : External Trade, by Port of Entry and Exit, 1982-1985

Year	Imports				Exports			
	Port Vila		Luganville		Port Vila		Luganville	
	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%
1982	33969	72	13386	28	10797	28	27640	72
1983	44967	74	15948	26	17022	34	32442	66
1984	44057	69	19961	31	32807	41	47109	59
1985	43988	65	23371	35	22555	40	33899	60

Source: Department of Ports and Marine

2.3 Present Air Transport

1) Airports

There are three international airports: Bauerfield International Airport (2,000m x 45m) at Port Vila; Pekoa Airport (1,600m x 35m) at Luganville having a paved runway; Burtonfield Airport (900m x 32m - grass), near Lenakel, which is licensed to operate aircraft up to Twin Otter class aircraft. Bauerfield is the only international airport which can accommodate jet aircraft, and is the centre of the domestic air services.

Twenty-four aerodromes (in addition to the international airports) handle domestic traffic. These facilities are predominantly grass strips varying in length from 700m to 1,000m. Table 2.3.1 lists Island Aerodromes and Aircraft Movements in Vanuatu in 1985.

Table 2.3.1: Island Aerodromes and Aircraft Movements, 1985

Aerodrome	Local Government Council Area	Aircraft Movements Per Week
Linua	Banks and Torres	1*
Ablow	Banks and Torres	6
Sola	Banks and Torres	7
N.W.Santo	Santo/Malo	1*++
Naone	Ambae/Maewo	8
Longana	Ambae/Maewo	28
Walaha	Ambae/Maewo	35
Lonorore	Pentecost	17
Sara	Pentecost	6++
Norsup	Malakula	38
Lamap	Malakula	18
S.W.Bay	Malakula	9
Craig Cove	Ambrym	22
Ulei	Ambrym	10
Lamen Bay	Epi	18
Valesdir	Epi	5
Pele	Shepherds	11
Emae	Shepherds	9
Quoin Hill	Efate	3
Dillons Bay	Tafea	9
Ipota	Tafea	5
Aniwa	Tafea	3
Aneityum	Tafea	1
Futuna	Tafea	1*++

Notes: An aircraft movement is one takeoff or landing.

* One flight each fortnight.

++ Opened during 1986.

Source: Department of Civil Aviation.

2) Air Routes

Figures 2.3.1 and 2.3.2 show the international and domestic air routes connected with Bauerfield International Airport, respectively.

There are currently a total of six international airlines operating 15 movements per week at Bauerfield. Table 2.3.2 lists the routes and frequency of operation.

There are two domestic air services, Air Melanesiae and DOVAIR. Air Melanesiae operates scheduled and charter services between the many islands of the archipelago using Embraer Bandeirante, DH Twin Otter, and BN2B Islander aircraft. DOV Air started operations in 1987.

Table 2.3.2: International Airlines Operations, Bauerfield

Airline	Destinations	No. of Flights Weekly
Air Vanuatu	Sydney	1
Ansett	Sydney	1
Air Caledonie	Noumea	5
Air Nauru	Nauru/Auckland	2
Air Pacific	Nadi/Brisbane	4
Solair	Honiara	2
Total		15

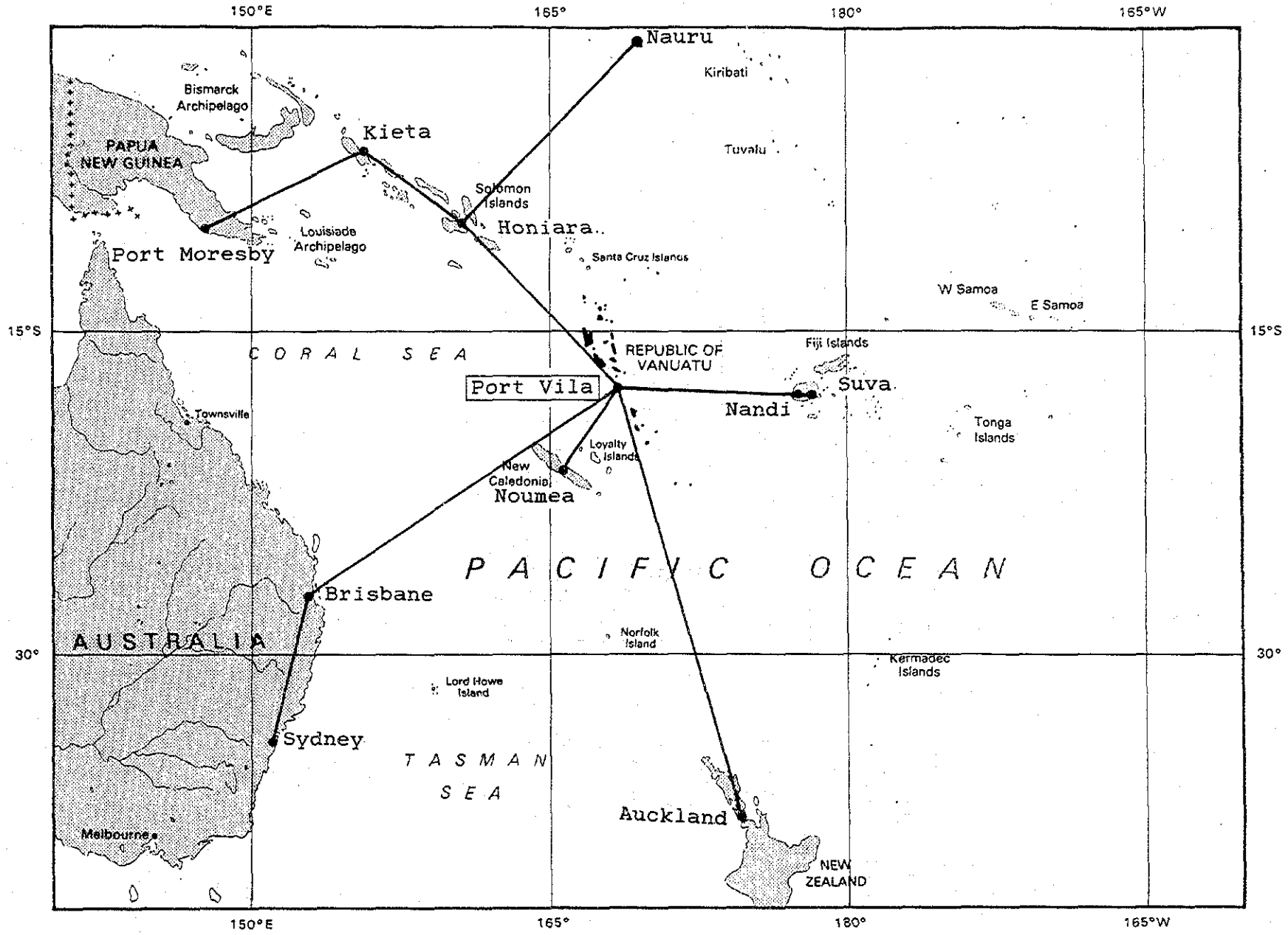


Fig. 2.3.1 International Air Routes Connected with Bauerfield

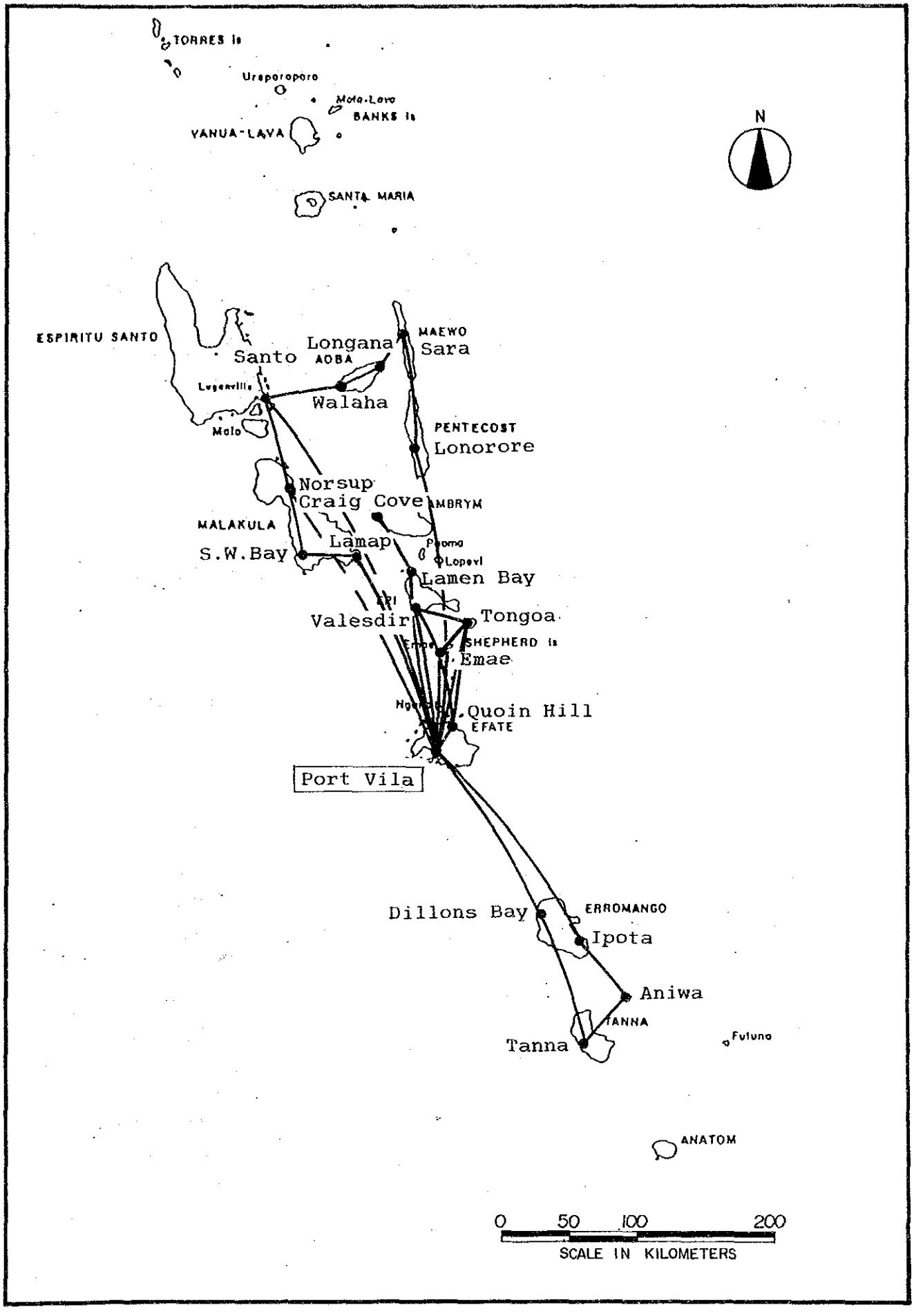


Fig. 2.3.2 Domestic Air Routes Connected with Bauerfield

3) Air Traffic Volume

(1) International

Table 2.3.3 lists international passenger movements at Bauerfield and Pekoa in recent years. The table shows a decrease in passenger movements after 1984. This is connected with a decrease in the number of Australian tourists which accounts for the majority of international passengers. The decline in the value of the Australian dollar relative to the Vatu and suspension of direct air services by Air Vanuatu are also considered to have adversely influenced the air traffic at Bauerfield airport.

(2) Domestic

Table 2.3.4 summarises the main domestic air passenger departure flows between 1980 and 1985, implying an average annual growth rate of 9.9%. A decrease in traffic due to the confusion following independence in 1980 was observed in 1981; however, air traffic continued to expand until 1985. Hub airports in Bauerfield and Pekoa account for 30% and 26% of the total passenger traffic respectively.

Table 2.3.3 : Commercial Traffic
- International Passenger Movements, 1980-1985

	Bauerfield			Pekoa		
	Arrivals	Departures	Total	Arrivals	Departures	Total
1980	28,846	28,452	57,298	340	275	615
1981	27,175	27,469	54,644	423	459	882
1982	34,704	35,870	70,574	441	520	961
1983	39,354	38,595	77,949	NA	NA	NA
1984	36,209	38,253	74,462	443	509	952
1985	30,372	32,961	63,333	176	394	670
1986	22,706	23,217	45,923	107	231	338
1987	20,129	20,614	40,743	62	57	119

Note : NA = Not available.

Source: Department of Civil Aviation.

Table 2.3.4: Domestic Commercial Traffic - Departures, 1980-85

	1980	1981	1982	1983	1984	1985
Linua	-	17	43	NA	94	98
Ablow	455	370	423	NA	536	599
Sola	171	221	213	NA	595	701
Pekoa	15095	19459	17607	NA	20936	24553
N.W.Santo++	-	-	-	-	-	-
Naone	-	28	148	NA	847	891
Longana	2056	1801	1549	NA	3204	3907
Walaha	2300	2321	3110	NA	4062	4669
Lonorore	1117	1153	1095	NA	1941	2339
Sara++	-	-	-	-	-	-
Norsup	3667	2904	3280	NA	6300	7343
Lamap	1035	959	1074	NA	1945	2035
S.W.Bay	-	-	-	-	848	877
Craig Cove	665	486	355	NA	1555	2858
Ulei	-	142	85	NA	604	990
Lamen Bay	548	372	355	NA	1254	1568
Valesdir	303	345	191	NA	444	565
Pele	1894	1942	1901	NA	2255	2632
Emae	577	652	570	NA	759	1071
Quoin Hill	89	5	9	NA	136	178
Bauerfield	245321	20295	22998	NA	27251	29186
Dillon's Bay	248	261	248	NA	533	646
Ipota	100	96	132	NA	386	383
Aniwa	-	-	-	NA	122	275
Lenakel	4878	4159	5944	NA	6974	6777
Aneityum	45	30	106	NA	550	535
Funtuna++	-	-	-	NA	-	25
Total	59564	58018	61436	NA	84131	95701

Notes : ++ Opened in 1986, NA = Not available

Source: Department of Civil Aviation.

2.4 Existing Conditions of Bauerfield International Airport

1) General Description

Bauerfield International Airport is located 5 kilometers north of Port Vila, the capital of the Republic of Vanuatu, and is approx. 20 meters above sea level. This airport was constructed by U.S. forces during World War II, and has a 2000 meter long runway, 150 meter wide runway strip 2 berths of international apron, etc.

Because hills and trees infringe upon the approach surfaces, a curved approach is applied. Due to these geological conditions, ILS (Instrument Landing System) is not istalled, but VOR/DME and Locator are installed. An extension of the terminal building was completed in 1982. Because the facilities were planned to cope with only one Boeing 737 (B-737) class aircraft, the terminal building with 1187 sq.m of floor area is insufficient in size to operate the Boeing 727 (B-727). Therefore, the terminal building shall be extended as soon as possible.

The airport is undergoing an improvement program to accommodate Boeing 767 (B-767) class aircraft. The runway, taxiway and apron pavements were strengthened in 1987. However, the expansion of the existing apron which is necessary for the introduction of B-767 class aircraft without infringement of the transitional surface by its vertical tail wing has not been carried out yet. Renewal of the air navigation equipment, such as VOR/DME, etc., is also necessary because it is obsolete.

Table 2.1.1 Outline of the Existing Airport Facilities

Country	INTL/DOM	Commencement of service	Position of the Reference Point		Magnetic Variation	Aerodrome Ref. Temp.	Administrative Authority
Republic of Vanuatu	INTL/DOM	N / A	S 17° 42′ 14″ E 168° 18′ 44″		12° E	30.0 C	Civil Aviation Department Ministry of Civil Aviation, Communications, Energy & Tourism
Name of Airport	ICAO Code	Total Area of Airport	Elevation	Runway Direction	Operation Hours		
Bauerfield	4 D	70 ha	20 m	N 118° E	19:00 / 07:00(GMT)		

Basic Facilities		Passenger Terminal Building	Other Facilities	
Runway Strip	2,120mx150m	One-Storied Building with corrugated steel sheet roof and reinforced concrete roof Total Area of Floor : 1,187 m2 International Arrival : 386 m2 International Departure : 554 m2 Domestic : 50 m2 Airline Offices, etc : 197 m2 Completed in 1982 (expansion area)	Administration Office	Made of Concrete Block
Runway	2,000mx 45m		Control Tower	ditto
Taxiway	98mx 21m		Meteorological Station	ditto
Apron	for B727 /B737 2 Berths : 6,000 m2 for Small Propeller Plane : 2,750 m2 T: 8,750 m2		Hanger	for Air Melanesia, Dovair, Small Aircraft : 3 aircraft
			Refueling Facilities	Fuel Hydrant Pits : 2 pits JET : 110,000 m3, AVGAS : 55,000 m3
			Fire Fighting	Fire Vehicle : 3, RIV : 1, Water Tank 20,000 m3
			Water Supply	City Water
			Electricity	Commercial Power Standby Generator : Nil
			Telephone	Available
			Car Park	Parking capacity : approximate 100
Pavement	LCN 40 SIWL 35t DW 45t	VIP Building Made of concrete block and wooden roof Completed in 1982	Others	Cool Storage and Incinerator

Condition of Nearby City			
Name of City	Population	Location	Transportation
Port Vila	14,180	5 km South of Airport	10 Minutes by Taxi

Air Navigation Facilities	NDB	VOR	DME	LOC	ILS	LMM	LOM
	0	0	0	0	x	x	x
Control and Communication Facilities	ASR	SSR	PAR	ASDE	ARTS	APP	DEP
	x	x	x	x	x	0	x
	TWR	GND	DLVRY	ATIS	AFTN	ATIS DS	
	x	x	x	x	0	0	
Ligthing Facilities	AGL	ALS	SALS	VASIS	PAPI	TDZ	RWTL
	0	x	x	11	11/29	x	11/29
	RWEL	RWYL	RWCL	TWYL	TWCL	AFL	ABN
	11/29	0	x	0	x	0	x
Meteorological Observation Facilities	WIND/TEMP	RVR	CEILOMETER	WX FAX	WX RADER	APT RX	VOLMET BROADCAST
	0	x	x	x	x	x	x

Transportation				
Passenger	1984	1985	1986	1987
Domestic	55074	58221	55752	59041
International	74462	63333	45923	40743
Total	129536	121554	101675	99748
Cargo (ton)				
Domestic	-	-	-	-
International	549	493	516	656
Total	549	493	516	656
Landing Frequency				
Domestic	2911	2813	2746	3141
International	976	833	610	656
Total	3887	3646	3356	3797

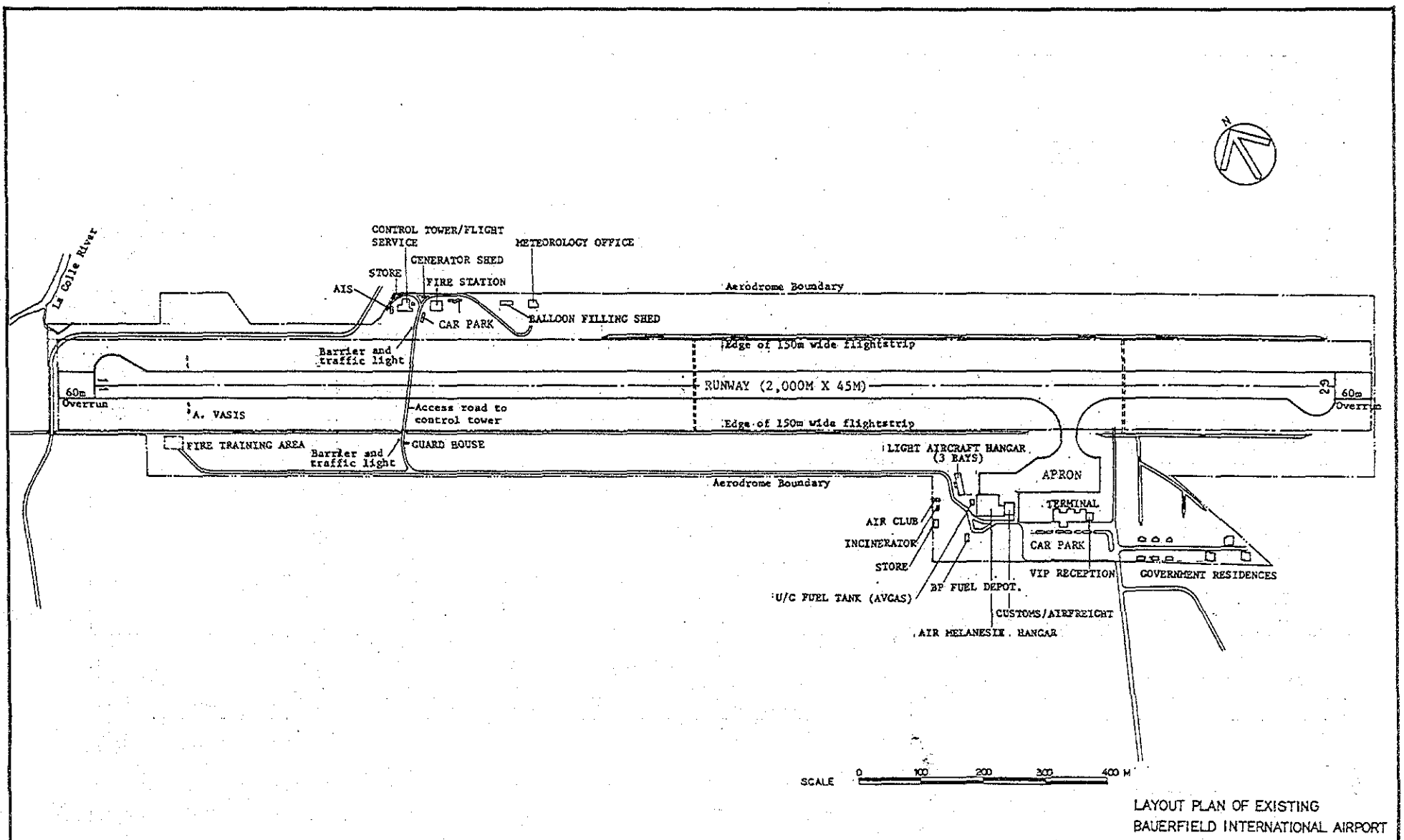


Fig. 2.4.1 : Facilities Layout Plan of the Existing Airport

2) Runway and Strip

The existing runway (2,000m long by 45m wide) is paved with asphalt concrete. Runway 11 serves approx. 90% of the operations due to the prevailing wind direction. Strengthening of the existing pavement of the runway to accommodate B-767 operations was completed with Australian aid in June 1987.

The existing 2,000m long runway, however, is not sufficiently long for non-stop B-727 flights to Brisbane with full passenger loads. Flights must call at Noumea to refuel at present, but extension of the runway to 2,600m is currently planned with Australian aid. The runway strip is 2,120m long by 150m wide.

3) Apron and Taxiway

The total area of the apron is 8,750m^2. The east side of 6,000m^2 is utilized as the international apron. Although it is marked for B-737s and B-767s (see Figure 2.4.2), the parking position is too close to the runway and the B-767's vertical tail infringes upon the 1 to 7 transitional surface from the 150m wide runway strip. Therefore, the parking position should be relocated before B-767s are introduced to this airport.

When B-737s and B-727s park simultaneously during the peak hours of the week from 3 to 4 p.m. on Sundays, they park parallel to the terminal building instead of following the markings. It is difficult to make spot assignments on the existing apron due to the lack of a spare stand. On rare occasions, three B-737s are parked on the apron in substandard configurations.

The west side of 2,750m^2 is utilized by such domestic aircraft as the DHC-6 and the BN2. The domestic apron is too small to accommodate three DHC-6 class, two BN2 class, and the air-club's aircraft without using the grass area for parking. The existing taxiway shall be widened from 18m to more than 23m for B-767 operations in accordance with ICAO requirements.

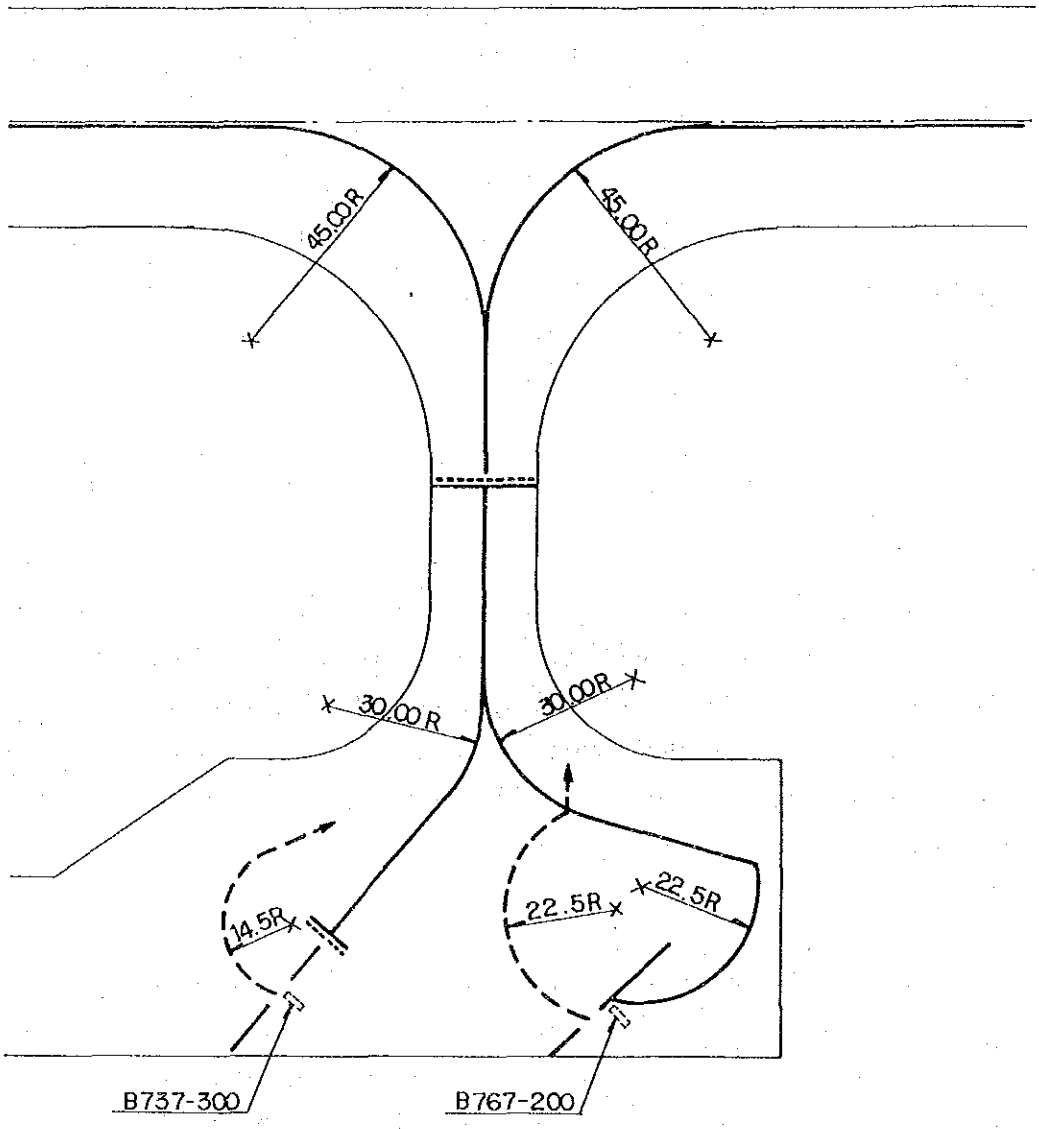


Fig. 2.4.2 : Existing Apron Marking

4) Passenger Terminal Building

(1) Architecture

The expansion of the passenger terminal building was completed in 1982. It has a 386 sq.m arrival area, a 605 sq.m departure area and a 197 sq.m common area for an overall floor area of 1,188 sq.m. This building is a reinforced concrete structure. It is one story high and is roofed with corrugated steel sheet except for the observation deck which has a reinforced concrete roof. Taking into consideration the tropical weather conditions, the building was designed to permit natural ventilation. It has a ceiling height of 4m and an inside wall height of 3m.

The check-in lobby is located at the west side, and is used by both international and domestic passengers. Eight check-in counters are provided. One of them handles domestic passengers with baggage and cargo. Baggage and cargo are moved by a gravity roller. The check-in lobby is overcrowded because greeters are allowed to enter the lobby. The domestic departure passenger flow is planned to have direct access to the apron from the check-in lobby. The international departure lobby is located at the centre of the terminal. Departing passengers pass through security and immigration check points before reaching the departure lobby. Security checks for the international departing passengers are carried out using a walk-through metal detector and a physical check of the hand-carried baggage. All hand-carried baggage is opened for inspection. This is a time-consuming process (about one minute per passenger), and creates a long queue during peak hours. The immigration check area is not crowded compared with the security check area. After immigration, there is a customs counter to declare the goods which were bought in the duty free shop in town.

The international arrival area is located at the east side of the terminal. There are four immigration counters in the arrival area, three handle foreigners, one takes care of Vanuatu citizens. However, due to the shortage of officers, only three counters are usually in operation and queueing often stretches to the outside of the terminal building in the peak hours. No conveyor belt is provided for the

baggage claim area where there is only a small counter. Therefore, the baggage claim counter is overcrowded and it takes a long time for passengers to claim their baggage. The customs counters also create a large crowd and a long queue which mingle with the crowd waiting for baggage because of a lack of queuing space and counters. There is a quarantine counter after the customs check, however, no quarantine check is made usually.

There are a bank, a tourist counter, a rent-a-car counter, and a snack bar, etc., in the public lobby.

The terminal building is maintained in good condition and is expected to be used for a long period of time. However, some repairs will be required as there are leaks in several locations.

Since the existing terminal was designed to cope with only one B-737 class aircraft, it has becomes extremely overcrowded and there are delays in passenger handling when a B-727 or two B-737 class aircraft arrive (the present peak hour). It is therefore necessary that a new international passenger terminal building be constructed as soon as possible in order to break the present bottleneck and to cope with future demand.

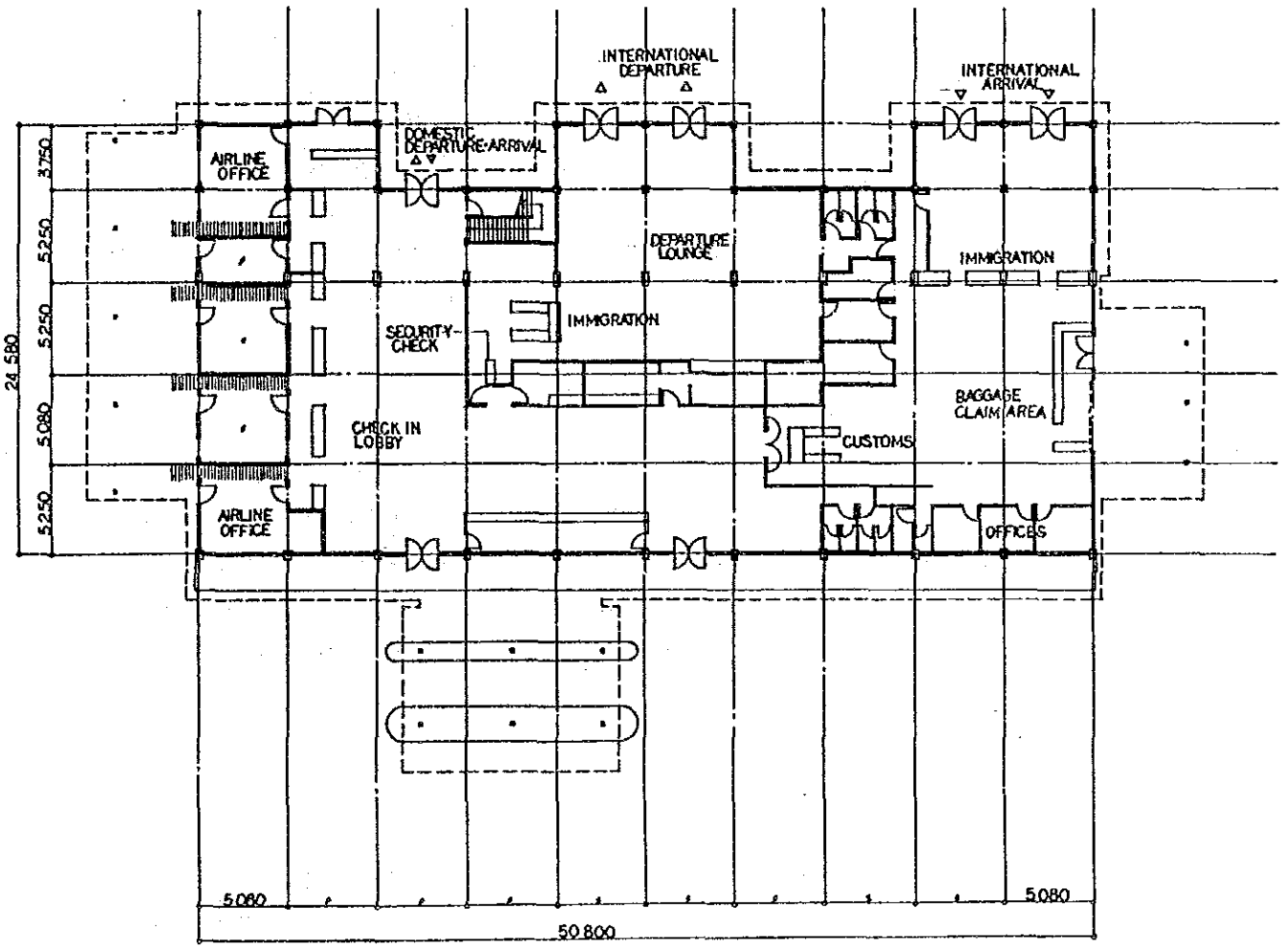


Fig. 2.4.3 Existing terminal Building

(2) Water Supply, Drainage and Air Conditioning System

a) Water Supply System

The existing terminal building and airport facilities are supplied with water by the Water Department through 2" steel pipes. Generally, the city of Port Vila maintains the water supply systems in good condition. The water pressure and the volume are sufficient for the users. The water pressure was measured as 4kgf/cm^2 at the meter of the existing terminal building since the main water tank is located on a hill (60m above sea level) near the airport. The water intake source is the Tekaru River which is located 0.8km south-southeast 0.8km of the airport, and from which water is pumped up to the tank. Generally, water consumption charges are based on the tariff meter, but the terminal building is exempt from such charges because it is a department of the government. The water charge is 40 Vatu per cubic meter.

b) Waste Water Drainage and Septic Tanks

Waste water from the existing terminal is discharged into two sets of septic tanks having digestion chambers. The effluent is disposed of through a soak field. There is no sea pollution because the terminal building is located 3km from the sea and the waste water is digested sufficiently by bacteria due to the year round high temperatures and high humidity.

c) Fire Hydrant System

The existing terminal building has three portable fire extinguishers but no fire hydrant. There is one outdoor fire hydrant in front of the VIP building. This is the closest fire hydrant to the terminal building. However, the terminal building has no hoses for fire fighting.

d) Air Conditioning and Ventilation Systems

Although natural draft is mainly utilised for ventilation, ceiling fans were installed for use during periods of no wind. A window-type air conditioner is installed in the Air Caledonie office.

(3) Electrical Systems

a) Power Supply

Electricity is supplied to the existing terminal building and airport facilities through a 5500V/380-22V 50KVA transformer which was installed at the end of the high tension over-head line along the airport access road. Government residences and the cool storage are also supplied with electricity through this transformer.

The power supply cables were installed and are maintained up to the watt hour meter by UNELCO, an electric power company in Vanuatu. The charge for electricity is 23.36 Vatu per 1 kwh with a basic charge in accordance with the contract demand. The average monthly charge for electricity at the existing terminal building is about 132,000 Vatu. The charge for electricity in Vanuatu is relatively high compared to other prices because it includes not only the cost of producing diesel generated electricity but also the maintenance cost for the power supply network and the repair costs for damage resulting from salt water and lightning. The existing terminal building has no standby generator. Emergency lighting fixtures (5 hours capacity) are installed for use during power failures.

b) Telephone System

Telephone networks are maintained by the Posts & Telecommunications Department. A 100 pairs underground telephone cable was installed for airport use, and was divided into 56 pairs for the control tower and the meteorological station, 20 pairs for the government residences, and 24 pairs for the existing terminal building with a number of spares by the

Civil Aviation Department. The existing terminal building has no telephone exchanger (EPABX).

c) Public Address System

The existing amplifier has no selector switches to facilitate announcing departures and arrivals separately. There are no ceiling speakers. Wall speakers were installed after an extension was made to the arrival hall.

d) Clock System

A total of three battery type wall clocks are installed in the check-in lobby, departure lounge, and baggage claim area. These clocks are maintained in good condition. There is an electric clock in the car park, but due to frequency fluctuations, it does not keep correct time.

e) Metal Detector

A walk-through type metal detector and a hand type metal detector are provided in the existing terminal building. The walk-through type metal detector is superannuated and sometimes functions poorly.

5) Air Navigation Systems

(1) Radio Air Navigation Facilities

Radio air navigation facilities, such as VOR/DME (VHF Omnidirectional Radio Range/Distance Measuring Equipment), NDB (Non-Directional Radio Beacon) and Locator (Non-Directional Radio Beacon) are installed in the Bauerfield International Airport. These facilities are shown in Table 2.4.2 and Figure 2.4.4.

Table 2.4.2 : The Existing Air Navigation Facilities

ITEMS	VOR	DME	NDB	LOCATOR
TYPE	VOR TAH511	FSD-5		Emetteur ERBT 2050/2
MANUFACTUR-ER & DATE	Thompson CSF 1975	ITT 1972	USA 1987	Telerad 1980
FREQUENCY	114.3MHZ	Channel 90X	300KHZ	361.0KHZ
IDENTIFICA-TION	VLI	VLI	PV	BA
RF POWER	50W	1KW(Peak)	500W	25W
RANGE	100NM	100NM	150NM	25NM
COORDINATES	17° 39' 59" S 168° 14' 11" E Approx. 7.5km northwest from RWY11, 245m above sea level	17° 39' 59" S 168° 14' 11" E Approx. 7.5km northwest from RWY11, 245m above sea level	17° 43' 46" S 168° 17' 36" E Approx. 3km south from airport. 60m above sea level	17° 41' 54" S 168° 15' 38" E Approx. 4km west from RWY11, 1m above sea level
POWER SOURCE	DC48V Standby Gen-set is out of order	AC220V Standby Gen-set is out of order	AC220V Standby Gen-set is under consideration	DC24 No Standby Gen-set
REMARKS			Belongs to the Posts and Telecom Dept.	

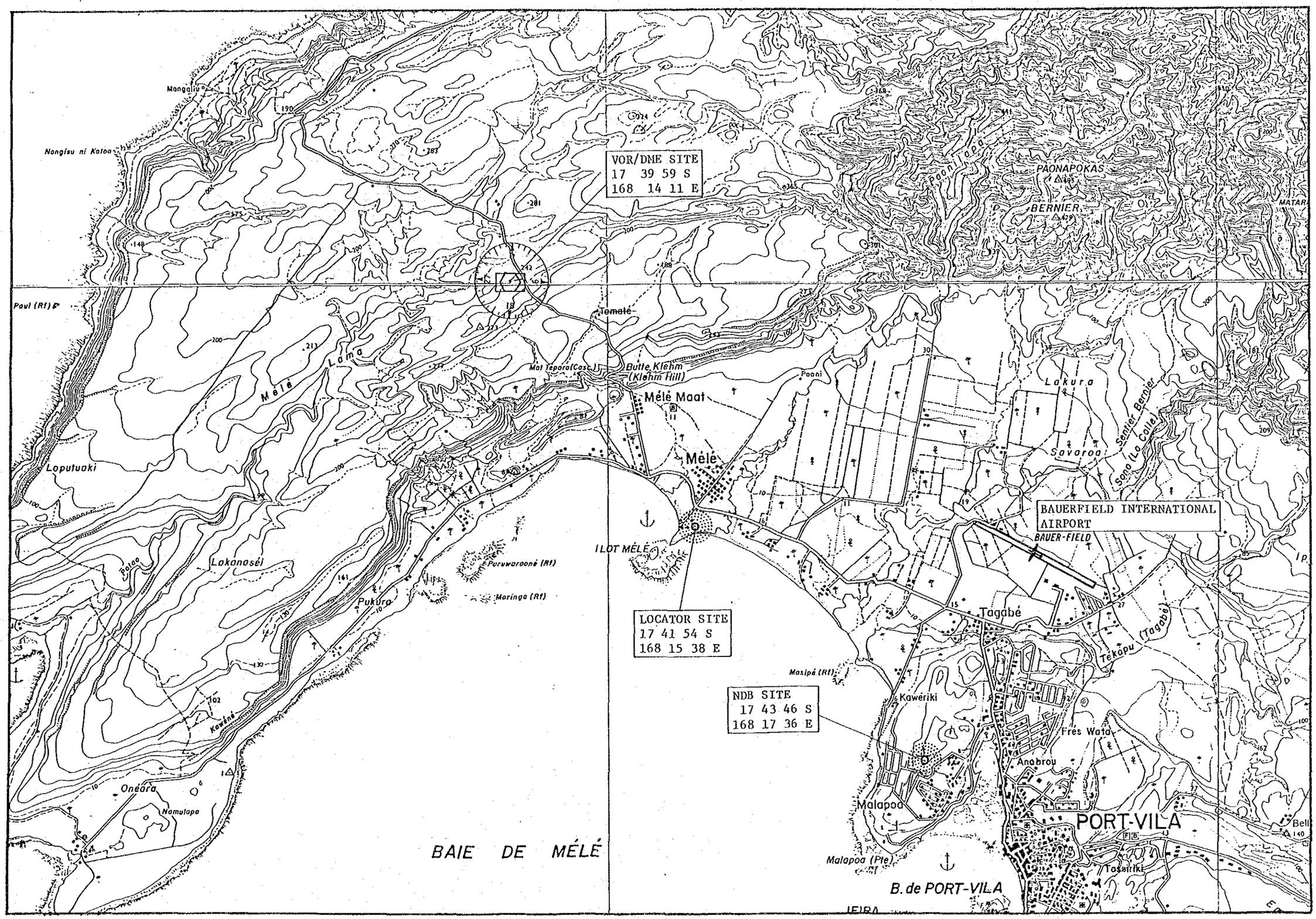


Fig. 2.4.4 Location of Air Navigation Facilities

a) VOR/DME

The VOR is a Conventional-VOR, and was installed in 1975. The DME was installed in 1972. Both the C-VOR and DME are superannuated. C-VOR No.2 is already out of order, and it is impossible to repair in Vanuatu due to the lack of spare parts. So, there is a definite possibility that C-VOR operation may come to a halt if VOR No.1 develops troubles. Because of deterioration the DME becomes overloaded even when only ten inquiries from aircrafts are received.

The C-VOR/DME are located on Klehm's Hill approx. 7.5km northwest from the RWY11 threshold. The remote control device for operating the C-VOR/DME from the control tower is out of order. There is no way to monitor the DME, but the C-VOR is being monitored by a VHF radio receiver in the airport. Although the existing C-VOR/DME sites are not flat, there are enough conditions to maintain the efficiency of the C-VOR operations.

The C-VOR/DME shelter consists of a C-VOR/DME equipment room and a generator room. It is a reinforced concrete structure. Although the shelter is old, it is possible to use the shelter with some repairs of the floors, ceilings, walls, etc.

Electricity for the C-VOR/DME is supplied through the 10KVA transformer which was installed beside the shelter by UNELCO. The C-VOR operates off DC48V batteries and a charger. The DME operates off AC220V commercial power only. As the standby generator for C-VOR/DME is out of order, if there is a commercial power failure, only the C-VOR can be operated by battery power(max. 20 hours).

b) NDB

The NDB serving aircraft and ships is located approx. 3km south of the airport. The NDB is operated and maintained by the Post and Telecommunications Department. The NDB has recently been replaced, and installation of a standby generator is also planned.

c) Locator

The locator is located approx. 4km west of the airport. As the locator was installed in 1980 and is superannuated, the equipment shall be replaced. However, the vertical antenna can be utilized because it was replaced recently.

The locator shelter is a reinforced concrete block structure, and can be used with some repairs of cracks and repainting. Electricity for the locator is supplied by UNELCO (3 phase 4 wire 380/220V) and is converted to DC24V batteries and a charger. The locator can operate on batteries for more than 48 hours. The suspension of the locator's signals should be minimized when equipment is being replaced because the locator plays a very important role in instrument approach procedures to Bauerfield International Airport.

(2) Airfield Lighting Facilities

a) Airfield Lights

A curved Approach Lighting System, Precision Approach Path Indicator, Runway Threshold and End Lights, Runway Edge Lights, Taxiway Edge Lights, and Apron Edge Lights are installed at Bauerfield International Airport. The same circuits handle the runway edge lights and the taxiway edge lights. The circuits consist of two blocks with two CCRs (Constant Current Regulators). It would be difficult to check the manufacturer and the capacity of the existing CCRs. However, both CCRs still have a final step for handling additional lights. Therefore, it is assumed that the additional loads of taxiway and apron edge lights for the widening of the taxiway and expansion of the apron are able to be supplied by the existing CCRs.

b) Apron Floodlights

The existing apron floodlights are installed on top of steel pipes which are set up on either side of the existing terminal building.

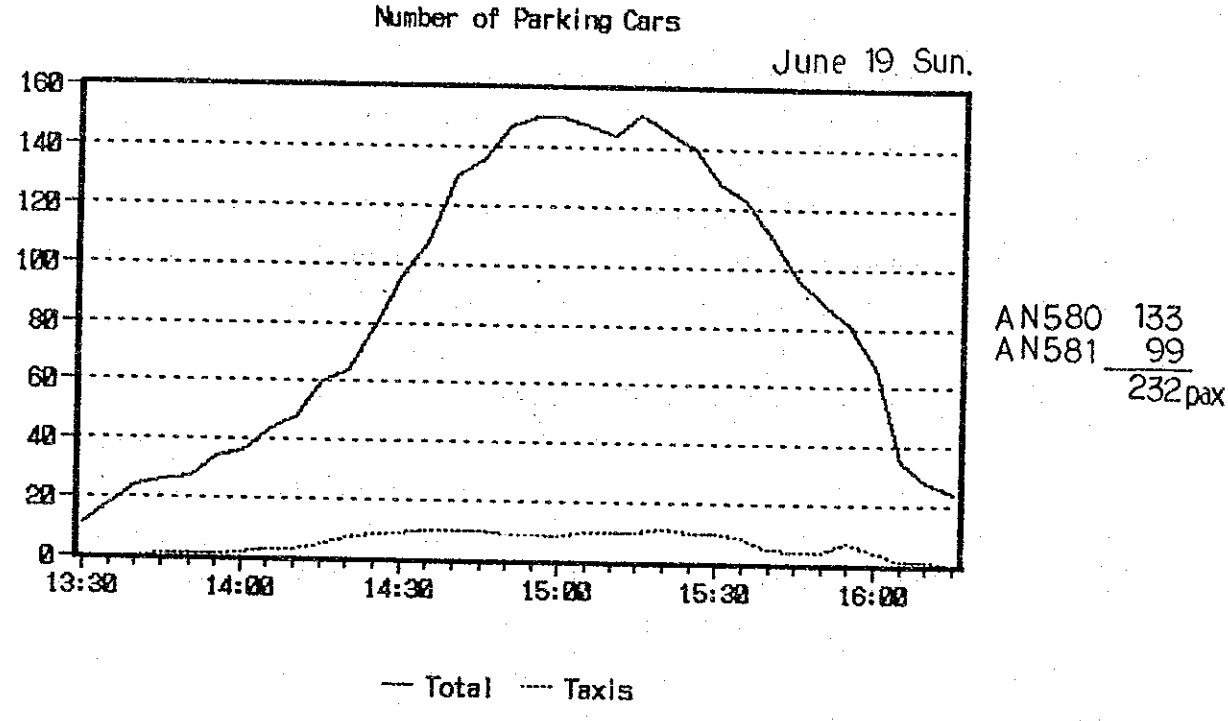
The apron floodlights operate only on commercially supplied power because the standby generator for the airfield lights is located near the end of RWY11 (approx. 1.2km from the terminal building).

c) Standby Generator for Airfield Lights

A standby generator (3 phase 4 wire 380/220V 110KVA) is installed in the generator house located beside the control tower. The generator could not be started within 15 seconds which is an ICAO recommendation. Therefore, the generator should be started before the commencement of night operations so that it will be ready to use in the event of a commercial power failure.

6) Car Park

The nominal capacity of the existing car park is 100 vehicles, but there is some more room for parking. As shown in Figure 2.4.4, approx. 150 vehicles (including approx. 10 taxis) parked at the peak hour (around 3:00 p.m.) during the traffic survey on Sunday, 19 June. The peak hour is due to the arrival of 133 international passengers (Flight No. AN580 Arr. 14:45) and the departure of 99 passengers (Flight No. AN581 Dep. 15:20). Therefore, the number of parking cars per passenger is calculated as 0.65. The curb front is about 10 meters long and has three lanes. Tour buses which drop off departing passengers there often wait more than one hour to pick up the arriving passengers. Taxis waiting for the passengers form two rows at the east end of the terminal building.



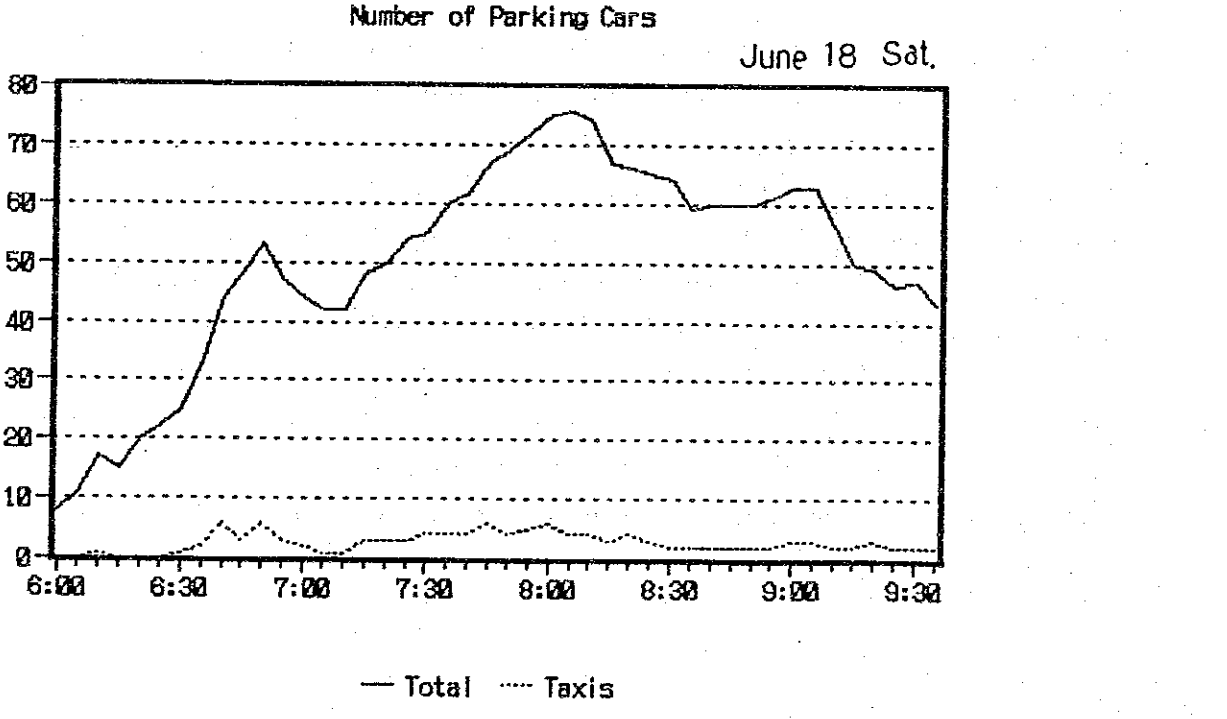


Fig. 2.4.5 Results of Traffic Counts

7) Traffic Record

(1) Annual Passenger Movements

The past trend of international air traffic is shown in Table 2.4.3. The number of international passengers dropped to 41,000 in 1987 from its peak volume of 78,000 in 1983. Although this decrease may be explained by the decrease of international tourists, quarterly passenger records in 1988 indicat an increase from 1987.

The transit rate is 30 to 35% throughout the year. The number of passengers per flight is approx. 50, and the average load factor is around 50% at present.

Table 2.4.3 : International Passenger Movements, Bauerfield

	No. of Passengers	No. of Transit Passengers	Rate of Transit (%)	No. of Aircraft Movements	No. of Passengers per Movement
1980	57,298	NA	NA	NA	NA
1981	54,644	NA	NA	2,008	NA
1982	70,574	NA	NA	2,342	NA
1983	77,949	NA	NA	2,478	NA
1984	74,462	15,917	29.9	1,952	54
1985	63,333	16,324	34.0	1,666	58
1986	45,923	8,077	26.0	1,220	51
1987	40,743	12,023	37.1	1,312	49

Note : NA = Not available.

Table 2.4.4 indicates the records of domestic air traffic at Bauerfield airport. The number of passengers has been increasing since 1982, except for a setback in 1985, and reached 59,000 in 1987. The number of passengers per flight is approx. 10 at present.

Table 2.4.4 : Domestic Passenger Movements, Bauerfield

	No. of Passengers	No. of Aircraft Movements	No. of Passengers per Movement
1981	53,068	20,188	2.6
1982	42,002	8,946	4.7
1983	43,038	9,952	4.3
1984	55,074	5,822	9.5
1985	58,221	5,626	10.3
1986	55,752	5,492	10.2
1987	59,041	6,282	9.4

(2) Monthly Passenger Movements

Tables 2.4.5 and 2.4.6 list the respective international and domestic monthly passenger movements during the 1986-87 period at Bauerfield.

The peak month for international passenger movements occurs in January and 1/8.5 of the annual passengers were concentrated in January in 1987.

The peak month for domestic passenger movements is December. Peak month ratios in 1987 and 1986 were 1/7.3 and 1/9.4 respectively. The a high peak month ratio in 1987 is thought to be explained by the increase of passengers due to commencement of services by DOVAIR in August.

Table 2.4.5 : Monthly International Passenger Movements, Bauerfield

	1987		1986	
	No. of Passengers	Ratio to Annual traffic	No. of Passengers	Ratio to Annual traffic
Jan.	4,784	1/8.5	5,046	1/9.1
Feb.	2,598	1/15.7	3,943	1/11.6
Mar.	2,340	1/17.4	3,967	1/11.6
Apr.	2,219	1/18.4	3,048	1/15.1
May	3,151	1/12.9	4,346	1/10.6
Jun.	3,285	1/12.4	3,146	1/14.6
Jul.	3,718	1/11.0	3,363	1/13.7
Aug.	3,246	1/12.6	4,786	1/9.6
Sep.	3,354	1/12.1	3,703	1/12.4
Oct.	4,276	1/9.5	3,322	1/13.8
Nov.	3,474	1/11.7	3,410	1/13.5
Dec.	4,298	1/9.5	3,843	1/11.9
Total	40,743	-	45,923	-

Table 2.4.6 : Monthly Domestic Passenger Movements, Bauerfield

	1987		1986	
	No.of Passengers	Ratio to Annual traffic	No. of Passengers	Ratio of Annual traffic
Jan.	4,985	1/11.8	5,515	1/10.1
Feb.	4,327	1/13.6	5,346	1/10.4
Mar.	3,237	1/18.2	3,781	1/14.7
Apr.	3.316	1/17.8	3,827	1/14.6
May	5,072	1/11.6	5,887	1/9.5
Jun.	4,028	1/14.7	3,841	1/14.5
Jul.	4,450	1/13.3	4,496	1/12.4
Aug.	5,682	1/10.4	5,054	1/11.0
Sep.	5,487	1/10.8	4,499	1/12.4
Oct.	4,868	1/12.1	3,889	1/14.3
Nov.	5,518	1/10.7	3,651	1/15.3
Dec.	8,071	1/7.3	5,966	1/9.3
Total	59,041	-	55,752	-

(3) Present Flight Schedule

The number of international flights per day at Bauerfield is 2-7 at present as is known from the flight schedules included in the Appendix. The peak hour of the traffic occurs during 15:00 and 16:00 on Sundays, and one B-727 and one B-737 aircraft are parked on the apron simultaneously.

Domestic flights per day number 22-26 for weekdays and 12 for Sundays. Peak traffic is generated around 7:00 in the morning by the departures of three DHC-6 and two BN2 aircraft which are based at Bauerfield.

2.5 Outline of the Related Projects

The development of Bauerfield International Airport is one of the objectives for the Air Transport Sector in the Second National Development Plan. The development plan consists of strengthening and extension (by 600m) of the runway, expansion of the apron and terminal building, and construction of an air navigation centre, etc. The projects are implemented with various external financial assistance based on this development plan.

The financial assistance provided by other countries for the development of Bauerfield International Airport is shown in Table 2.5.1.

Assistance from the Government of Japan for this Project has been requested by the Government of Vanuatu, and this Project constitutes the main part of the overall airport development plan which is aimed at enhancing tourism development.

Previous reports related to the airport development plan are as follows;

i) Government of Vanuatu Bauerfield Airport Study
Sep. 1983 ADAB/ACCA

ii) Bauerfield Airport Vanuatu Review of Airport Development Options
Jun. 1987 ADAB/ACCA

iii) The Development of Civil Aviation in Vanuatu
Dec. 1987 ITA

iv) Bauerfield Airport Vanuatu Runway and Movement Area Extensions
Draft Report May 1988 AIDAB/ACCA

Notes) ADAB : Australian Development Assistance Bureau
ACCA : Airport Consulting and Construction Australia Pty Ltd
AIDAB: Australian International Development Assistance Bureau

Table 2.5.1 Outline of the Financial Assistances

	COUNTRY	DESCRIPTION	PERIOD	BUDGET
Past Assistance	Australia	Strengthening of the existing runway, taxiway and apron to provide for operations by B-767 class aircraft.	1986/87	3.1 million AU$
	United Kingdom	Supply of Precision Approach Path Indicator and tape recorder	1985/87	10.7 million Vatu
	France	Supply of one Rapid Intervention Fire Vehicle and one Major Crash Tender	1986/87	58 million Vatu
	New Zealand	Supply of Emergency First Aid Trailer	1985/86	4.3 million Vatu
Approved Assistance	EEC	Provision of Air Navigation Center and Control Tower	1989	50 million Vatu
	United Kingdom	Obstruction Lights and Improved Curved Approach Lighting System	1988/89	0.3 million Vatu
Assistance Requested	Australia	Extension of runway (600m) and associated facilities to permit operations by B-767s	1988/90	5 million AU$
	New Zealand	Provision of Perimeter Security Fence		7.5 million Vatu

These studies cover an air traffic demand forecast, a feasibility study on the development of the existing airport including studies on a new airport site, studies on widening of the runway strip to 300 meters, etc.

The widening of the runway strip to 300 meters was recommended in the above (iv) Draft Report in order to retain the option of installation of MLS in the future. However, the Government of Vanuatu decided to develop Bauerfield International Airport based on a 150 meter wide runway strip because the acquisition of the land necessary for a completely new terminal site based on a 300 meter wide strip is difficult.

Concerning this matter, a discussion was held with a study team from the Government of Australia which visited Vanuatu for a field survey for the runway extension project of Bauerfield during the second field survey by the JICA Study Team. The scope of the projects by Australian and Japanese assistance and their implementation schedules, etc., were confirmed between the Government of Vanuatu, the Australian study team and the JICA Study Team. Major items which were confirmed with the Australian side are as follows:

i) The Government of Australia will extend the runway by 600m with a 150m wide runway strip.

ii) Construction works will be carried from May 1989 and be complete in six months.

iii) Operation of B-767 aircraft at Bauerfield with its 150m wide runway strip is considered no problem though operational restrictions may be imposed depending on meteorological conditions.

(Refer to Minutes of Meeting attached in the Appendix.)

CHAPTER 3. PROJECT DESCRIPTION

CHAPTER 3. PROJECT DESCRIPTION

3.1 Objectives and Contents

1) Objectives

The tourism industry in Vanuatu which utilizes its abundant natural beauty is one of the country's major sources of foreign exchange earnings, and tourism development is an important national policy for its relation to national economic self-reliance. However, the capacity of Bauerfield International Airport, the gateway to the republic, is insufficient even for the present level of traffic and is a bottleneck to tourism development.

This Project is aimed at removing the above bottleneck that hinders tourism development and is planned as a part of the ongoing development plan of Bauerfield International Airport. Major objectives are solving the problems of capacity by means of improving the terminal facilities in order to meet the future demand by B-767 class aircraft and ensuring operational safety by renewal of air navigation facilities which have become too old for use.

2) Contents

The contents of the final request which was confirmed by the discussions between the Government of Vanuatu and the survey team are as follows ;

(1) To construct a new international terminal building and to renovate the existing terminal building for domestic services

(2) To expand the apron to accommodate two B-767 class aircraft, including marking, edge lights and floodlights, but excluding fuel hydrant facilities

(3) To construct the necessary ancillary facilities such as roads and a car park with marking signs and lighting, etc.

(4) To provide the following equipment to handle the passengers and baggage :

- Necessary furniture such as check-in counters, CIQ counters, chairs in the public hall, etc., except for the office (Int'l and Dom. terminals)
- Baggage conveyors for arrival and departure areas (Int'l terminal)
- Walk-through and hand type metal detectors (Int'l and Dom. terminals)
- Public address system (Int'l and Dom. terminals)
- Scales for check-in of baggage (Int'l terminal)
- Telephone and interphone (Int'l and Dom. terminals)
- Septic tank (Int'l terminal)
- Emergency generator service (Int'l and Dom. terminals)
- Air conditioning in the limited area (Int'l and Dom. terminals)
- Fire hydrant (Int'l and Dom. terminals)

(5) To relocate the cool storage to the cargo area.

(6) To accommodate a VIP room in the new terminal building

(7) To replace the VHF Omnidirectional Range (VOR) / Distance Measuring Equipment (DME) and Locator

3.2 Outline of the Project Site

The project site is located in and around Bauerfield International Airport.

Efate, where Bauerfield International Airport is located, is situated in the central part of the archipelago of Vanuatu extending from south to north and has an area of 887 square kilometers. It is one of the most important islands for this country along with Espiritu Santo. The capital, Port Vila (population: 14,184 in 1986), is situated in the area facing the Bay of Port Vila in the southwestern part of this island and is the centre of administration and the economy. The transport facilities to Bauerfield International Airport, which is 5 kilometers north of Port Vila, consist of public buses, hotel buses and taxis.

Efate lies on latitude 18 degrees South and its climate is tropical, with high temperatures and high humidity. In summer (the rainy season) the average daily maximum temperature is 30 degrees centigrade and is 27 degrees centigrade even in winter.

In Vanuatu, since public investment emphasized on urban areas, particularly Port Vila and Luganville, during the period of the Anglo-French Condominium, Port Vila is complete with roads, telephones, and a water supply. In the National Development Plan, improvement plans for sewerage and the maintenance of waterworks are clearly drawn up in order to prevent a drop in public utilities service after independence.

3.3 Basic Condition of the Design

3.3.1 Airport Development Plan

The development plan of Bauerfield International Airport is being realized by external financial assistance from Australia, the U.K., the EC, Japan, etc. The major projects of the development plan are as follows:

i) Extension of the runway by 600 meters

ii) Construction of an air navigation centre

iii) Extension of terminal facilities

iv) Improvement of air navigation facilities necessary for introduction of B-767 class aircraft

The widening of the runway strip to 300 meters was recommended in "the Draft Report on Bauerfield Airport Vanuatu Runway and Movement Area Extensions" (May 1988, AIDAB/ ACCA) in order to retain the option of installing MLS in the future. As the width of the runway strip is the key condition of the Basic Design Study, the Study Team requested the Government of Vanuatu to make a decision on the width of the runway strip on which the Basic Design would be based.

The Government of Vanuatu decided to develop Bauerfield International Airport based on a 150 meter wide runway strip because the land acquisition necessary for a new terminal site caused by a 300 meter wide strip is difficult. The Government of Australia has also been informed of this decision, and agreed to extend the runway by 600 meter based on a 150 meter runway strip.

Figure 3.3.1 shows an airport development master plan based on a 150 meter wide runway strip prepared by AIDAB/ACCA.

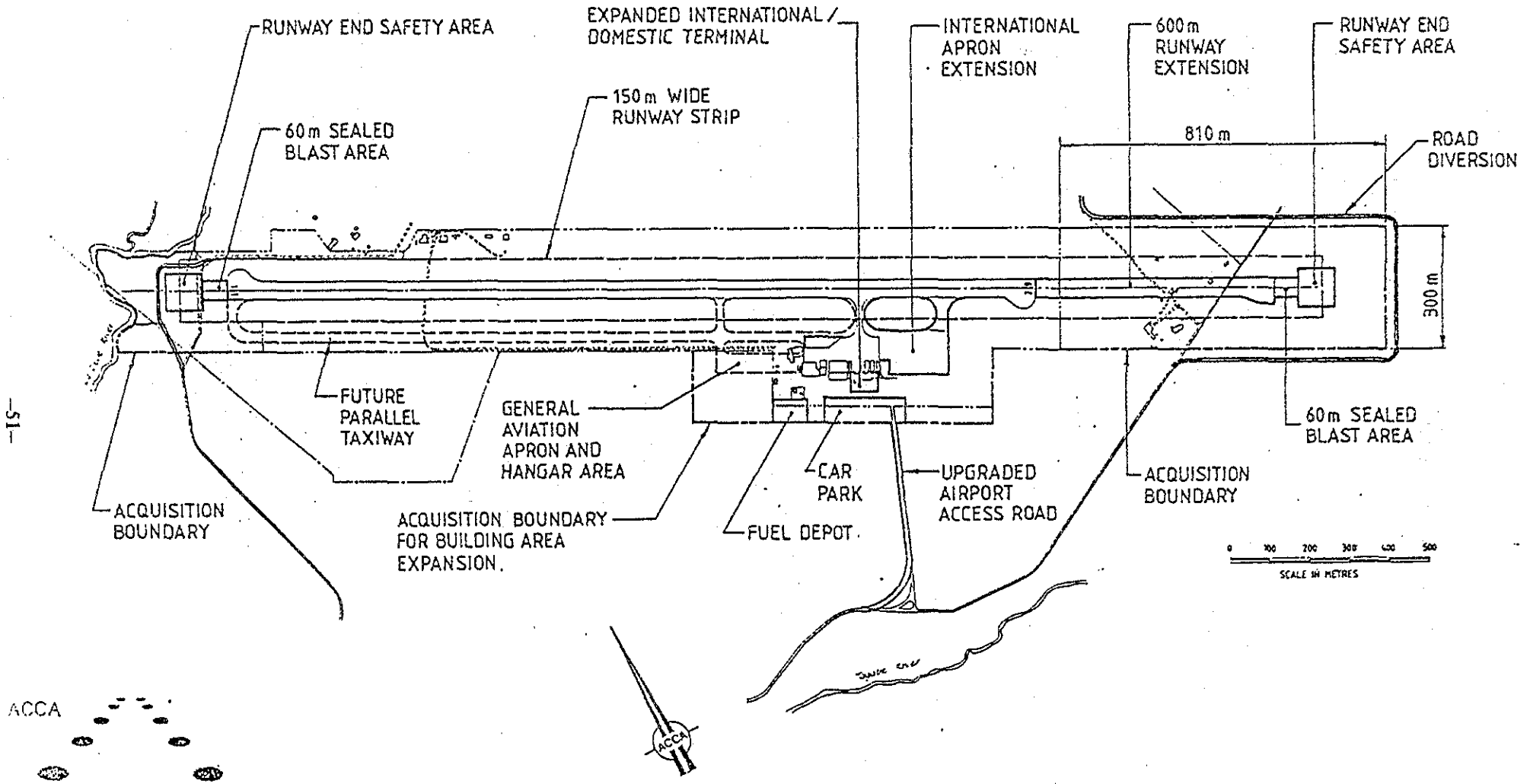


Fig. 3.3.1 Development Master Plan of Bauerfield International Airport

3.3.2 Air Traffic Demand Forecast

(1) Target Year

Terminal facilities are to be planned for the target year of 1995 (five years after completion of the construction) and to meet the demand of an average day of the peak month.

(2) Previous Forecast

Previous studies of the air traffic demand are the theoretical basis of the airport development plan. The results of those studies are summarized below :

Second National Development Plan

International Passengers Arrival

1991: 46,130 pax. 1996: 71,370 pax.

Domestic Passengers *1

1987-1992 annual average growth rate 4-5%

AIDAB/ACCA

International Passengers Arrival *2

1990: 41,000 pax. 1995: 70,000 pax.

ITA

International Passengers Arrival *3

1990: 48,550 pax., 1995: 64,550 pax., 2000: 98,140 pax.

Domestic Passengers Arrival

1990: 27,930 pax., 1995: 30,780 pax., 2000: 35,034 pax.

Note *1 Expanding the result 59,041 in 1987 by 4-5% per year,
1990: 66,400-68,300 pax., 1995: 80,800-87,200 pax.

*2 In case of introduction of B-767

*3 In case of moderate investment in hotels

(3) Annual International Passengers

Seeing the change of the number of international passengers, it is found that after the peak in 1983, approx. 78,000, the number of passengers decreased to 41,000 by 1987. This is because tourism from Australia (the biggest tourist source country for Vanuatu) decreased due to the strength of the Vatu relative to the Australian Dollar, the lack of promotion, and the suspension of direct flights to Australia by Air Vanuatu. Table 3.3.1 sets out a comparison of the number of flights for 1984, 1986 and at present.

Table 3.3.1 : Trend of International Flights

Airline	Destination	Number of Flights per Week		
		1984	1986	1988
Air Vanuatu	Sydney	3	-	1
Ansett	Sydney	2	1	1
Air Caledonie	Noumea	4	4	5
Air Nauru	Nauru/Aukland	2	2	2
Air Pacific	Nadi/Brisbane	4	1	4
Polinesian	Apia	1	-	-
Solair	Honiala	2	2	2
Total		18	10	15

In the above table it is shown that when Air Vanuatu suspended operations, and the total number of flights was only 10 per week in 1986. However, Air Vanuatu has resumed operations, and the number of flights has recovered to 15 flights per week in 1988. Air Vanuatu has a plan to lease a B-727 in November of 1988 and will operate two flights per week to Australia and one flight per week to New Zealand.

Also noting the quarterly traffic record (Figure 3.3.2), which shows a recovery of demand and an increasing number of flights, one would be led to believe that the number of passengers in 1988 will recover to the level of 1985.

However, it can be most misleading to assess future demand from the past record of traffic like this. Furthermore, the air traffic demand

is easily affected by the tourism policy of the nation, since most of the passengers at this airport are tourists.

In the Second National Development Plan, the development of the tourism industry is listed as one of the important objectives, and increased attention will be given to the Japanese and American markets. Furthermore, the air fares of the B-767 are expected to be cheaper compared with those of old type aircraft such as the B-727 and the B-737 and, as a result, the number of tourists coming to Vanuatu is expected to increase.

The Second National Development plan aims to provide approximately 100 hotel rooms by 1991 and approximately 300 rooms during the period of 1991 to 1996, and to achieve a 65% room occupancy rate. Based on these figures, the international passenger arrivals in 1996 are estimated as approximately 71,000. At present, the development of eight hotels (total number of rooms more than 1,000) is planned in Efate and other islands, so this forecast is considered to be reasonable.

Therefore, planning demand is estimated at approximately 140,000 per annum which is twice the forecasted number of arrival passengers in 1996 in DP2. It is noteworthy that this value, 140,000 passengers per annum, is equal to the scale needed to expand the 60,000 passengers (estimate for year 1988) by 7.4% per annum (average growth rate of South Pacific region, forecasted by IATA) and to add the number of passengers equivalent to two B-767 flights per week. It also seems to be a reasonable estimate taking into account the impact on demand by introduction of the B-767.

The past and projected international passenger traffic is indicated in Figure 3.3.3 with previous forecast.

Transit passengers are estimated at 40,000 persons per annum based on a previous transit passenger ratio to annual passengers of 35%.

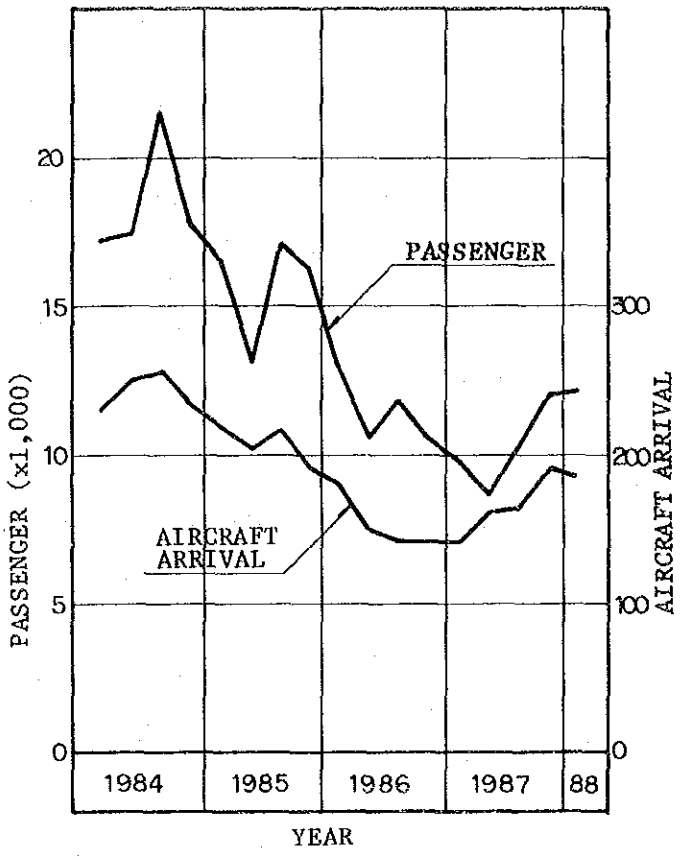
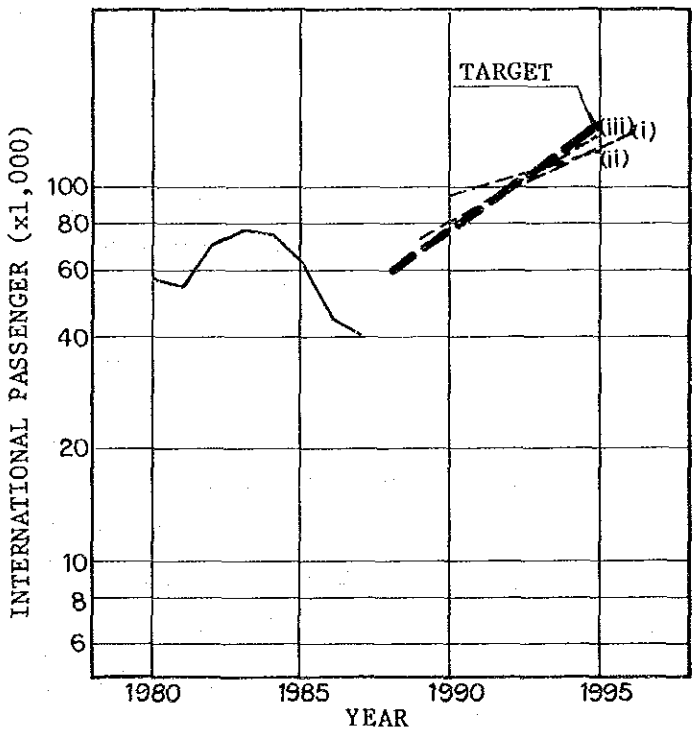


Fig. 3.3.2 Quarterly Record of International Traffic



(i) SECOND NATIONAL DEVELOPMENT PLAN
(ii) ITA FORECAST
(iii) AIDAB/ACCA FORECAST

Fig. 3.3.3 Projected International Air Passenger Traffic Demand

(4) Annual Domestic Passengers

Comparing the relation between the number of domestic passengers and GDP during the period of 1983-1987, statistics show a close correlation. Computing the Passenger Demand against GDP, we find:

$$Pd = 471,273.46 \times \text{Log (GDP)} - 1,884,771$$

$$r^2 = 0.965$$

Pd: The Number of Domestic Passengers

GDP: Gross Domestic Product (VT 1 million, the constant 1983 price)

r : Correlation Coefficient

The National Planning and Statistics Office estimates the GDP growth rate to be 3% in 1988, 3.5% in 1989, 4% in 1990 and 4.5% in 1991. GDP in 1991 is estimated to be VT 12,540 million based on this rate and the GDP in 1987. If the growth rate of 4.5% continues after 1991, GDP in 1995 is estimated to be VT 14,950 million.

Putting this GDP into the above correlation expression, the number of domestic passengers in 1995 is calculated to be 123,000 (approx.).

The planning demand is estimated at 100,000 persons per year taking into account the above previous forecast.

Table 3.3.2 : Domestic Passenger Demand Forecast

Forecast	Number of Domestic Passengers in 1995
Correlation Expression with GDP	123,000
DP2	80,800 - 87,200
ITA	61,600 (≒ 30,780 x 2)
Target for the Project	100,000

(i) SECOND NATIONAL DEVELOPMENT PLAN
(ii) ITA FORECAST
(iii) CORRELATION WITH GDP

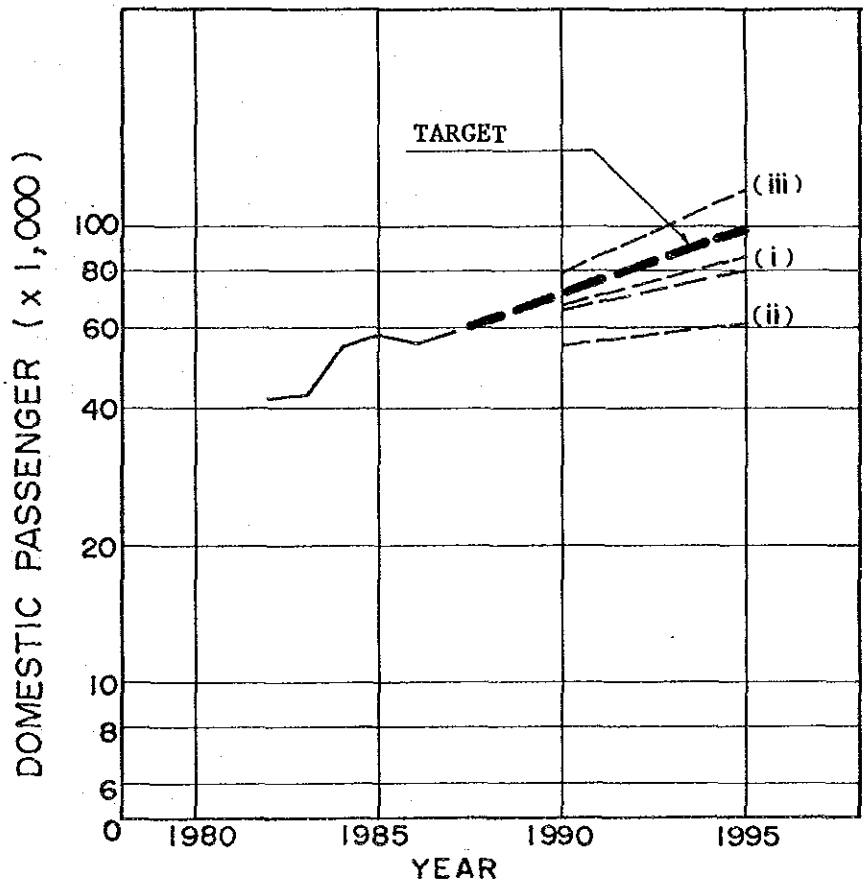


Fig. 3.3.4 Projected Domestic Air Passenger Traffic Demand

(5) Peak Hour Demand

i) The Number of Passengers on the Design Day

Based on the traffic record in 1986 and 1987, the peak month for this airport is late December and early January (Christmas and new year holiday). Around 1/8.5 of annual international passengers and 1/9.4 of domestic passengers are concentrated in this peak month (see Tables 2.4.5 and 2.4.6). Assuming that this trend remains in the future, the peak number of passengers is estimated to be about 1/260 international (1/8.5 (of annual passengers) x 1/31). Therefore, the number of passengers on the design day is as follows; international passengers: 540, transit passengers: 150, and domestic passengers: 340.

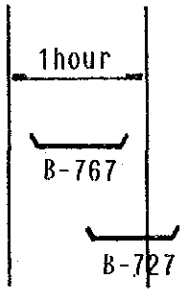
ii) Flight Frequency by Aircraft Type on the Design Day

As the passenger load factor is 70% for international flights and 80% for domestic flights, flight frequency by aircraft type on the design day is estimated by the number of passengers on the design day as follows;

International	B-767	230 seats	2 movements
	B-727	160 seats	2 movements
	B-737	110 seats	4 movements
Domestic	DHC-8	36 seats	4 movements
	DHC-6	19 seats	12 movements
	BN-2	9 seats	8 movements

iii) Peak Hour Passengers and Flight Frequency

Currently, the peak hour for international traffic is from 15:00 to 16:00 on Sunday at which time a B-737 and a B-727 park simultaneously in case of an early arrival or delay of departure. At the peak hour in 1995, a B-767 and a B-727 will be staying as shown below:



The peak hour passengers are estimated at 360 (departure and arrival) and 75 in transit, because of the process as follows;

B-767: for turnaround
B-727: for transit

Rate of Transit Passengers of Flight for Transit Flight : 65%

Passenger Load Factor: 70%

Departure and Arrival Passengers:
230 x 2 x 0.7 + 160 x 0.7 x 0.35 = 360

Transit Passengers: 160 x 0.7 x 0.65 = 75

As for domestic flights, all aircraft depart around 7:00 and return around 10:00 currently, and all aircraft make 1-3 round trips a day. It is possible to assume that this trend will continue in the future. Therefore, if each aircraft makes two round trips a day, the fleet size necessary for the domestic services will be one DHC-8, three DHC-6s and two BN-2s. Therefore, it is assumed that there will be one-way traffic of six aircraft during the peak hour. Therefore, peak hour passengers number 85 persons, a quarter of the design day passengers (all aircraft make 2 round trips a day).

3.3.3 Facilities Requirements

(1) Passenger Terminal Building

The required floor area for an international passenger terminal is roughly calculated as 3,350 sq.m based on 9.3 sq.m per peak hour passenger using the "Guidelines for Airport Consultative Committee" of IATA. As this figure shows the average ratio, it is necessary to take into account the characteristics of each airport such as the ratio of transit passengers, visitors, etc. According to the Basic Design Study the total floor area of the new international passenger terminal building is planned to be 3,225 sq.m (or 4,863 sq.m including the canopy which is more or less the same as the above estimated figure).

The necessary scales for the main facilities were calculated based on the following conditions.

- Visitors will be able to enter the check-in lobby as at present.

- Average staying time in the lobby is considered to be 30 minutes for passengers and visitors.

- Space per person is 1.5 sq.m.

- The unit floor area for passengers is planned to provide 1.0 sq.m for standing passengers and 1.5 sq.m for seated passengers which are planned to be 75% of the total passengers.

- Average waiting time and processing time per passenger for facility requirements are shown in Table 3.3.3.

Table 3.3.3 : Average Waiting Time and Processing Time per Passenger

Facility		Waiting Time	Processing Time
Int'l	Check-in Counter	15 (Min.)	1.3-1.5 (Min.)
	Dep. Immigration	15	0.9
	Security Check	15	0.3
	Arr. Immigration	15	0.9
	Customs Check	15	1.0
Dom.	Check-in Counter	15 (Min.)	2.0 (Min.)
	Security Check	15	0.3

The results of the calculations are shown in Table 3.3.4. Detailed calculations are explained in the Appendix.

Table 3.3.4 : Facility Requirements of Passenger Terminal Building

Facility			Requirement
Int'l	Dep.	Check-in Lobby	540m^2
		Check-in Counter	6
		Ticket Counter	2
		Dep. Immigration Counter	4
		Security Check Counter	4
		Departure Lounge	470m^2
	Arr.	Arr. Immigration Counter	4
		Customs Counter	5
		Effective Length of Conveyor Belt	33.5m
Dom.		Check-in Counter	4
		Ticket Counter	1
		Security Check Counter	1
		Departure Lounge	130m^2
		Public Hall	480m^2

(2) Apron

The Government of Vanuatu has requested financial assistance for apron expansion sufficient to accommodate two B-767 class aircraft and two smaller aircraft such as the B-727 and B-737. However, simultaneous parking of two B-767s is not expected in 1995 based on the demand forecast. Therefore, the apron will be expanded to accommodate one B-767 class aircraft in addition to a B-727 and a B-737 on the existing part of the apron.

(3) Car Park

The required number of parking spaces is estimated to be approx. 230 (cars: 200, taxi: 25 and buses: 7) based on the number of parking cars per passenger (0.65 car per passenger) calculated from the traffic survey.

(4) Air Navigation Equipment

The existing equipment will be replaced with new equivalent equipment.

3.3.4 Executing Agency and Airport Operations Organization

The executing agency of the Project is the Ministry of Civil Aviation, Communications, Energy and Tourism of the Government of Vanuatu. Administration, operation and maintenance of the facilities to be completed under the Project will be undertaken by the Civil Aviation Department under the above ministry. The present organization chart of the Civil Aviation Department is shown in Figure 3.3.5.

At present, the number of airport staff is approx. 60, and it is expected to be increased to approx. 75 members in line with the expansion of the terminal building.

This organization for airport operations is thought to be adequate even after the expansion of the terminal building and apron, and the replacement of the existing air navigation equipment.

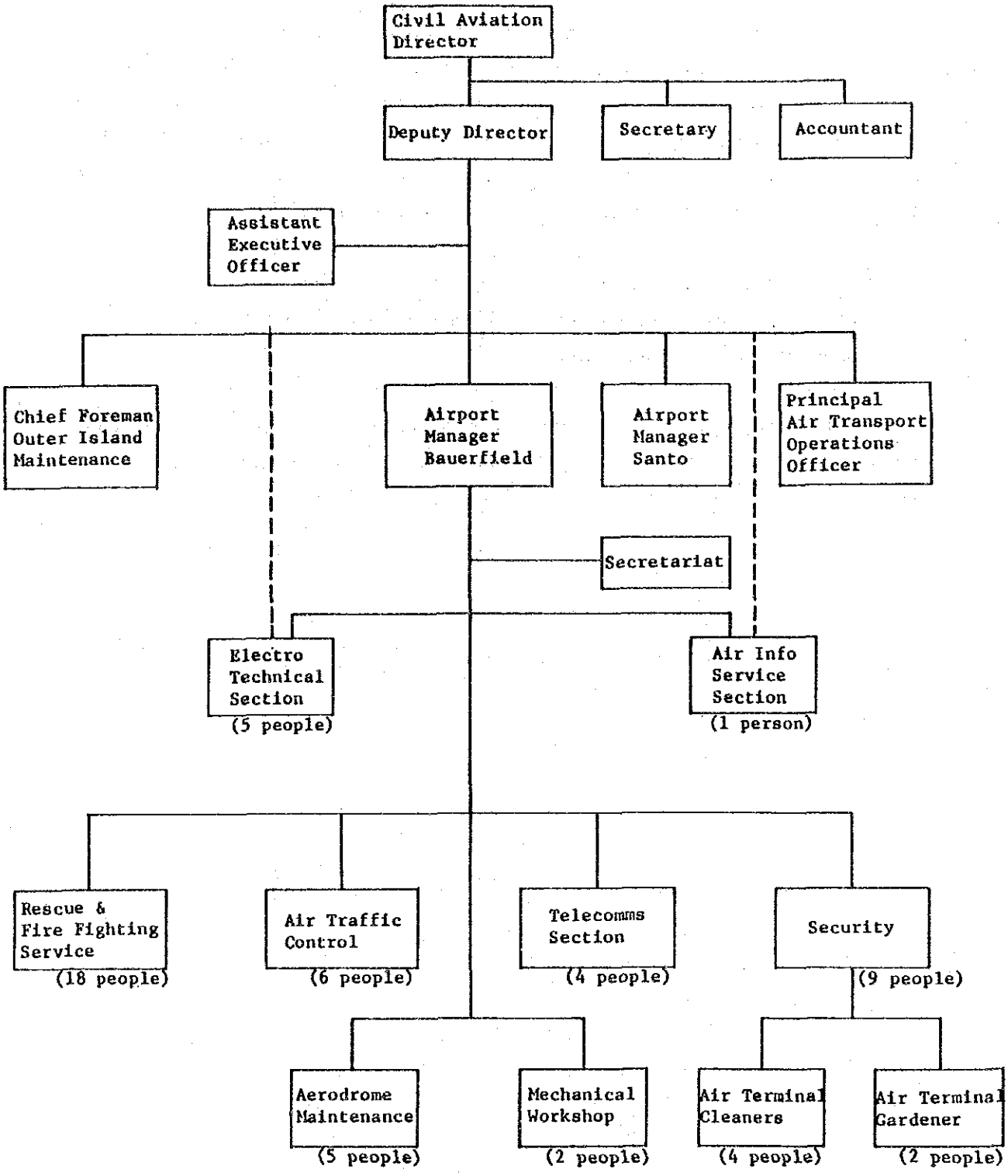


Fig. 3.3.5 Organization Chart of Civil Aviation Department

3.3.5 *Technical Assistance*

At present, two expert radio engineers are dispatched to the civil aviation department of the Government of Vanuatu from the Government of Japan.

After the completion of the replacement of C-VOR/DME, and Locator, maintenance work of the radio air navigation facilities will be less than at present; however, technical assistance in this field is necessary for the training of local personnel.

CHAPTER 4. BASIC DESIGN

CHAPTER 4. BASIC DESIGN

4.1 Design Policy and Conditions

1) Design Policy

(1) Passenger Terminal Building

i) The passenger terminal building consists of various functional facilities to handle passengers and baggage.

ii) The passenger terminal building will be planned so as to function efficiently as a system and to have expandability and flexibility to cope with changing demand in the future.

iii) Considering the climatological and other natural conditions including the heavy rainfall, high humidity, and high temperature, the ventilation of the building, salt corrosion protection, etc., are taken into account in the structural design and material selections for the terminal building.

iv) Materials and equipment of local origin, or procurable in Vanuatu, will be used as much as possible for ease of maintenance. Low maintenance design is a basic design policy for the terminal building.

(2) Air Navigation Equipment

i) The frequency of maintenance should be decreased as much as possible. If maintenance is necessary, it should be carried out as easily as possible. For instance, the spare parts had better be supplied in modules. Expendable parts, ex. battery, etc., should be compatible with parts which can be supplied in Vanuatu.

ii) To provide a design which will not be affected by salt damage, the building must be sealed hermetically. Entry of salt particles is to be prevented as much as possible, for the sake of protecting the parts of equipment and materials.

iii) The replacement of the equipment is to be designed so as to shorten the stoppage period of the existing VOR/DME and Locator as much as possible. However, it is planned that the existing VOR/DME and Locator will be replaced with the new equipment in the present site because a new site will call for land acquisition, an access road, power supply, etc.

(3) Apron

The apron will be expanded toward the east because the aircraft hangars are located on the west. The parking configuration should be determined considering such factors as the effects of jet blast on the terminal facilities, the possibility of land acquisition, the transitional surface, and the self-manoeuvering conditions of the aircraft.

2) Design Conditions

(1) Passenger Terminal Building

The passenger terminal building is basically designed in accordance with the Vanuatu Code. Where no Vanuatu Code is available, Australian Standards, New Zealand Standards, Japanese Architectural Standard Specifications (JASS), Japan Industrial Standard (JIS), etc., will be used.

(2) Air Navigation Equipment

The performance of the VOR/DME system is to be designed to satisfy the requirements of ICAO Annex-10. Other electrical and mechanical

performance is to conform to the International Electrotechnical Commission (IEC) and JIS.

(3) Apron

Dimensions of the apron should be determined to fulfill the requirements of ICAO Annex-14. Pavement of the apron is to be designed based on Australian standards and practices because they are applied to the pavement strengthening work of the runway, taxiway and existing apron.

4.2 Site Planning

1) Terminal Facilities

Based on the assumption of a 150 meter wide runway strip, the following two alternative development concepts were discussed by the Government of Vanuatu and the Study Team.

Alt-1 To construct a new international terminal building on the east of the existing terminal building and to renovate the existing terminal building for domestic services (see Figure 4.2.1)

Alt-2 To extend and renovate the existing terminal building to the west (International on the east and domestic on the west) (see Figure 4.2.2)

The Government of Vanuatu prefered basically to adoped Alt-1 for the terminal development concept. Further study was made on Alt-1 and four variations of Alt-1 (see Figures 4.2.3 through 4.2.6) and a comparison table (see Table 4.2.1) were submitted to the Government of Vanuatu.

These alternative concepts were put to the Cabinet and Alt-1B was adopted by the Government of Vanuatu.

Based on the above, the Study Team executed a basic design and prepared a draft final report. During the explanation of the draft final report, a request was made by the Vanuatu side to add a sheltered passageway to Alt-2B between the existing apron and the new passenger terminal in order to reduce inconvenience to passengers during rainy weather as much as possible. The Study Team analyzed the cost increase resulting from the above addition, the walking distance for passengers, and the convenience for airport staff walking between the domestic and international passenger terminals, and requested the Government of Vanuatu to study the possibility of adopting Alt-1A. The Government of Vanuatu again studied the layout plan of the terminal area, and finally decided to adopt Alt-1A.

It is considered to be possible to remove the six government residences because the site of Alt-1A belongs to the government. The neighboring land is the test farm of the Department of Agriculture. Therefore,it is considered that there will not be any trouble with the local inhabitants.

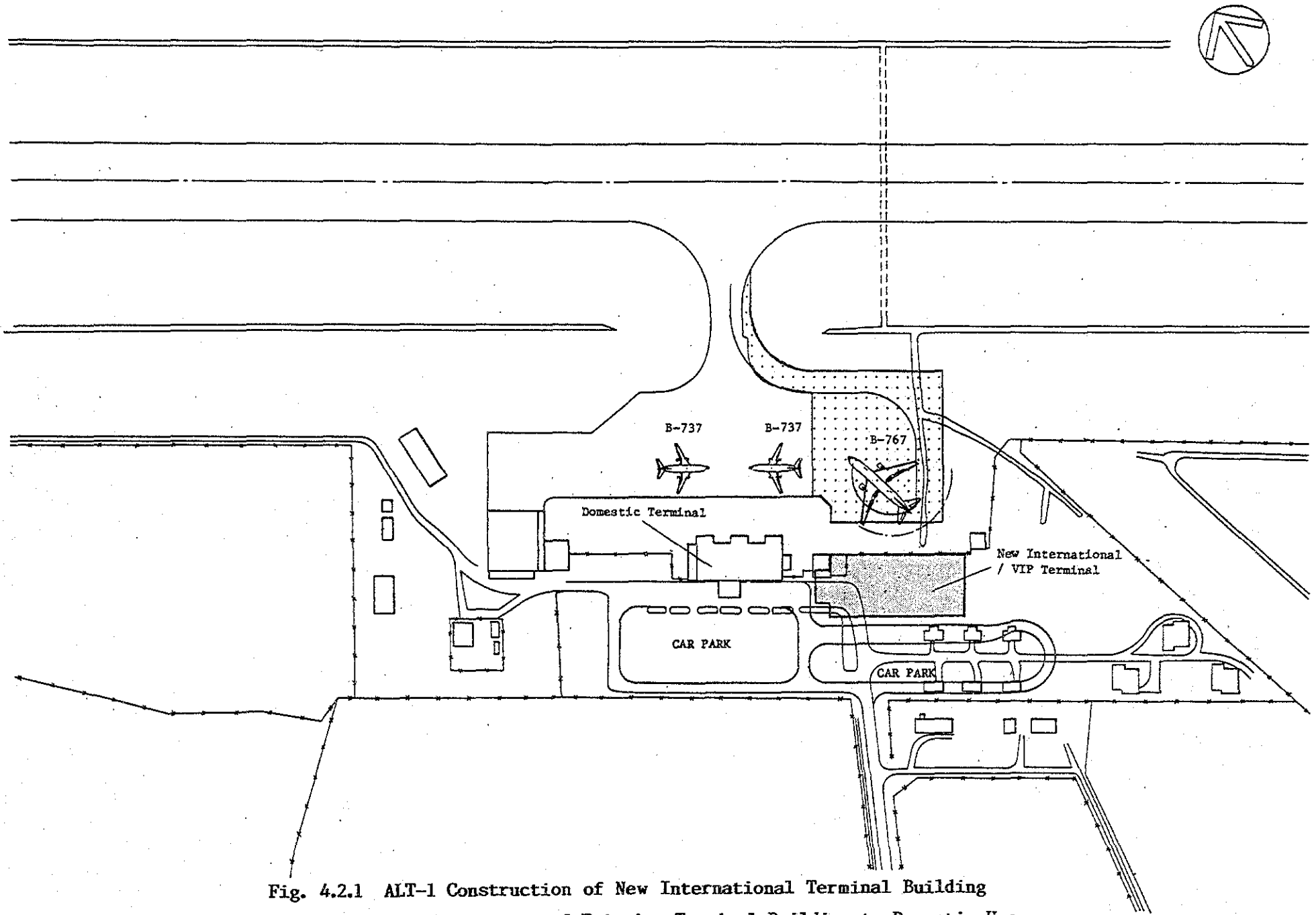


Fig. 4.2.1 ALT-1 Construction of New International Terminal Building and Renovation of Existing Terminal Building to Domestic Use

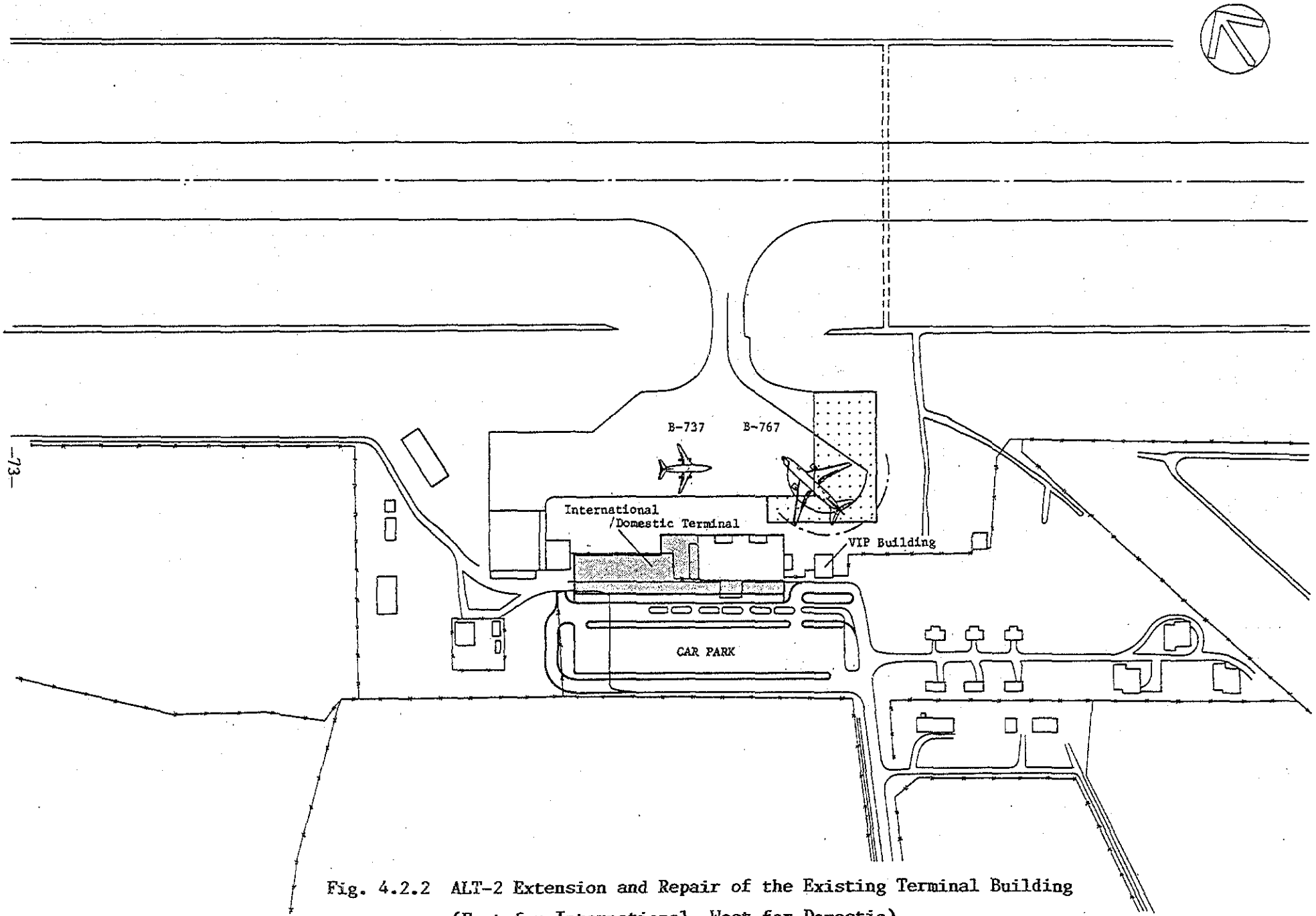


Fig. 4.2.2 ALT-2 Extension and Repair of the Existing Terminal Building
(East for International, West for Domestic)

Table 4.2.1 : Comparison of Alternative Layout Plan for Terminal Area Development

Items	Alt-1A	Alt-1B	Alt-1C	Alt-1D
Land Acquisition & Compensation	Six houses to be relocated.	Same as Alt-1A	Nine houses to be relocated.	Same as Alt-1A But more land acquisition than Alt-1A
Constructional Matters	VIP to be demolished and measures required before construction works start.	The present operation is free from construction works.	Same as Alt-1B	Same as Alt-1B
Influence of Jet Blast	East corner of Int'l Bldg. is exposed to jet blast.	Exst. VIP area is exposed to jet blast.	Workers in front of Dom. are exposed to jet blast. Continuous expansion of apron to the east may cause problems of jet blast to aircraft due to parallel parking	Same as Alt-1C Same as Alt-1C
Vehicular Traffic Circulation	It is difficult to separate traffic to Dom. and Int'l from each other. Land side area is limited.	Easy to find the way to go. Int'l and Dom. traffic are completely separated from each other Land side area is limited.	Same as Alt-1B Demerits of Alt-1B are solved.	Same as Alt-1B
Flexibility for Future Development	Limited expandability to the west and the south. The southwestern land may be difficult to acquire.	Expandability on the east, the west and the south.	Same as Alt-1B But land side expansion will not be necessary.	Same as Alt-1B

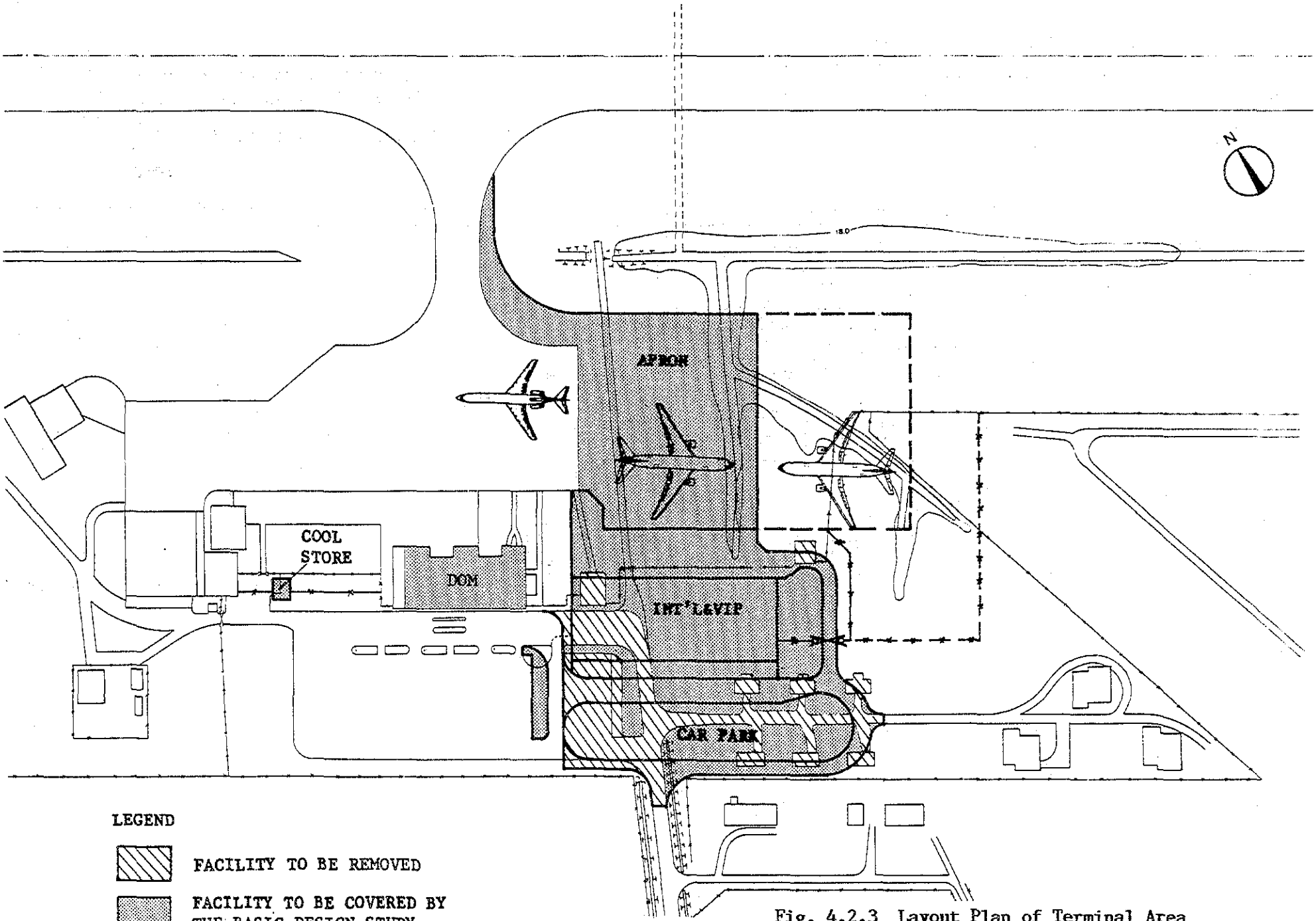


Fig. 4.2.3 Layout Plan of Terminal Area

ALT-1A S = 1 : 2,000

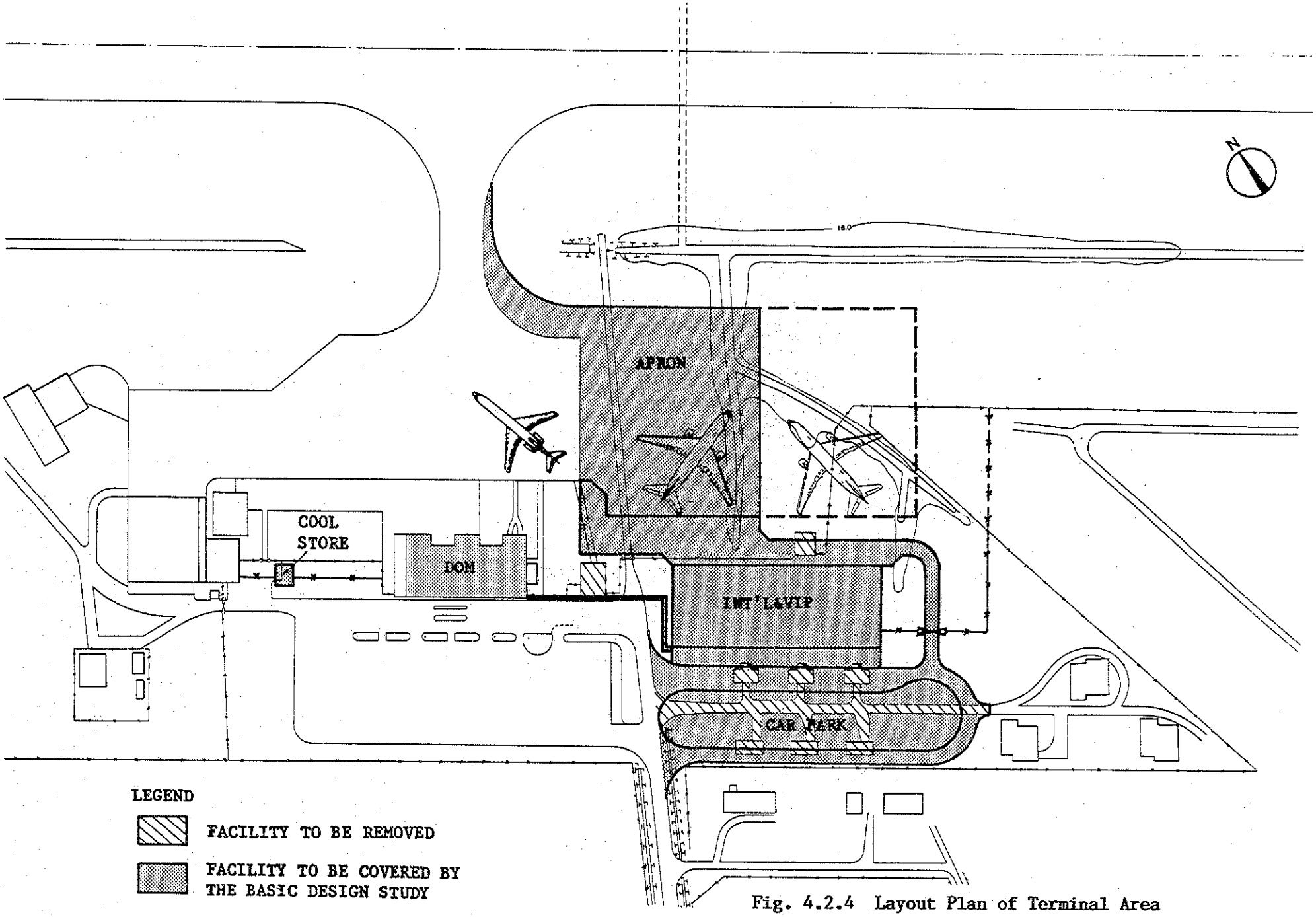


Fig. 4.2.4 Layout Plan of Terminal Area

ALT-1B S = 1 : 2,000

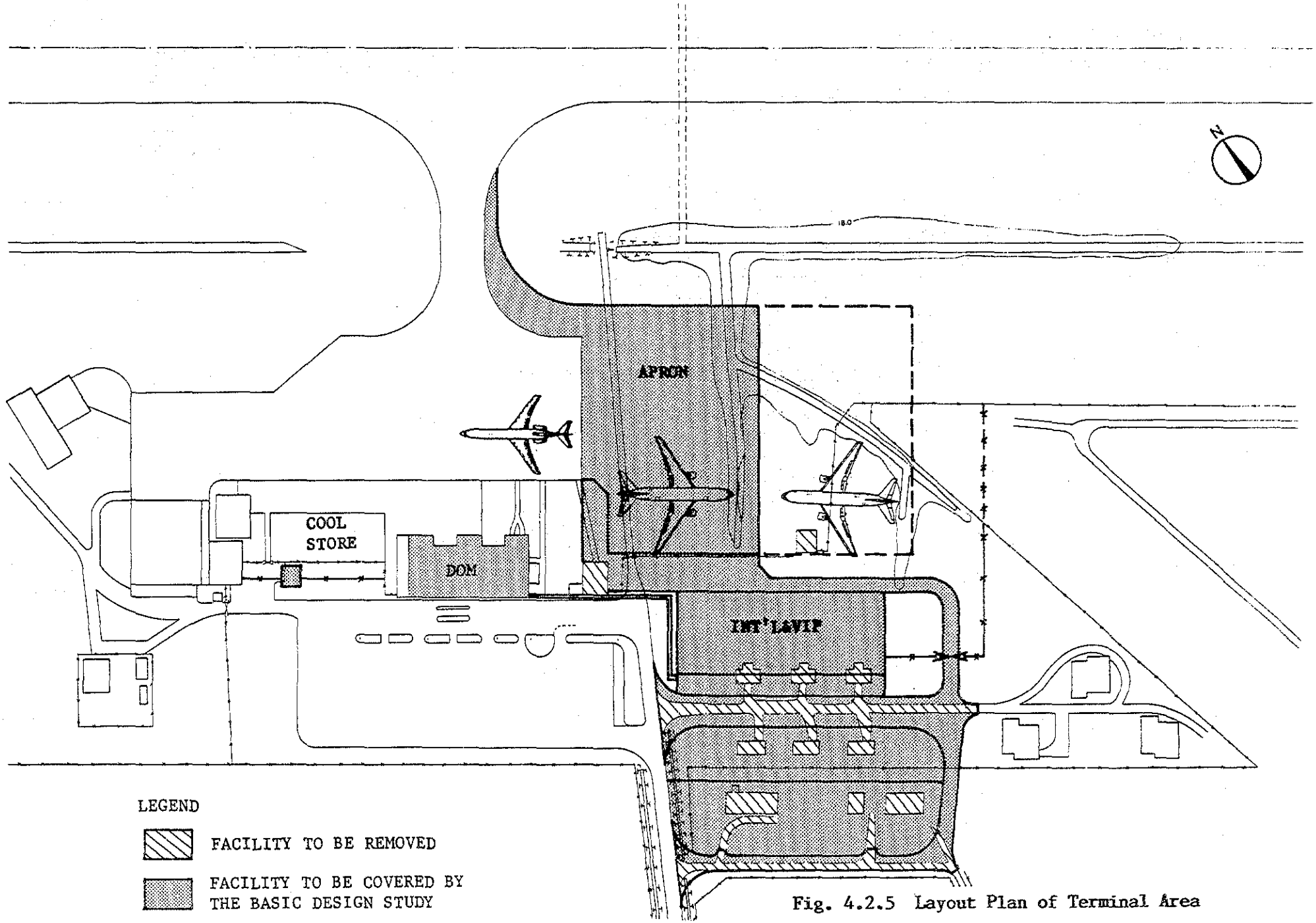


Fig. 4.2.5 Layout Plan of Terminal Area
ALT-1C S = 1 : 2,000

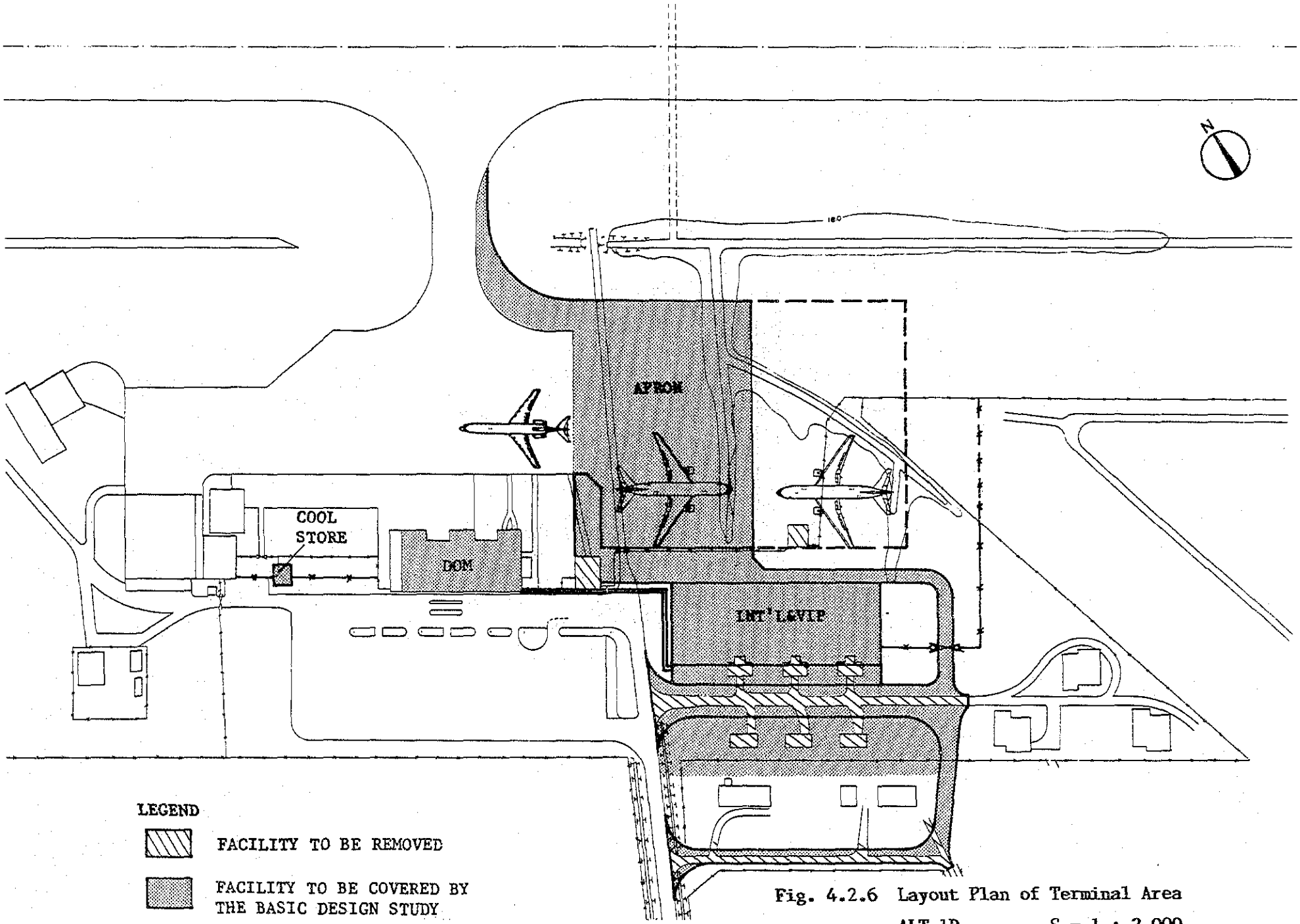


Fig. 4.2.6 Layout Plan of Terminal Area

ALT-1D S = 1 : 2,000

2) Air Navigation Facilities

(1) C-VOR/DME Site

As the existing C-VOR/DME is set up in a good location from the viewpoint of coverage and performance of radio waves, and instrument approach procedures, etc., there is no reason to change the site.

On the other hand, it was studied as an alternative that the new C-VOR/DME be installed at a new site to allow the continued operation of the existing C-VOR/DME while the equipment is being replaced. In this case, however, 2.3ha of land must be acquired and installation of power cables would be necessary. This work would be difficult from the viewpoint of finance and timing of the work. Therefore, the position of the C-VOR/DME site remains unchanged, and the existing C-VOR/DME will stop its operation during replacement of the equipment.

It was agreed with the Government of Vanuatu that the suspension of VOR/DME services during construction work will be shortened as much as possible with consideration on the construction method of the shelter.

(2) Locator Site

The Locator site also remains unchanged for the same reasons as applicable to the above VOR/DME site.

4.3 Basic Design

1) Passenger Terminal Building

(1) Architectural Design

(i) Floor Plan

a) Required Facilities in the International Passenger Terminal Building

Generally, the function of an international passenger terminal building is divided into the categories as shown in the following table:

Table 4.3.1 : Functional Classification of Facilities in International Passenger Terminal Building

Categories	Facilities
Departing Passengers	Check-in Lobby, Check-in Counters Departure Lobby and Departure Lounge
Arriving Passengers	Arrival Lobby, Baggage Claim Area
Baggage Handling	Baggage make-up area, Baggage break-down area
CIQS Check	C: Customs check counter I: Immigration check counter Q: Quarantine check counter S: Security check counter
Offices	Offices for Authorities (CIQS), Airport Administrative Office, Airline Offices, Crew Rest Room, Police
Concessions and Other Services	Snacks, Souvenir Shops, Duty Free Shops, Banks, Observation Deck, Information and Other Counters, Washrooms, Nursery, Storage, Public Lobby

The flows of both passenger and baggage are planned in relation to the above facilities as indicated in Figure 4.3.1.

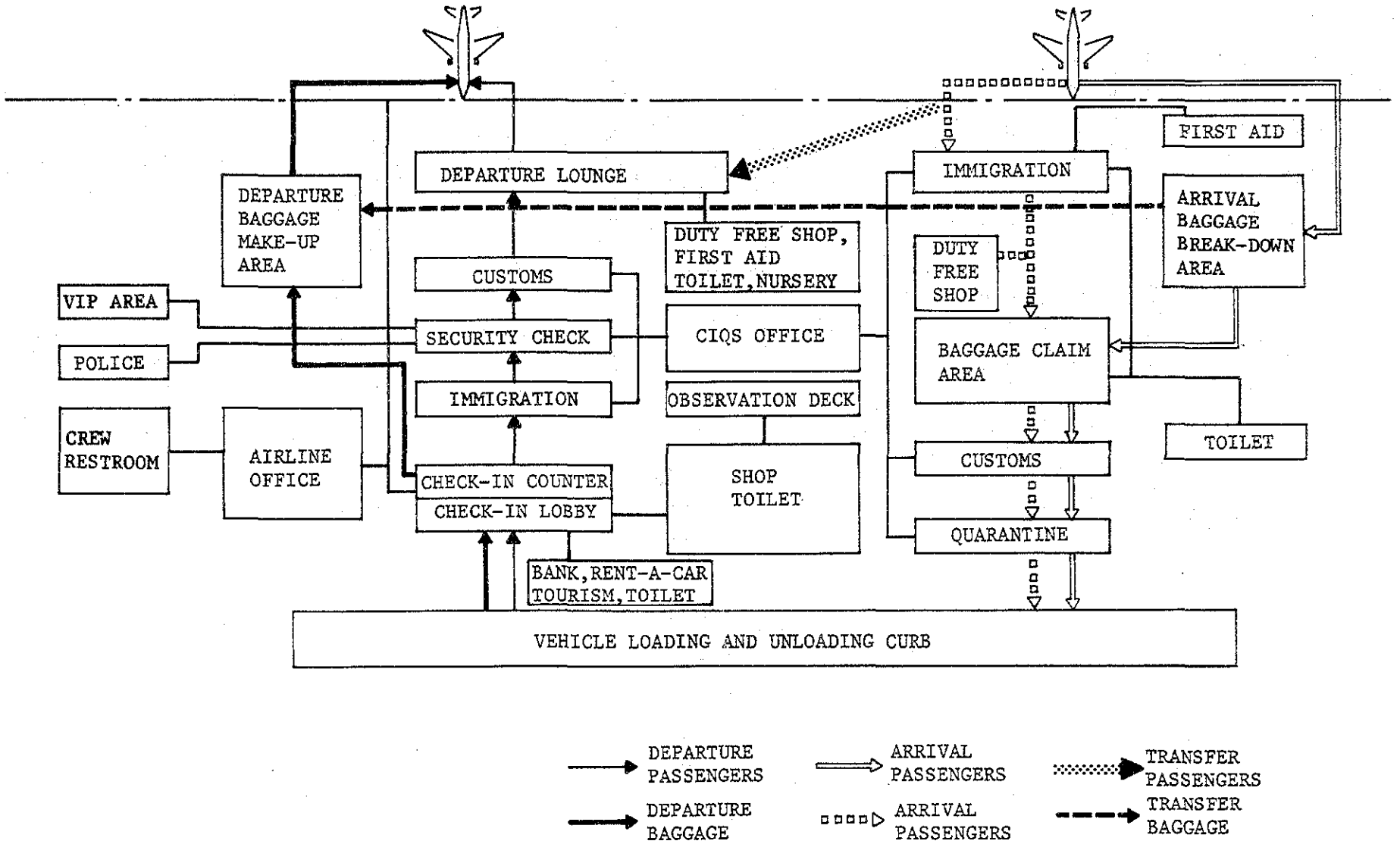


Fig. 4.3.1 General Flow Diagram of Passenger and Baggage for International Passenger Terminal Building

b) Zoning

The departure area will be located at the west side, the check-in lobby and check-in counter area will be located in the central zone of the terminal, and the arrival area will be located at the east side of the terminal. The existing terminal building has a departure area at the west side and central zone, and an arrival area at the east side. This building will be renovated for domestic services with minimum work. The domestic and international terminal buildings will be connected by a sheltered passageway so that passengers can avoid rain and wind.

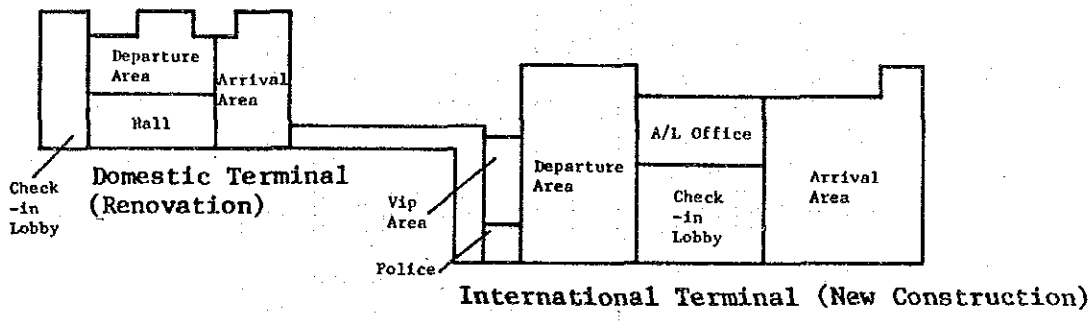


Figure 4.3.2 : Zoning of Passenger Terminal Building

c) Required facilities

The number of counters and the effective length of the conveyor belt are estimated as indicated in the Appendix and summarized in Table 4.3.2.

Table 4.3.2 : Facility Requirements

Facilities	Nos.
1. Departure	
Check-in Counter	6
Ticket Counter	2
Immigration Counter	4
Security Check Counter	4
2. Arrival	
Immigration Counter	4
Customs Counter	5
Effective length of Baggage Claim Conveyor	33.5m

d) Layout Plan of Facilities

The facility layout is planned considering the relations between facilities, simple and short passenger and baggage flow, and the requests of the Government of Vanuatu.

i) Check-in Lobby : In Vanuatu, greeters are allowed to enter the check-in lobby, therefore, the area behind the passenger queuing area to the check-in counter should be considered as public space and one visitor is anticipated for each passenger.

ii) Immigration Check Area : Immigration counters will be located so as to have a minimum walking distance to the check-in lobby. No tax counter is required because tax payments are taken at the check-in counter.

iii) Security Check Area : A walk through type metal detector will be provided for passengers and hand type metal detectors will be provided for hand baggage.

iv) Departure Lounge : This lounge will be provided for the passengers of B-767 and B-727 aircraft (with 80% passenger load factor). A duty free shop and a nursery will be provided facing the lounge.

v) Arrival Lounge : According to the system of the Republic of Vanuatu, immigration counters will be provided without quarantine checks. Sufficient passenger queuing areas will be provided in front of the counters. A duty free shop will be provided for the convenience of the arrival passengers.

vi) Baggage Claim Area : The layout of the conveyor belt will consider easy accessibility of passengers to the claiming frontage. Baggage cart space will also be provided.

vii) Customs Check Area : Customs check counters will be located so that they are not disturbed by the baggage claiming passengers. A return passage for the baggage carts will be provided beside the counter area. A quarantine counter will be provided after the customs check area according to the request of the Government of Vanuatu.

viii) Offices for Government Control : The quarantine office and treatment room will be located facing the apron in consideration of the convenience for ambulances. Other offices will be provided near each counter area.

ix) Airport Authority Office : An airport manager room and airport administration office will be provided at the central area on the first floor of the building facing the apron area.

x) Airline Administrative Office : The administrative office for the airline companies will also be accommodated on the first floor facing the apron area.

e) Floor Area

The existing and proposed floor areas are listed in Table 4.3.3.

Table 4.3.3 : List of Floor Area

	Facilities	Existing Terminal		Proposed Terminal			
		Area(㎡)	Remarks	Area (㎡)			Remarks
				Int'l	Dom.	Total	
Arrival Area	Arrival Lobby			51.0		51.0	
	Inbound Immigration Lobby	87.2	Counter*4	286.9		286.9	Counter*4
	Immigration Office	19.3		38.3		38.3	
	First Aid			10.6		10.6	
	Quarantine Office			21.3		21.3	
	Baggage Claim Area	158.3	Counter14m	255.0	221.9	476.9	Effective Belt Conveyor33.5m(Int'l), Counter10m(Dom.)
	Customs Check Area	41.1	Counter*2	262.5		262.5	Counter*5
	Customs Office	18.5		32.5		32.5	
	Bank			18.0		18.0	
	Duty Free Shop			19.1		19.1	
	Storage			32.6		32.6	
	General Office	28.4			74.7	74.7	
	Airline Office				45.7	45.7	
	Toilet	24.8		31.9	24.8	56.7	
	Others	8.5		11.3		11.3	
	Subtotal	386.1		1,071.0	367.1	1,438.1	
Departure Area	Check-in Lobby	166.6		450.5	166.6	617.1	
	Check-in Counter	37.0	Counter*8	84.1	37.0	121.1	Counter*6(Int'l), Counter*4(Dom.)
	Airline Office	130.7		76.9	101.6	178.5	
	Security Check Area	4.7	Walk Through*1	127.5	4.7	132.2	Walk Through*1(Int'l), Walk Through*1(Dom.)
	Outbound Immigration	34.0	Counter*2	127.5		127.5	Counter*4
	Immigration Office			22.5		22.5	
	Security Office			23.9	31.7	55.6	
	Departure Lounge	198.0		501.5	196.4	697.9	
	VIP Lounge			83.4		83.4	
	Police Office			31.9		31.9	
	Duty Free Shop	11.3		22.5		22.5	
	Snack Bar			29.0		29.0	
	First Aid			15.9		15.9	
	Nursery			11.0		11.0	
	Shop			31.9	11.3	43.2	
	Crew Rest Room			23.4		23.4	
	Worker Room			30.0		30.0	
	Storage			19.3	52.0	71.3	
	Toilet	17.5		59.0	17.5	76.5	
	Others	5.0		102.5	5.0	107.5	
	Subtotal	604.8		1,874.2	623.8	2,498.0	
Common Area	Public Lobby	131.1			131.1	131.1	
	Bank	10.0			10.0	10.0	
	Snack Shops	11.3			11.3	11.3	
	Concessions	25.4			25.4	25.4	
	Staircase	15.2			15.2	15.2	
	Others	3.8			3.8	3.8	
	Subtotal	196.8			196.8	196.8	
First Floor	Airport Administration Office			93.6		93.6	
	Airline Office			76.5		76.5	
	Hall			46.8		46.8	
	Toilet			23.4		23.4	
	Others			40.2		40.2	
	Subtotal	0.0		280.5	0.0	280.5	
	Total	1,187.7		3,225.7	1,187.7	4,413.4	
Baggage Sorting Area	Baggage Make-up Area	90.0		153.0	90.0	243.0	
	Baggage Break-down Area	40.0		153.0	40.0	193.0	
	Grand Total	1,317.7		3,531.7	1,317.7	4,849.4	

f) Renovation of Existing Terminal

The existing terminal will be renovated for domestic services. Minimum renovation work will be needed, as listed below, since the existing building is maintained in good condition.

i) Removal of CIQ counters and repairs of floors and walls concerned.

ii) Provision of two airline offices.

iii) Repair of waterproofing at the observation deck.

iv) Removal of rollers and repairs of floors and walls concerned.

v) Partial repair of canopy ceiling on side facing away from the runway.

vi) Partial repair of plastic tile floor where required.

(ii) Finishing schedule

The finishing schedule will be planned as listed in Table 4.3.4 based on the considerations mentioned below.

i) To minimize kinds of finishing materials by grouping according to the function of the area.

ii) To use local materials (aggregates, sand, concrete blocks and wood) as much as possible.

Table 4.3.4 : Finishing Schedule

Location	Part	Finishing Materials		Principal reason for selection
		Materials to be used	Materials as alternatives	
Outside:	Roof	Coloured Corrugated Cement Sheet	Coloured Steel Sheet	Durability
	Waterproof	Polyurethane	Asphalt	
	Wall	Acrylic Resin Spray on Concrete Block	Paint on Concrete Block	Easy Construction
	Doors & Windows	Glazed Aluminum Doors and Windows	Glazed Wooden Doors and Windows	Ventilation Durability
	Floor	Cement Mortar Brushed Finish	Ceramic Tile	Durability
Interior: Passenger Area .Check-in Lobby .Immigration Check Area .Departure Lounge .Arrival Hall .Baggage Claim Area	Floor	Plastic Tile	Ceramic Tile	Easy Construction
	Base	Wood with Oil Finish	Ceramic Tile	Easy Construction
	Wall	Acrylic Resin Spray on Concrete Block	Painted on Wooden Partition	Durability
	Suspended Ceiling	Wood lath with Thermal Insulation	Corrugated Cement Sheet	Thermal and Sound Insulation
Offices: .CIQS .Administration .Airline	Floor	Plastic Tile	Carpet Tile	Durability
	Base	Plastic Tile	Wood with Oil Finish	Easy Maintenance
	Wall	Painted	Vinyl Cloth	
	Ceiling	Wire Mesh Painted	Wooden Louver	Natural Ventilation
Wet Rooms: .Toilet	Floor	Ceramic Tile	Mosaic Tile	Easy Maintenance
	Wall	Ceramic Tile	Painted	Easy Maintenance
	Ceiling	Painted	Painted	Easy Maintenance
Rental Rooms (Concession)	Floors, wal ls, and ceilings are preliminary finished.			

(iii) Structural Design

Considering that the site location is near the sea, the structural design should be resistant to corrosion. A reinforced concrete structure will be adopted because this is common in Vanuatu. As for bearing capacity, 10 tonnes per sq.m will be expected based on the construction of the cool storage near the site. The seismic load is taken to be the same as in Japan.

(2) Mechanical and Electrical Systems

(i) Air Conditioning and Ventilating Systems

Although natural drafts will be mainly utilized with a high ceiling and grill, ceiling fans will be installed to complement the natural draft. Window type air conditioners will be installed in such closed rooms as administration offices, airline offices on the first floor and the VIP room. Ventilating fans will be installed in toilets.

(ii) Plumbing Systems

a) Water Supply System

The terminal building is not to be equipped with a water reservoir since the present water supply system in Port Vila is in good condition with sufficient pressure and volume. The water consumption of the new terminal building is estimated as follows. Total floor area of the proposed terminal building (excluding canopy) is approximately 3,200m^2.

Daily Average: $3,200m^2$ x 10 liters/m^2.day
= 32,000 liters/day ($32m^3$/day)

Daily Maximum: $3,200m^2$ x 20 liters/m^2.day
= 64,000 liters/day ($64m^3$/day)

Hourly Average: 64,000 liters/day ÷ 24 hours/day
= 2,666 liters/hour

Hourly Maximum: 2,666 liters/hour x 2
= 5,332 liters/hour (88 liters/minute)

The fire hydrants will be connected to the water supply system. Water consumption for fire fighting is estimated as follows:

Indoor Fire Hydrants : 130 liters/minute x 1 place
= 260 liters/minute

Outdoor Fire Hydrants: 360 *liters/minute x 1 place*
= 360 liters/minute

Water to the terminal building will be supplied by 75mm steel pipes in consideration of fire fighting capability.

b) Drainage, Waste and Vent System

Drainage will be gathered and treated by a septic tank. The effluent from the septic tank is to be discharged into a soak field.

c) Sanitary Fixtures

Considering airport security, the flush valve type will be installed.

d) Septic Tanks and Soak Field

A septic tank will be installed for the new terminal building. The capacity of the septic tank is determined as $64m^3$ with an average retention time of two days. The soak field will be $213m^3$ based on the permeating capacity of $0.15m^3/m^2.day$.

e) Existing Terminal Building

One fire hydrant set will be installed in the existing terminal building.

(iii) Electrical Systems

a) Estimation of Transformer Capacity

Transformer capacity will be 150 KVA based on the following estimation.

Table 4.3.5 : Calculation of Transformer Capacity

Loads	Installed Capacity	Demand Factor	Transformer Capacity
Lighting, Receptacles ($20VA/m^2$)	64KVA	80%	51KVA
Air conditioners, Fans	38KVA	100%	38KVA
Conveyor Belt	9KVA	100%	9KVA
Outdoor Lighting, Apron Flood Lights	16KVA	100%	16KVA
Septic Tank (Pumps)	3KVA	70%	2KVA
Snack Bar	8KVA	50%	4KVA
Total			120KVA

b) Power Supply

A new high tension (H/T) switchgear house (which includes a generator room) will be constructed near the new terminal building. Power will be supplied from an existing over-head H/T line by XLPE/SWA/PVC cable. The cable will be buried but protected with pipes where the cable crosses roads.

c) Standby Generator

A 3 phase, 4 wire, 100KVA 380/220V standby generator will be installed in the generator room. The storage capacity of the main oil tank will be sufficient to supply at least 48 hours continuous operation. The existing terminal building will be served from the standby generator.

e) Main Cables and Distribution Boards

The power to the new terminal building will be supplied from the switchgear house by underground cables as 3 phase, 4 wire 380/220V power. The terminal building will have distribution boards to which PVC insulated cables will be installed, being protected by PVC pipes.

f) Lighting and Receptacles

Taking account of local conditions, the following average illuminance is to be applied for the design based on the discussions between the officials concerned of the Government of Vanuatu and the Study Team.

Rooms	Average Illuminance
Offices, Shops	250 lux
Other Rooms	150 lux

Lighting fixtures under the higher ceiling and in the public space are designed to be controlled by airport staff from the administration room. Self-contained, battery operated emergency lighting fixtures will be installed mainly in the public space. Besides receptacles for general use, receptacles for airconditioners and ventilating fans will be installed where necessary.

g) Telephone System

A telephone exchanger (EPABX) and terminal board will be installed in the administration room. Cables with piping and extension telephones will be installed. Piping and terminal boxes for direct lines will be installed in airline offices, concessions, banks, etc.

h) Clock System

A master quartz clock with battery back-up will be installed in the administration room and secondary clocks in other necessary spaces.

i) Public Address System

An amplifier will be installed at the information counter, and speakers will be installed in the public space, departure and arrival areas. The public address system will be designed to be able to announce departures and arrivals separately.

j) Conveyor Belt

A conveyor belt with electric motors will be installed in the check-in counter and the baggage claim area.

k) Weighing Scale

Weighing scales will be installed in the check-in counters.

1) Security Equipment

A walk-through type metal detector and hand type metal detectors will be provided in the security check places.

2) Apron

(1) Layout Plan

As explained in Section 3.3, 3), (2), the apron is to be designed to accommodate three aircraft (B-767, B-727 and B-737) simultaneously, and one B-767 class aircraft stand is to be constructed next to the existing apron.

The dimensions of the apron are designed based on the following turning radii and 7.5m of clearance between aircraft and objects (see Figure 4.3.3).

B-767-300	R=27m	(Min. 25.6m)
B-727-200	R=20m	(Min. 19.2m)
B-737-300	R=15m	(Min. 14.0m)

The existing 18m wide taxiway should be widened to 23m with a necessary fillet in order to accommodate B-767s with the necessary wheel clearance.

(2) Section

The existing apron slopes gently down from the terminal building to the runway, and from runway 29 to runway 11. The elevation of the south eastern corner of the existing apron is approx. 60 cm higher than that of the runway. The elevation of the apron expansion is planned to be lower than that of the existing apron in order to keep som crealance between the tail wing of B-767 and transitional surface. therefore, the apron expansion is designed to have a crown at the central part of apron and 0.4 % down slopes toward the runway and toward the new terminal building.

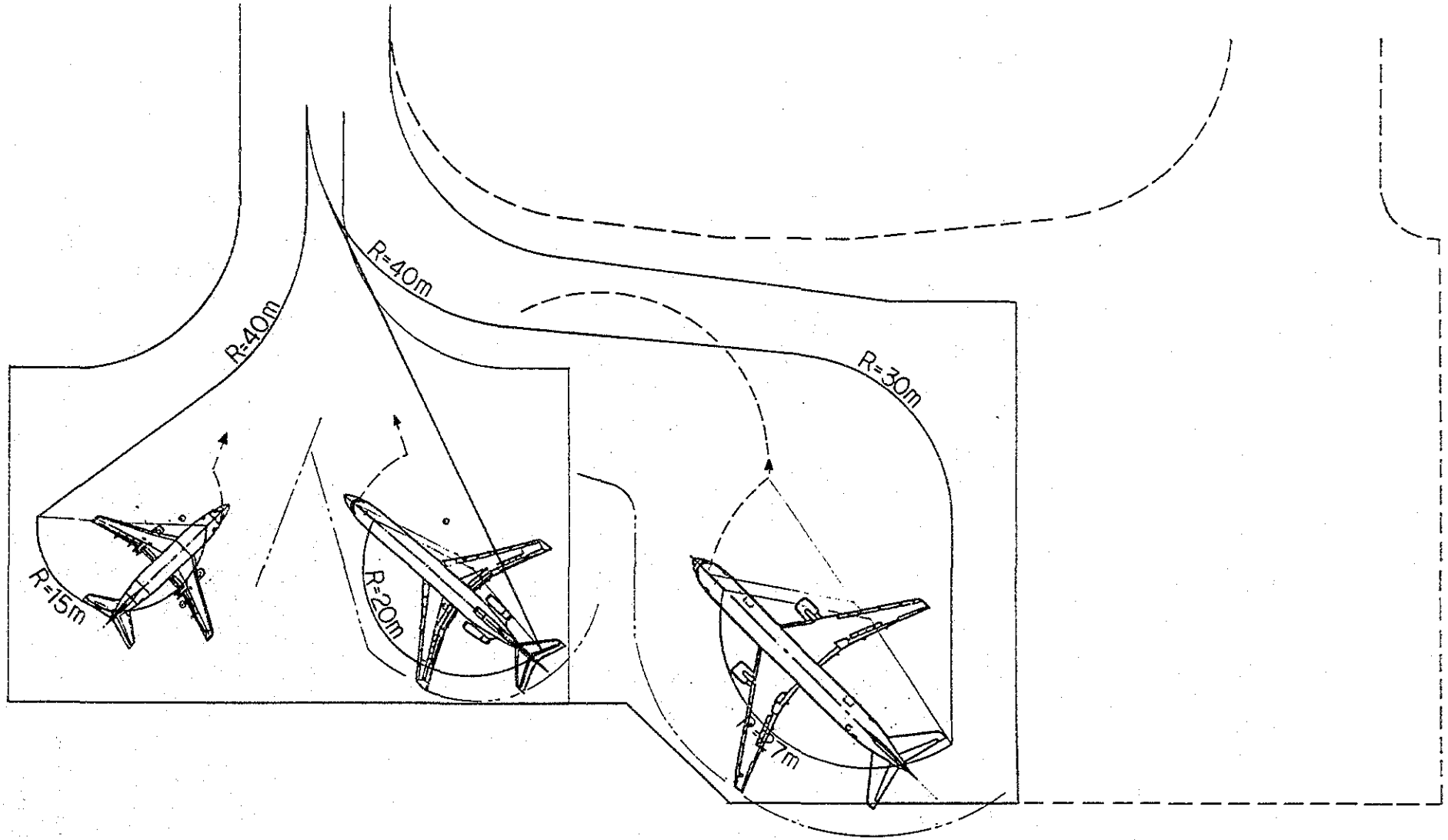


Fig. 4.3.3 Apron Layout Plan

(3) Pavement

The pavement structure is to be designed based on Australian standards and practices which were applied to the pavement strengthening work of the runway, taxiway and existing apron, in order to unify the strength and the construction methods throughout the pavement facilities.

As a soil test in the apron expansion area has not been carried out, the subgrade was assumed to be fine pumice sand, rated at CBR 9 in "the Draft Report on the Runway and Movement Area Extension, May 1988" (AIDAB/ACCA).

The southeast edge of the existing apron is approx. 60cm lower in elevation than the existing runway. The elevation of the apron to be expanded is planned to be lower than the existing apron in order to secure a clearance between the vertical tailwing of the B-767 and the transitional surface. The runway side edge of the apron to be extended will be the same level as that of the existing apron, and 0.4% downward slopes from the approx. centre of the apron are planned for rectangular direction to the runway.

Based on this assumption, a bituminous concrete pavement structure for the B-767 is designed as follows :

- Bituminous concrete surface course : 5 cm
- Graded crushed rock base : 15 cm
- Crushed coral sub-base : 50 cm

It is noted that the pavement will require maintenance periodically, because the apron surface will suffer some damage in service, as a result of sharp manoeuvering of the aircraft and spilled oil.

3) Roads and Car Park

(1) Layout Plan

The principal design criteria for the roads are as follows:

Design speed : 20 km/hr
Width of road: 10 m (3 lanes in front of the building)
6 m (2 lanes for other roads)

As for the parking configuration, 45° parking is adopted, the same as the existing car park. The parking lot is 5m long and 2.25m wide.

(2) Section

The proposed site for the car park is flat. The terminal frontage road is planned to have a downward slope from the terminal building in order to avoid any standing water at the curb front. The car park is planned to be higher than the terminal in elevation in order to utilize waste soil excavated from the apron area.

(3) Pavement

The pavement structure for the road and car park is planned to be 25cm thick with a sprayed bituminous double seal, based on the assumed subgrade CBR value of 9%, and the relatively small traffic volume anticipated in the future.

4) Air Navigation Facilities

According to Section 3.1, 2), a C-VOR/DME and a Locator are to be included. The necessary measuring equipment, spare parts, communications equipment and a vehicle are to be supplied for maintenance purposes.

(1) C-VOR/DME

a) The C-VOR/DME will be replaced at the present location as explained in Section 4.2, 2).

b) Three alternative plans are as follows:

i) To renovate the existing shelter and to replace the equipment. (ALT-1)

ii) To construct a new shelter beside the existing shelter and install new equipment, and to demolish the existing shelter. (ALT-2)

iii) To set up a prefabricated shelter for the new equipment and to construct a new shelter for the generator beside the existing shelter and demolish the existing shelter. (ALT-3)

In addition to the above three, two variations of ALT-1 were compared with each other. The comparison of alternative schedules for the suspension period of the C-VOR/DME are shown in Table 4.3.6.

Table 4.3.6 : Comparison of Alternative Schedule for Suspension Period of VOR/DME

Comparison Items		Description	Merits	Demerits	Suspension Period
Renovation of the existing shell	ALT-1 (a)	1. Generator room to be renovated. 2. VOR/DME operation to be stopped and equipment removed. 3. Equipment room to be renovated.	The existing equipment can be removed with notam of VOR's suspension	Suspension period is longer than ALT-1(b)	2.8 (months)
ALT-1	ALT-1 (b)	1. Generator room to be renovated. 2. VOR/DME equipment to be relocated and continue in operation for the moment. 3. Equipment room to be renovated.	Shortest schedule for VOR's suspension.	Pay attention to the continued operation of the VOR because of its obsolescence.	2.3 (months)
Construction of the new shell ALT-2		1. New shelter to be constructed. 2. The existing shell to be demolished.	Life span of building to be extended.	Longest schedule for VOR's suspension.	4.0 (months)
Prefabricated shelter with new generator house ALT-3		1. Prefabricated shelter to be prepared as equipment room. 2. Generator room to be constructed. 3. The existing shelter to be demolished	Equipment to be assembed without interruption from building work.	Shelter will be damaged by salt water. Suspension is longer than ALT-1	3.6 (months)

c) Schedule

ALT-1(b) gives the shortest suspension period of the C-VOR's signals among the options. Therefore, Alt-1(b) is to be adopted for this Project. In order to maintain continuous operation, the existing C-VOR/DME equipment is to be temporarily relocated in the generator room during the installation of the new equipment. It should be noted, however, that problems can occur during this relocation, and the possibility does exist for temporary shut down.

d) Lightning Rod

A lightning rod to protect the equipment would require installation of an approx. 13m steel pole in accordance with the JIS requirement. This pole, which would be a big steel pipe to stand up to wind pressure, would detrimentaly influence the C-VOR/DME signals. Therefore, a lightning rod will not be installed, but a lightning arrester will be installed in the power units of each piece of equipment and the transformer panels in order to protect against lightning surges via the power lines, as is the practice in Japan.

e) Monitor and Control

During monitoring and control of the C-VOR/DME through the VHF link, mistakes in monitoring operations occur frequently due to lightning surges. The monitoring and control system is not presently being operated due to equipment failure. Even if a new VHF link is provided, the system would be troubled by lightning surges again. Although it is possible to monitor and control via cables, this is infeasible because the cables would have to be installed for more than 10km along the road between the airport and the C-VOR/DME site. Therefore, monitoring and control of the C-VOR/DME from the airport will not be provided.

f) Power Supply to Equipment

The existing C-VOR and DME are supplied with DC 48V and AC 220V respectively. However, the new C-VOR and DME are planned to be supplied with AC 220V. A standby generator, a transformer panel, a distribution board and power supply cables will be replaced with new ones. There will be no backup battery, but the standby generator will supply electricity within 15 seconds in accordance with the ICAO requirement.

The block diagram of the C-VOR/DME is shown in Figure 4.3.4.

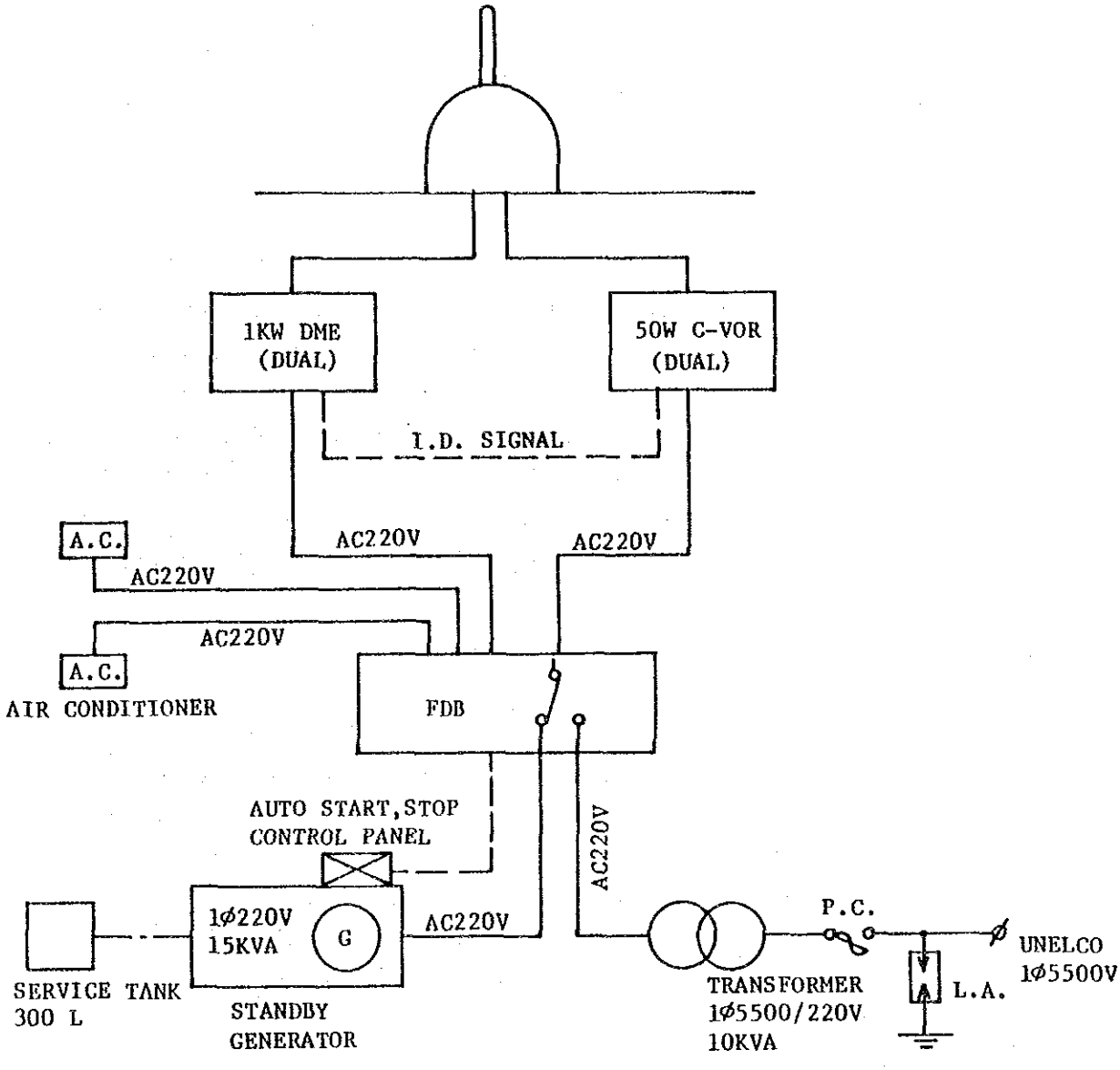


Fig. 4.3.4 : Block Diagram of VOR/DME

(2) Locator

a) The Locator will be replaced at the existing location as explained in Section 4.2, 2).

b) The Locator's shelter will be renovated the same as the VOR/DME's shelter.

c) Schedule

Renovation of the shelter and installation of the equipment will be planned to minimize the suspension period of the Locator signals. The existing antenna will be utilized and a change-over switch will be installed in the shelter so that the existing equipment will continue to be in operation until the new equipment passes the flight check. The existing equipment will be removed after confirmation of the satisfactory performance of the new equipment by the flight check.

d) Power Supply to Equipment

The existing equipment is supplied with DC 24V by the battery charger. The existing batteries, charger and distribution board will be renewed. New equipment will be supplied with AC220V and backup battery. The change-over switch, which is installed in the power unit of the equipment will be turned to the battery side automatically should the commercial power fail. In addition, one portable engine generator will be provided for lengthly power failures.

The block diagram of the Locator is shown in Figure 4.3.5.

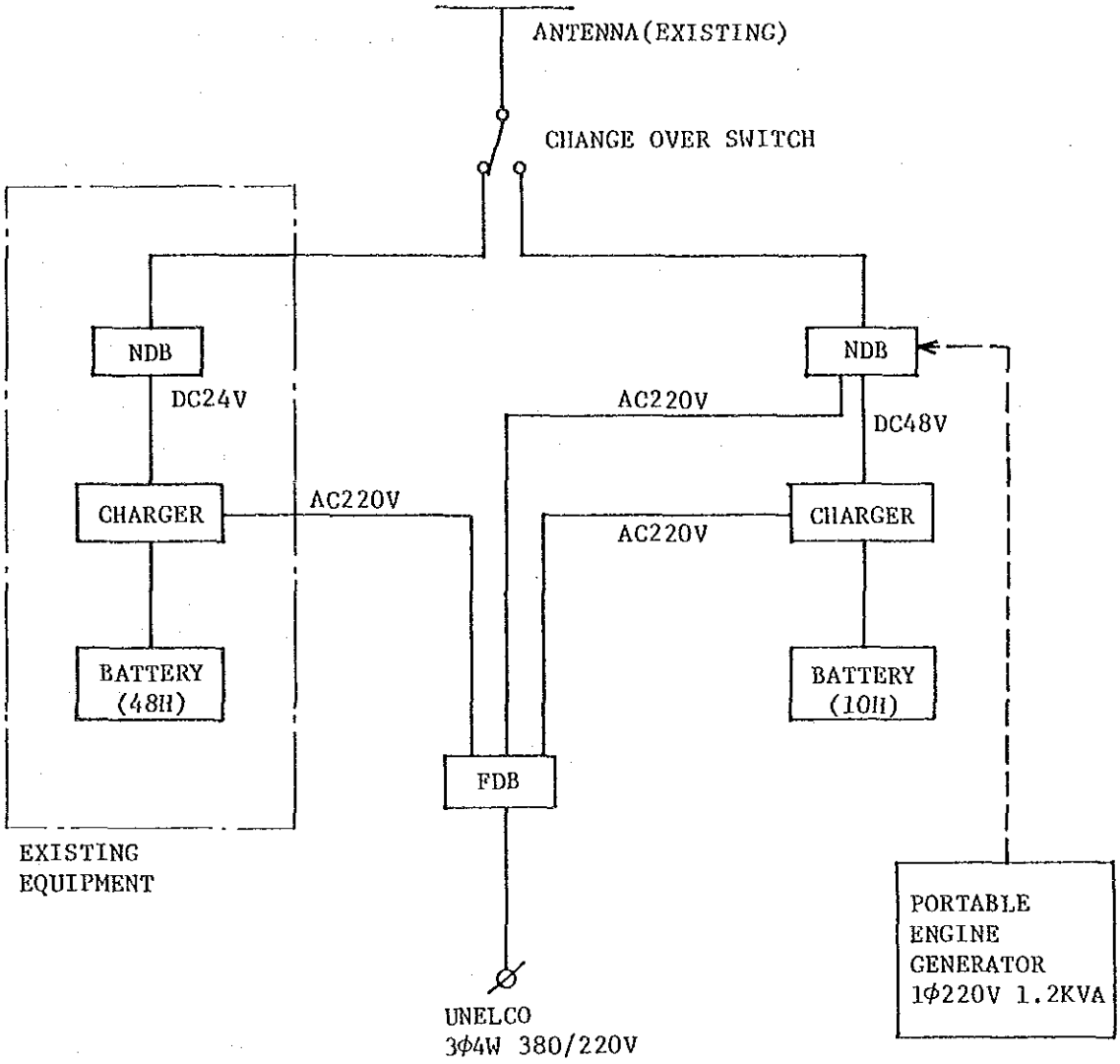


Fig. 4.3.5 : Block Diagram of Locator

(3) Testing Equipment and Monitor Receiver

The following testing equipment and moniter receivers will be supplied.

Tale 4.3.6 : Testing Equipment and Monitor Receivers

Equipment	Q'ty
a. Testing Equipment	
1) Oscilloscope: 150 MHz. one channel	1 set
2) Frequency counter: 200 MHz. Accuracy: 1×10^{-7}	1 set
3) RF standard signal generator up to 150 MHz	1 set
4) Attenuator: 200 watt. 30 dB. 500 MHz	1 set
5) Wattmeter: Element: 95-150 MHz 2.5 watt: 1 piece/each 100-250 MHz 100 watt: 1 piece/each	2 sets
6) DC power supply equipment Noiseless (series regulator) type 0-30 volt. 0-10 Amp.	1 set
7) AF signal generator: 200 KHz maximum, 600 Ohm, 1 V RMs	1 set
b. Monitor Receivers	
1) Air monitor receiver: 100 KHz - 30 MHz Accuracy: 10 Hz. digital display	1 set
2) NDB monitor receiver	1 set

(4) Maintenance Vehicle

A four-wheel drive motor vehicle will be provided for maintenance of the air navigation facilities. A VHF AM air band tranceiver for the motor vehicle will be equipped to communicate with the control tower.

(5) Others

Flight check of the VOR/DME and Locator will be performed by the Corporation of New Zealand Limited. Close coordination on the schedule of the flight check and training for local staff will be indispensable.