4.4 Annual Domestic Air Cargo Forecast

4.4.1 Procedure for Forecasting Annual Domestic Air Cargo

The forecast of annual domestic air cargo is made by the procedure shown in Figure 4.4.1.

1. Formulation of the domestic air cargo demand forecast model by regression analyses using the actual annual domestic cargo traffic volume and GRDP of Region XI.

Å´

2. Forecast of the future domestic air cargo demand by the application of the model using the forecast GRDP of Region XI as the input data.

Figure 4.4.1 Procedure for Forecasting Annual Domestic Air Cargo

4.4.2 Formulation of the Domestic Air Cargo Forecast Model

The formulation of the domestic cargo demand forecast model is carried out by regression analyses using the yearly data of domestic cargo traffic volume at Davao International Airport and the GRDP of Region XI during 1981 to 1989.

Applied data in the regression analyses for the model formulation are shown in Appendix-4.4.1.

The formulated model is shown in the following equation (4.4.1).

$$DCG_{(t)} = 6.66980574 \bullet GRDP_{(t)} - 32{,}666.7 \text{----} (4.4.1)$$
$$R = 0.910$$

where, $DCG_{(t)}$: The quantity of domestic air cargo traffic volume for the year (t) (ton)

$GRDP_{(t)}$: GRDP of Region XI for the year (t) (in million pesos at 1972 constant prices)

4.4.3 Results of the Estimation for Domestic Air Cargo Demand

The results of the estimation applying the foregoing model using the projected data of GRDP in Region XI (see foregoing Table 4.2.2) are shown in Table 4.4.1 and Figure. 4.4.2.

Table 4.4.1 Domestic Cargo Volume from/to Davao

	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Total Air Cargo	9,437	19,685	30,800	43,800	57,100	72,400
Growth Rate	-	15.8%	9.3%	7.3%	5.4%	4.8%

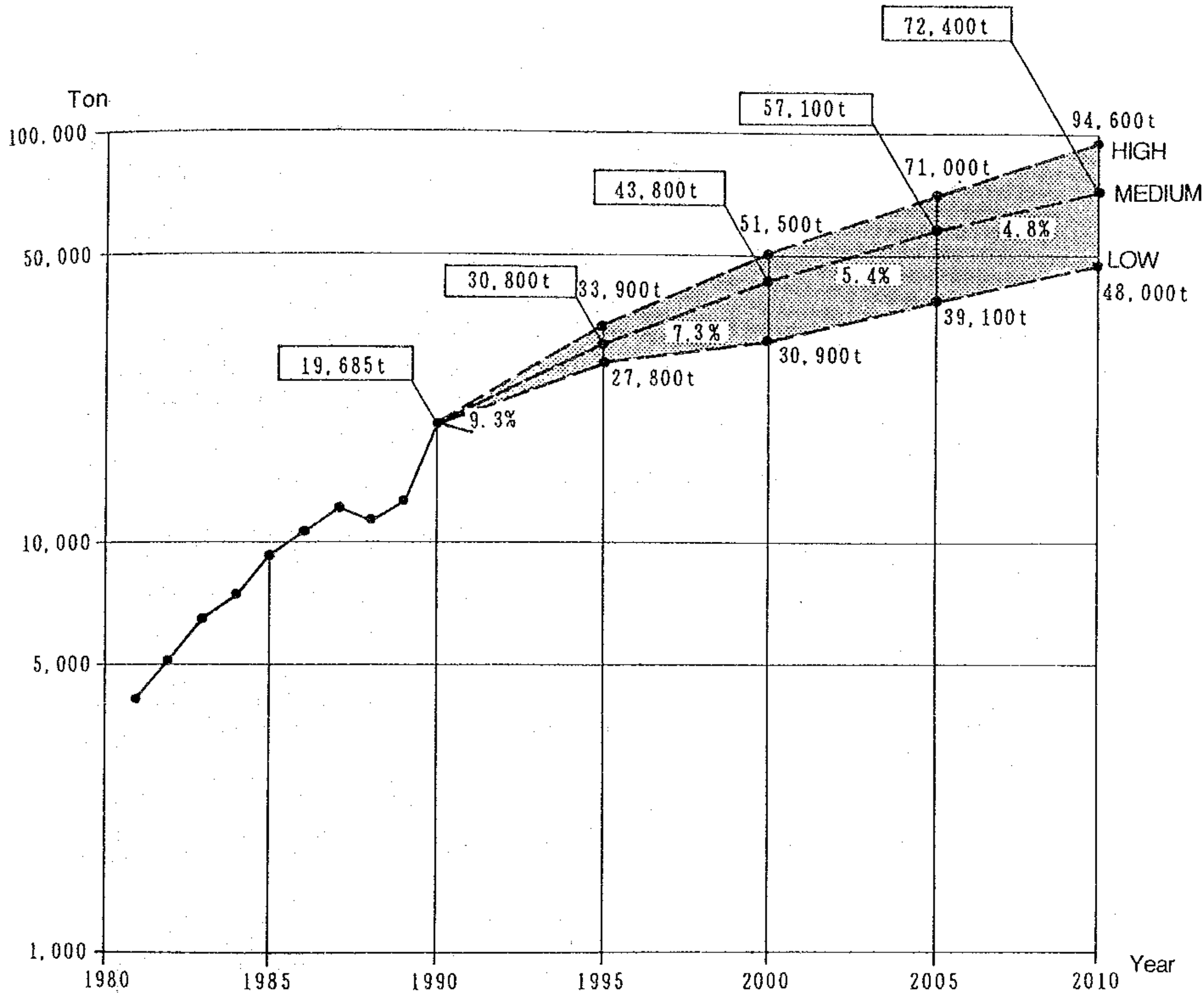


Figure 4.4.2 Projections for Domestic Air Cargo

4.4.4 Low and High Projection of Domestic Air Cargo Demand

Low and high projections for the domestic air cargo demand are made based on the projected GRDP of Region XI shown in Table 4.4.2.

Table 4.4.2 Presumed GRDP of Region XI

	Actual 1985	1990	Forecast 1995	2000	2005	2010
High Projection	-	4.1	4.9	4.8	4.3	4.2
Low Projection	-	4.1	2.9	2.8	2.3	2.2

However, on the low projection, 30% of the present cargo traffic volume which consists of tuna products is reduced from the above mentioned forecast total because the tuna products would be shifted to a new airport at General Santos which is planned to open in 1996.

The results of the estimation are shown in Table 4.4.3 and Figure 4.4.1.

Table 4.4.3 Low and High Projections for Domestic Air Cargo

Low Projection						
	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Total Cargo	9,437	19,685	27,800	36,800	45,000	53,900
Cargo Shifted to G. Santos	-	-	-	5,900	5,900	5,900
Net Total Cargo	9,437	19,658	27,800	30,900	39,100	48,000
Growth Rate	-	15.8%	7.1%	2.4%	4.8%	4.2%
High Projection						
	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Total Cargo	9,437	19,685	33,900	51,500	71,000	94,600
Growth Rate	-	15.8%	11.5%	8.7%	6.6%	5.9%

4.5 Annual International Air Cargo Forecast

4.5.1 Procedure for Forecasting Annual International Air Cargo

The forecast of annual international air cargo is made by the procedure shown in Figure 4.5.1.

1. Formulation of international air cargo demand forecast model by regression analyses using actual annual international air cargo traffic volume and GDP of the Philippines.

↓

2. Forecast of international air cargo demand between the Philippines and major overseas city, where scheduled air route may be inaugurated, by the model application using forecast GDP of the Philippines as the input data.

↓

3. Obtaining the international air cargo demand between Davao and the major city applying the component ratio of Region XI to the total Philippines in GDP.

↓

4. The international traffic demand obtained in the section 3 above is reduced to the half of that volume assuming the other 50% as "via Manila".

↓

5. Final estimate of the international air cargo demand from/to Davao is made by summing up only those air cargo demands that are able to be transported by scheduled international flights operating at Davao International Airport.

Figure 4.5.1 Procedure for Forecasting Annual International Air Cargo

4.5.2 Formulation of Models for International Air Cargo Demand between the Philippines and Major Overseas Cities

The formulations of international air cargo demand models are made by regression analyses using yearly data of GDP in the Philippines and air cargo traffic volumes between the Philippines and major overseas cities from 1981 to 1990. (See Appendix-4.5.1)

The formulated models by intercity are shown in Table 4.5.1

Table 4.5.1 Formulated Models by Intercity

from/to the Philippines	Formulated Models	
Tokyo	Exp(-14.61767) * GDP^2.1342523 * 0.984939882	R = 0.980
Hong Kong	Exp(-14.78166) * GDP^2.1260727 * 1.016742851	R = 0.910
Honolulu	Exp(-33.32206) * GDP^3.6629157 * 0.884451219	R = 0.940
Singapore *	Exp(-14.0130) * GDP^1.9965962 * 0.99244808	R = 0.896

* The model for Singapore from/to the Philippines is applicable only to the "high projection" mentioned below.

4.5.3 Results of Estimation for International Air Cargo Demand between the Philippines and Major Overseas Cities

The results of the estimation applying the foregoing models using the projected GDP in the total Philippines (See foregoing Table 4.2.1) are shown in Table 4.5.2.

Table 4.5.2 International Air Cargo Demand between the Philippines and Major Overseas Cities

	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Tokyo	16,049	25,334	38,500	58,500	84,500	122,000
Growth Rate	-	9.6%	8.7%	8.7%	7.6%	7.6%
Hong Kong	14,275	20,186	30,600	46,500	67,000	96,600
Growth Rate	-	7.2%	8.7%	8.7%	7.6%	7.6%
U.S.A	4,941	8,703	17,900	36,600	68,700	129,000
Growth Rate	-	12.0%	15.5%	15.4%	13.4%	13.4%

4.5.4 Estimation of International Air Cargo Demand between Davao and Major Overseas Cities

The international air cargo volumes between Davao International Airport and major overseas cities are estimated based on the component ratios of Region XI to the total Philippines in GDP shown in Table 4.5.3.

Table 4.5.3 Component Ratio of REGION XI to Total Philippines in GDP

Item	1990	1995	2000	2005	2010
Ratio	0.071	0.071	0.07	0.07	0.069

The estimated results are further reduced to the half of that volume assuming the other 50% as "via Manila". The results of the estimation are shown in Table 4.5.4.

Table 4.5.4 International Air Cargo from/to Davao

	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Tokyo	-	1,810	2,740	4,120	5,880	8,370
Excl. Via Manila	-	905	1,370	2,060	2,940	4,190
Growth Rate	-	-	8.6%	8.5%	7.4%	7.3%
Hong Kong	-	1,442	2,180	3,280	4,670	6,630
Excl. Via Manila	-	721	1,090	1,640	2,340	3,320
Growth Rate	-	-	8.6%	8.5%	7.3%	7.3%
U.S.A	-	622	1,270	2,580	4,790	8,860
Excl. Via Manila	-	311	640	1,290	2,400	4,430
Growth Rate	-	-	15.5%	15.4%	13.4%	13.4%

4.5.5 The Final Estimation of International Air Cargo Demand from/to Davao

The final estimation of the international air cargo demand from/to Davao is made by summing up only those cargo demands that are able to be transported by scheduled international flights operating at Davao International Airport. The results of the estimation are shown in Table 4.5.5 and Figure 4.5.2.

Table 4.5.5 International Cargo Demand from/to Davao

	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Tokyo	-	905	1,370	2,060	2,940	4,190
Growth Rate	-	-	8.6%	8.5%	7.4%	7.3%
Hongkong	-	721	1,090	1,640	2,340	3,320
Growth Rate	-	-	8.6%	8.5%	7.3%	7.3%
U.S.A	-	311	640	1,290	2,400	4,430
Growth Rate	-	-	15.5%	15.4%	13.4%	13.4%
Total				1,640	5,280	11,940

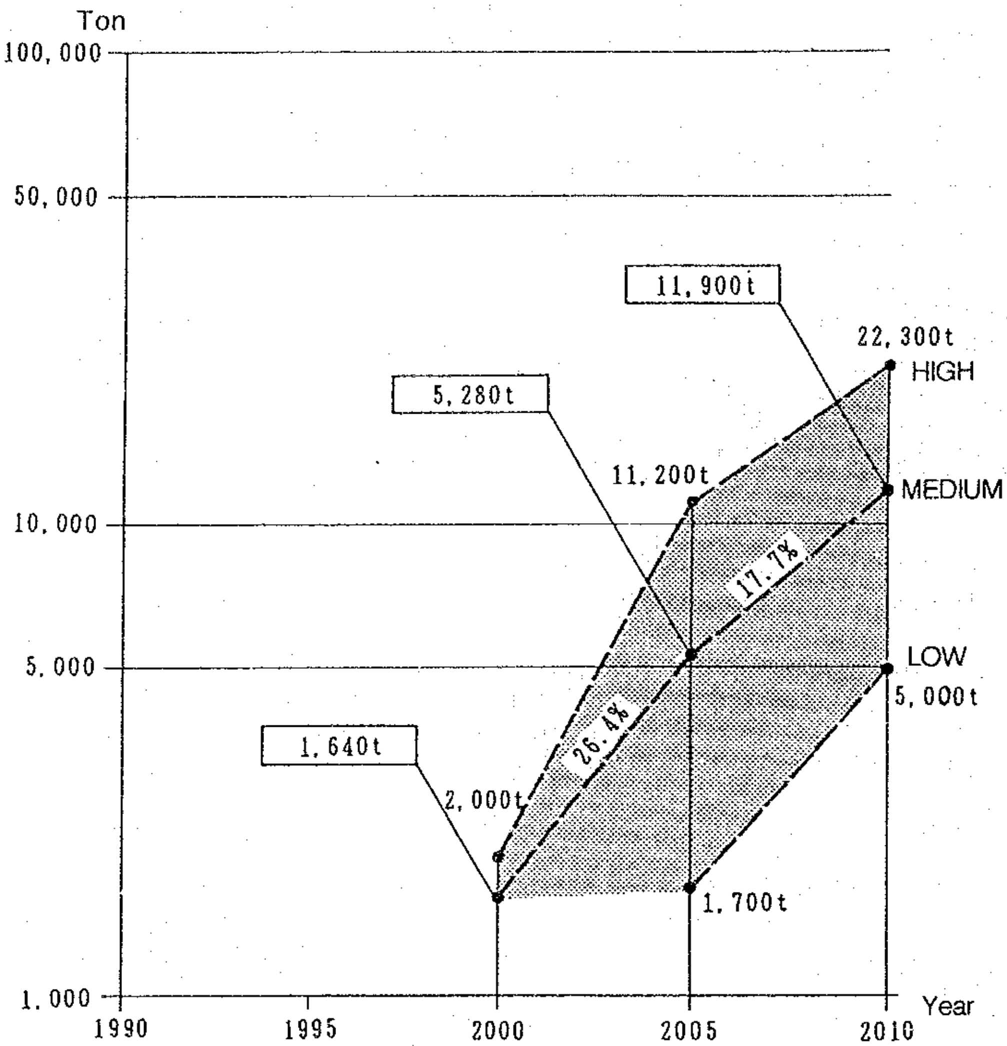


Figure 4.5.2 Projection of International Air Cargo

4.5.6 Low and High Projection of International Air Cargo Demand

Low and high projections of international air cargo demands were made based on the low and high levels of GDP growth rate shown in Table 4.5.6.

Table 4.5.6 Presumed GDP Growth Rate For Low and High Projection

	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Low	-	4.1%	3.0%	3.0%	2.5%	2.5%
High	-	4.1%	5.0%	5.0%	4.5%	4.5%

The results of the above estimation are shown as follows:

Low and high projections of international air cargo demands from/to the Philippines are shown in Table 4.5.7.

Table 4.5.7 Low and High Projections of International Air Cargo Demand from/to the Philippines

Low Projection						
	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Tokyo	16,049	25,334	34,700	47,600	62,000	80,600
Growth Rate	-	9.6%	6.5%	6.5%	5.4%	5.4%
Hongkong	14,275	20,186	27,600	37,800	49,200	64,000
Growth Rate	-	7.2%	6.5%	6.5%	5.4%	5.4%
U.S.A	4,941	8,703	15,000	25,700	40,400	63,500
Growth Rate	-	12.0%	11.4%	11.4%	9.5%	9.5%
High Projection						
	Actual		Forecast			
	1985	1990	1995	2000	2005	2010
Tokyo	16,049	25,334	42,600	71,800	115,000	784,000
Growth Rate	-	9.6%	11.0%	11.0%	9.8%	9.8%
Hongkong	14,275	20,186	33,900	57,000	90,900	145,000
Growth Rate	-	7.2%	10.9%	10.9%	9.8%	9.8%
U.S.A	4,941	8,703	21,300	52,000	90,900	261,000
Growth Rate	-	12.0%	19.6%	19.6%	17.5%	17.5%
Singapore	6,956	9,462	15,400	25,100	38,900	60,400
Growth Rate	-	6.3%	10.2%	10.2%	9.2%	9.2%

Note:Cargo volumes in 1990 for Manila-Tokyo and Manila-Hong Kong are estimated.

Low and high projections of international air cargo demands from/to Davao on the scheduled flights are shown in Table 4.5.8.

Table 4.5.8 International Air Cargo from/to Davao on Scheduled Flight

Low Projection (ton)	1985	1990	1995	2000	2005	2010
	Actual		Forecast			
Davao - Tokyo		1,810	2,470	3,360	4,320	5,530
Exclude via Manila		905	1,240	1,680	2,160	2,770
Annual Growth Rate(%)			6.4	6.3	5.2	5.1
Davao - Hong Kong		1,442	1,970	2,670	3,430	4,390
Exclude via Manila		721	985	1,340	1,720	2,200
Annual Growth Rate(%)			6.4	6.3	5.1	5.1
Davao - USA		622	1,060	1,810	2,810	4,360
Exclude via Manila		311	530	910	1,410	2,180
Annual Growth Rate(%)			11.3	11.2	9.2	9.1
Davao - Singapore		676	904	1,200	1,520	1,920
Exclude via Manila		338	452	600	760	960
Annual Growth Rate(%)			6.0	5.9	4.8	4.7
Total			-	-	1,720	4,970

High Projection (ton)	1985	1990	1995	2000	2005	2010
	Actual		Forecast			
Davao - Tokyo		1,810	3,030	5,060	8,000	12,600
Exclude via Manila		905	1,520	2,530	4,000	6,300
Annual Growth Rate(%)			10.9	10.8	9.6	9.5
Davao - Hong Kong		1,442	2,410	4,020	6,340	9,960
Exclude via Manila		721	1,210	2,010	3,170	4,980
Annual Growth Rate(%)			10.8	10.7	9.6	9.5
Davao - USA		622	1,510	3,660	8,110	17,900
Exclude via Manila		311	756	1,830	4,050	8,950
Annual Growth Rate(%)			19.5	19.4	17.2	17.1
Davao - Singapore		676	1,100	1,770	2,710	4,140
Exclude via Manila		338	550	890	1,360	2,070
Annual Growth Rate(%)			10.1	10.0	8.9	8.9
Total			-	2,010	11,220	22,300

4.6 Decomposition of Air Traffic Demand

4.6.1 Design Basis

Airport facilities should be planned on the design traffic which is determined so that the facilities may not unnecessarily cater on peak traffic. Peak hour traffic of an average day of the peak month, which is the most common design basis for airport facilities, is utilized in this Study. A flowchart describing the breakdown of the annual traffic volume to the peak hour demands is shown in Figure 4.6.1.

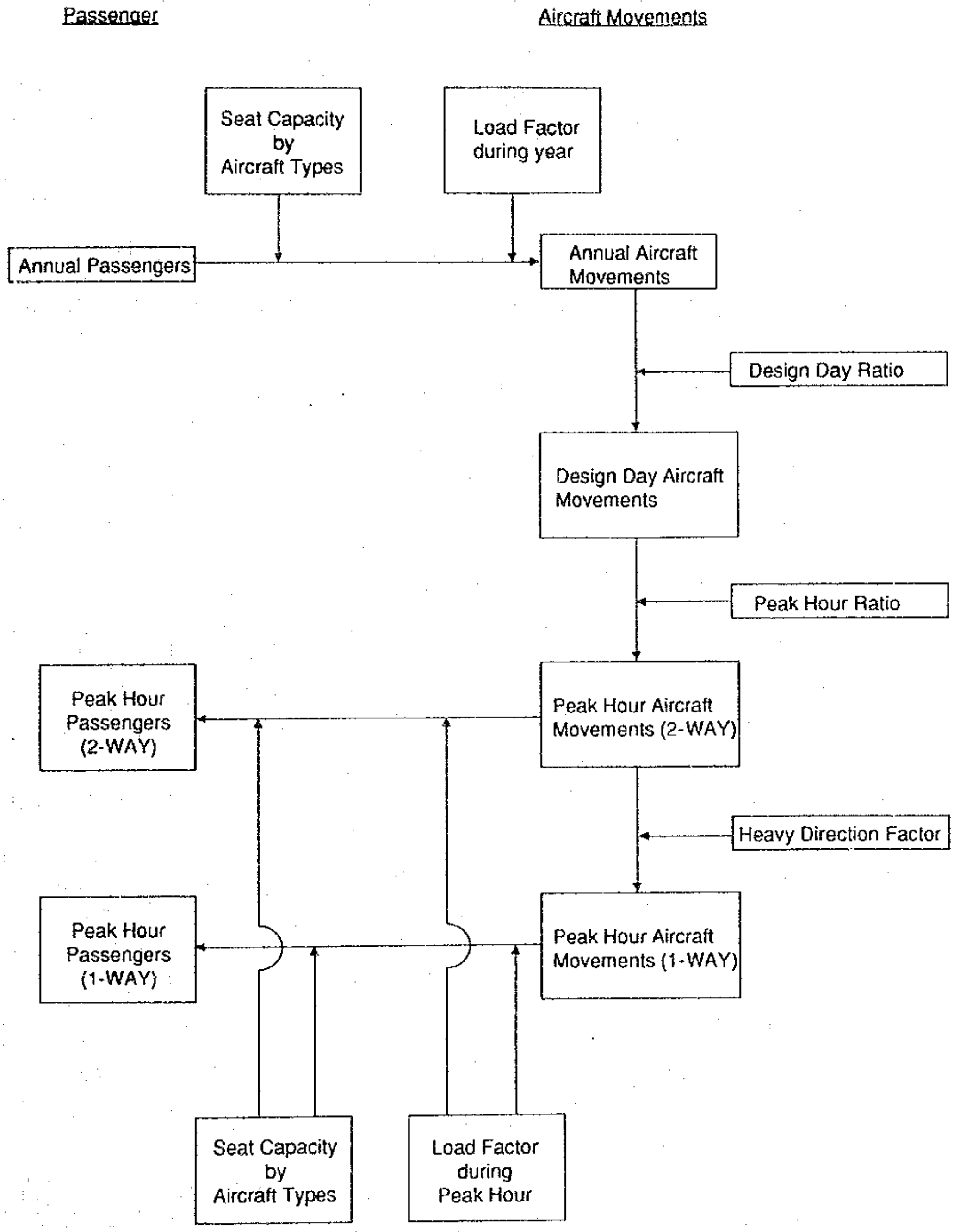


Figure 4.6.1 Flowchart of Traffic Breakdown

4.6.2 Annual Aircraft Movements

Load factor and seat capacity are used for calculating annual aircraft movements from the number of annual passengers. Load factor during year of 70 % is utilized.

These load factors were obtained from the actual traffic records of Davao International Airport in 1991.

Seat capacities by aircraft types are shown in Table 4.6.1.

Table 4.6.1 Seat Capacity by Aircraft Types

Aircraft Type	Seat Capacity
DC10	274
A300	244
B737	141
F50	54
HS748	42

The following equation is found to express the annual aircraft movements.

$$a = A/B/C$$

where, a : Annual aircraft movements
A : Annual passengers
B : Load factor
C : Seat capacity

Type of aircraft to be operated on domestic flights is estimated as shown in Table 4.6.2.

Table 4.6.2 Frequency of Domestic Flights

Route/YEAR	Present	1995	2000	2005	2010
MNL					
Annual Passengers	281,000	367,000	465,000	565,000	660,000
Daily Movement	A300:4	A300:6	A300:8	A300:10	A300:12
Load Factor	79%	69%	65%	63%	62%
CEB					
Annual Passengers	120,000	167,000	223,000	283,000	357,000
Daily Movement	B737:3	B737:5	B737:7	B737:9	A300:6
Load Factor	78%	65%	62%	61%	67%
CGY					
Annual Passengers	31,600	52,000	75,000	103,000	138,000
Daily Movement	B737:1	B737:2	B737:2	B737:3	B737:4
Load Factor	61%	51%	73%	67%	68%
ZAM					
Annual Passengers	21,400	28,000	36,000	45,000	55,000
Daily Movement	F50:2	F50:2	F50:3	F50:3	F50:4
Load Factor	55%	71%	61%	76%	70%
TOTAL	454,000	614,000	799,000	996,000	1,210,000

4.6.3 Peak Coefficients

Design day ratio, peak hour ratio and heavy direction factor are used for the breakdown of annual aircraft movements as shown in Figure 4.6.1. These peak coefficients are obtained from the analysis on actual traffic records.

(1) Design Day Ratio

A design day ratio is a value indicating the degree of the traffic concentration on an average day of the peak month against the annual traffic. A design day ratio of 1/292 is utilized. This value was obtained from the monthly traffic records at Davao International Airport in 1991.

Design day aircraft movements are obtained by multiplying the above design day ratio by annual aircraft movements.

(2) Peak Hour Ratio

A peak hour ratio indicates a percentage of 2-way aircraft movements during the peak hour for the aircraft movements of the design day. This factor is usually given as a decreasing function to the number of design day aircraft movements because the peak of the traffic will gradually be flattened when the airport becomes congested. The following equations are found to express the peak hour factors of the domestic, international and total aircraft movements, and used for the peak hour forecast.

Domestic : $$a = \frac{1.51}{A} + 0.115$$

International : $$a = \frac{1.05}{A} + 0.114$$

Total : $$a = \frac{1.00}{A} + 0.100$$

where, a : Peak hour factor
A : Design day aircraft movements

As for general aviation aircraft, the frequency of annual aircraft movements are more than domestic aircraft movements. But, the peak of general aviation movements is flattened. So the peak hour ratio is smaller than that of other aircraft movements.

It is assumed that the present peak characteristic will remain unchanged in the future. Therefore, the present peak hour ratio of 0.07 is adopted as the future peak hour ratio.

Two-way peak hour aircraft movements are calculated by multiplying the above peak hour factor by design day aircraft movements for each category of aircraft.

(3) Heavy Direction Factor

Heavy direction peak hour traffic, which is the traffic volume of 1-way traffic (arrival or departure) during the peak hour is also necessary for airport planning. A heavy direction factor which indicates the percentage of 1-way traffic to 2-way traffic is usually used to estimate this traffic. The value of around 0.7 is used for the forecast based on the actual heavy direction factor at Mactan Airport in Cebu, because around 2010 air traffic demand at Davao will approach the same level as the present air traffic demand in Cebu.

4.6.4 Peak Hour Aircraft Movements

Aircraft movements during the peak hour of the design day of the peak month are estimated for five year intervals up to 2010 as shown in Table 4.6.3 for Davao International Airport.

Table 4.6.3 Peak Hour Aircraft Movements of Davao International Airport

		International				Sub Total	Domestic			Sub Total	Others	Total
		DC-10	A-300	B-737	HS-748		A-300	B737	F-50			
Annual Aircraft Movements	1990				104	104	1,645	1,536	566	3,747	7,756	11,607
	1995		48	24	139	211	2,149	2,219	741	5,109	7,980	13,252
	2000	12	214	24	180	430	2,722	3,019	952	6,693	8,186	15,309
	2005	12	481	24	221	738	3,308	3,911	1,190	8,409	8,439	17,586
	2010	210	680	24	269	1,183	5,954	1,398	1,455	8,807	8,550	18,550
Design Day Aircraft Movements	1990	-	-	-	1	1	6	5	2	13	27	40
	1995	-	-	-	1	1	7	8	3	18	27	46
	2000	-	1	-	1	2	9	10	3	23	28	52
	2005	-	2	-	1	3	11	13	4	29	30	60
	2010	1	2	-	1	4	20	5	5	30	29	64
Peak Hour Aircraft Movements (2-WAY)	1990	-	-	-	1	1	1	1	-	2	2	4
	1995	-	-	-	1	1	1	2	1	4	2	6
	2000	-	1	-	-	1	2	2	-	4	2	6
	2005	-	1	-	-	1	2	2	1	5	2	7
	2010	1	0	-	1	2	3	1	1	5	2	7
Peak Hour Aircraft Movements (1-WAY)	1990	-	-	-	1	1	1	1	-	2	1	3
	1995	-	-	-	1	1	1	1	1	3	1	4
	2000	-	1	-	-	1	1	1	1	3	1	4
	2005	-	1	-	-	1	1	2	-	3	1	5
	2010	1	0	-	-	1	2	1	1	4	1	5

4.6.5 Peak Hour Passengers

The future number of peak hour passengers at Davao International Airport should correspond to the peak hour aircraft movements in Table 4.6.3. Peak hour passengers are calculated by multiplying the peak hour aircraft movements, seat capacity by aircraft types and passenger load factor during the peak hour. The load factor of 80 % is used for both international and domestic traffic. The results of the estimation are shown in Table 4.6.4.

Table 4.6.4 Peak Hour Passengers at Davao International Airport

Year		1990	1995	2000	2005	2010
2-Way	International	30	30	200	200	250
	Domestic	310	460	620	660	740
	Total	340	460	620	660	960
1-Way	International	30	30	200	200	250
	Domestic	310	350	350	420	550
	Total	340	350	350	460	720

CHAPTER 5 AIRPORT FACILITY REQUIREMENTS

CHAPTER 5 AIRPORT FACILITY REQUIREMENTS

5.1 General

This chapter explains airport facility requirements of Davao International Airport based on the air traffic demand forecasts in Chapter 4. The facility requirements are estimated basically in compliance with the relevant standards and recommended practices of International Civil Aviation Organization (ICAO). Those of the Federal Aviation Administration (FAA) of the United States, the Japan Civil Aviation Bureau (JCAB) and the International Air Transport Association (IATA) are also referred to as necessary where the ICAO does not cover or more practical planning is possible by these standards. The facility requirements for Davao International Airport are established for a period from 1995 to 2010 at five year intervals, and the results are summarized in Table 5.1.1.

Table 5. 1. 1 Summary of Airport Facility Requirements

Items		Unit	Present Condition	Year 1995	Year 2000	Year 2005	Year 2010
1. Annual Passengers			*1				
- Domestic		no.	454,000	614,000	799,000	996,000	1,210,000
- International		no.	-	14,700	46,500	93,400	167,000
- Total		no.	454,000	628,700	845,500	1,089,400	1,377,000
2. Annual Cargo			*1				
- Domestic		ton	19,685	30,800	43,800	57,100	72,400
- International		ton	-	-	1,600	5,300	11,900
- Total		ton	19,685	30,800	45,400	62,400	84,300
3. Annual Aircraft Movements			*1				
- Domestic		no.	6,710	5,110	6,690	8,410	8,810
- International		no.	-	210	430	740	1,180
- Others		no.	7,650	7,980	8,190	8,440	8,550
- Total		no.	14,360	13,300	15,310	17,590	18,550
4. Peak Hour Passengers							
- Domestic		no.	310	460	620	660	740
- International		no.	30	30	200	200	250
- Overall		no.	340	460	620	660	960
5. Peak Hour Aircraft Movements							
- Domestic		no.	2	4	4	5	5
- International		no.	1	1	1	1	2
- Others		no.	2	2	2	2	2
- Overall		no.	4	6	6	7	7
6. Maximum Aircraft and Longest Route in Operation	Scheduled Flight		A 300 Manila	A 300 Manila	A 300 Hong Kong	A 300 Tokyo	DC-10 Honolulu
	Non-scheduled Flight		A 300 Hong Kong	A 300 Hong kong	DC-10 Sydney	DC-10 Sydney	DC-10 Sydney
7. Runway							
- Length		m	2,500	2,500	2,500	2,500	3,000
- Width		m	45	45	45	45	45
8. Reference Code			4D	4D	4D	4D	4D
9. Type of Runway			Non - precision approach	Precision Approach Category - I	Precision Approach Category - I	Precision Approach Category - I	Precision Approach Category - I

(to be continued)

Table 5. 1. 1 (Con't.)

Items	Unit	Present Condition	Year 1995	Year 2000	Year 2005	Year 2010
10. Runway Strip						
- Length	m	2,540	2,620	2,620	2,620	3,120
- Width	m	200	300	300	300	300
11. Taxiway						
- System		2 Entrance Taxiways	2 Entrance Taxiways	2 Entrance Taxiways	2 Entrance Taxiways	2 Entrance Taxiways
- Width	m	23	23	23	23	23
12. Apron						
- Aircraft Stands	no.	A300 : 2 Total : 2	A300class : 2 B737class : 2 Total : 4	DC10class : 1 A300class : 2 B737class : 1 Total : 4	DC10class : 1 A300class : 2 B737class : 2 Total : 5	DC10class : 1 A300class : 3 B737class : 1 Total : 5
13. Passenger Terminal Building						
- Domestic	sq.m	3,250	4,600	6,200	6,600	7,400
- International	sq.m	0	600	4,000	4,000	5,000
- Total	sq.m	3,250	5,200	10,200	10,600	12,400
14. Cargo Terminal Building	sq.m	625	2,300	3,500	5,100	7,200
15. Administration and Operations Building	sq.m	590	1,800	1,800	1,800	1,800
16. Access Road		One lane per direction	One lane per direction	One lane per direction	One lane per direction	Two lanes per direction
17.Car Parking						
- Parking Spaces	no.	174	230	310	330	480
- Area *2	sq.m	4,440	4,600	6,200	6,600	9,600
18. Passenger Building Curb	m	95	60	80	90	130
19. Air Navigation Systems		VOR/DME LLZ, NDB	ILS	*3 MLS	MLS	MLS
20. Public Utilities						
- Power Supply	KVA	300	1,200	1,800	2,000	3,300
- Water Supply	L/day	600	140,000	260,000	280,000	320,000
- Sewage Disposal	L/day	-	140,000	260,000	280,000	320,000
- Solid Waste Disposal	kg/day	-	1,000	1,500	1,800	2,200
21. Rescue and Fire Fighting						
- Level of Protection	Cat.	6	6	8	8	8
- Vehicles *4	no.	2	4	4 or 5	4 or 5	4 or 5
- Fire Station	sq.m	235	450	550	550	550
22. Fuel Supply Facility						
- Jet A1 Tank Capacity	KL	210	860	1,200	1,600	2,900
- Fuel Farm	sq.m		5,400	6,300	6,300	7,700

Note, *1 : As of 1990
*2 : Only paved area excluding green zones and internal roads
*3 : Installation of MLS might be delayed if the transition from ILS to MLS is delayed in the world.
*4 : Including ambulance

5.2 Runway and Runway Strip

5.2.1 Runway

(1) Aerodrome Reference Code and Operational Category

The aerodrome reference codes, i.e., code numbers and code letters will be as shown in Table 5.2.1 based on the largest aircraft anticipated to serve the airport.

Even for an airport with favorable meteorological conditions, a precision approach procedure is a standard requirement for safe operations of modern jet aircraft. Landing by auto-pilot using an integrated flight system (flight director system) and ILS are standard procedures for reducing operational routine work of the flight crew. Therefore, the operational category of the airport is recommended to be precision approach.

Table 5.2.1 Aerodrome Reference Code and Operational Category

Item	1990	1995	2000	2005	2010
Maximum Aircraft Type	A300	A300	DC-10	DC-10	DC-10
Reference Number	4	4	4	4	4
Reference Letter	D	D	D	D	D
Operational Category	Non-precision	Precision	Precision	Precision	Precision

(2) Runway Length and Width

The required runway lengths are calculated for A300, DC-10 and MD-11 as representing the aircraft which will require the longest runway length among the aircraft expected to serve Davao International Airport. The details of the calculation are shown in Appendix-5.2.1. Typical destinations require the runway length shown in Table 5.2.2.

Table 5.2.2 Required Runway Length

Destination	Distance (NM)	Aircraft Type	Required RWY Length		Allowable Cargo Volume	
			Max. Pay Load (m)	Full Pax (m)	under 3,000m	under 2,500m
Honolulu	4,599	DC-10	3,292	-	-	-
Honolulu	4,599	MD-11	3,048	-	77%	-
Sydney	2,861	DC-10	2,630	2,103	-	67%
Tokyo	1,974	A300	2,920	1,920	-	77%
Hong Kong	1,128	A300	2,080	-	-	-

As seen in Table 5.2.2 non-stop operation to Honolulu by DC-10 requires a 3,292m long runway. It is expected that DC-10s will be replaced by MD-11s, that are presently operated by other airlines and have displayed superior takeoff performance. In 2010, the runway length requirement for non-stop operation to Honolulu studied on MD-11 from technical and economical aspects, 3,000m will be sufficient for non-stop flights to Honolulu by MD-11s with some restrictions on cargo volume. Reduced 30% cargo volume is acceptable. Because aircraft are not always operated carrying maximum payloads, the load factor utilized for the annual air traffic demand is 70%.

MD-11, with the cargo volume reduced to 23% of the maximum volume, can take off for Honolulu under 3,000m length runway. In the same way, a 2,500m length runway is long enough length for takeoffs for Sydney with DC-10s and Tokyo with A300s.

Table 5.2.3 shows demanded international longest routes and aircraft types.

Table 5.2.3 Longest Routes

Item	1990	1995	2000	2005	2010
Aircraft Type	A300	A300	DC-10	DC-10	DC-10
Longest Route	Hong Kong	Hong Kong	Sydney	Sydney	Honolulu

As seen in the above Tables 5.2.2 and 5.2.3, the required runway length is 2,500m up to 2005 and 3,000m for 2010.

The required width of the runway is 45m with a 7.5m wide shoulder on each side for an aerodrome with a reference code of 4D.

(3) Runway Strip

The runway strip should extend short of the threshold and beyond the end of the runway for a distance of at least 60m where the aerodrome code number is 4.

As for the width of the runway strip, ICAO stipulates as a standard that at least a 300m wide strip shall be provided for a precision runway having a code number of 3 or 4.

5.3 Obstacle Limitation Surfaces

The dimensions and slopes of the obstacle limitation surfaces required for Davao International Airport are shown in Table 5.3.1 and Figure 5.3.1 in accordance with ICAO Annex 14. New objects or extension of existing objects should not be permitted above those obstacle limitation surfaces, and existing objects above an approach surface, transitional surface, conical surface and inner horizontal surface should as far as practicable be removed.

Since Davao International Airport has a plan to develop its runways to precision approach runways in the future, inner approach, inner transitional and balked landing surfaces should additionally be required as shown in Figure 5.3.2.

Table 5.3.1 Dimensions and Slopes of Obstacle Limitation Surfaces

APPROACH RUNWAYS

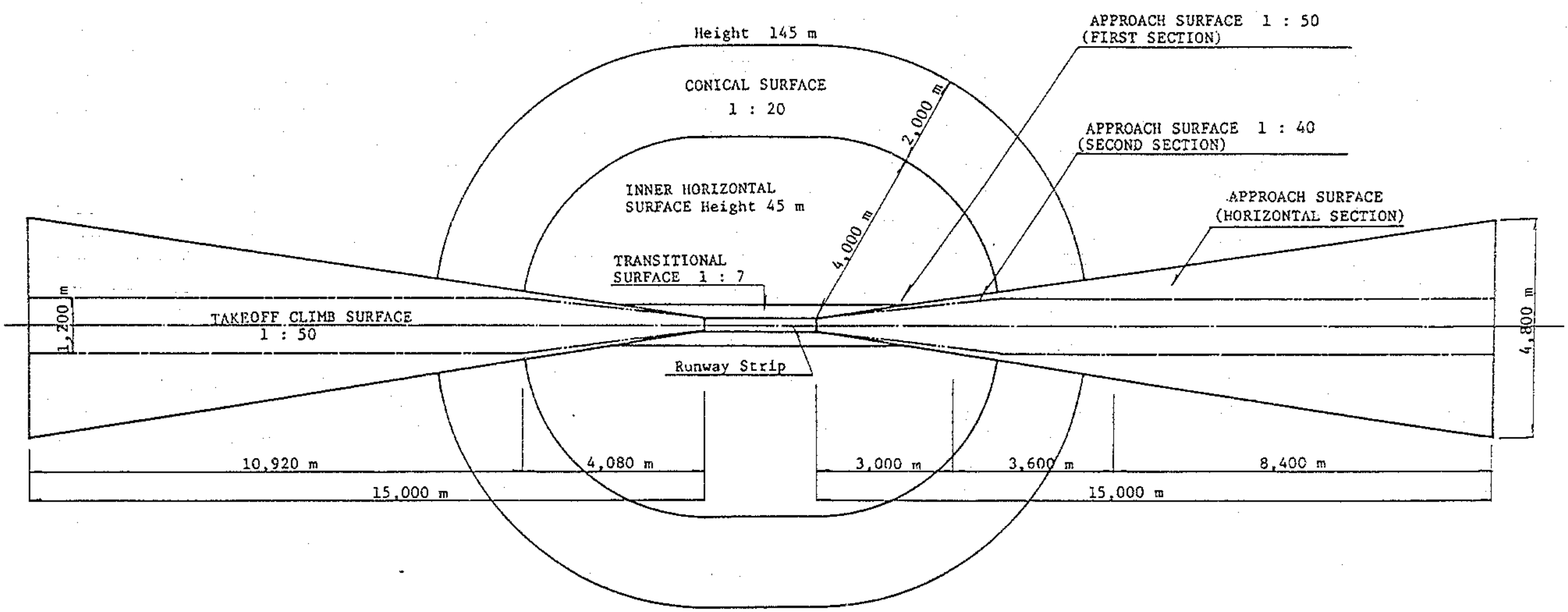
	RUNWAY CLASSIFICATION									
	Non-instrument				Non-precision approach			Precision approach category		
								I		II or III
	Code number				Code number			Code number		Code number
Surface and dimensions [a]	1	2	3	4	1,2	3	4	1,2	3,4	3,4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35m	55m	55m	100m	60m	75m	100m	60m	100m	100m
INNER HORIZONTAL										
Height	45m	45m	45m	45m	45m	45m	45m	45m	45m	45m
Radius	2000m	2500m	4000m	4000m	3500m	4000m	4000m	3500m	4000m	4000m
INNER APPROACH										
Width	-	-	-	-	-	-	-	90m	120m	120m
Distance from threshold	-	-	-	-	-	-	-	60m	60m	60m
Length	-	-	-	-	-	-	-	900m	900m	900m
Slope								2.5%	2%	2%
APPROACH										
Length of inner edge	60m	80m	150m	150m	150m	300m	300m	150m	300m	300m
Distance from threshold	30m	60m	60m	60m	60m	60m	60m	60m	60m	60m
Divergence(each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1600m	2500m	3000m	3000m	2500m	3000m	3000m	3000m	3000m	3000m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2.5%
Second section										
Length	-	-	-	-	-	3600m [b]	3600m [b]	12000m	3600m [b]	3600m [b]
Slope	-	-	-	-	-	2.5%	2.5%	3%	2.5%	2.5%
Horizonal section										
Length	-	-	-	-	-	8400m [b]	8400m [b]	-	8400m [b]	8400m [b]
Total length	-	-	-	-	-	15000m	15000m	15000m	15000m	15000m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope	-	-	-	-	-	-	-	40%	33.3%	33.3%
BALKED LANDING SURFACE										
Length of inner edge	-	-	-	-	-	-	-	90m	120m	120m
Distance from threshold	-	-	-	-	-	-	-	c	1800m [d]	1800m [d]
Divergence(each side)	-	-	-	-	-	-	-	10%	10%	10%
Slope	-	-	-	-	-	-	-	4%	3.33%	3.33%

a. All dimensions are measured horizontally unlessspecified otherwise.
b. Variable length (see 4.2.9 or 4.2.17).
c. Distance to the end of strip.
d. Or end of runway whichever is less.

TAKE OFF RUNWAYS

	Code number		
Surface and dimensions [a]	1	2	3 or 4
(1)	(2)	(3)	(4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end [b]	30 m	60 m	60 m
Divergence (each side)	10 %	10 %	13 %
Final width	380 m	580 m	1,200 m 1,800 m [c]
Length	1,600 m	2,500 m	15,000 m
Slope	5 %	4 %	2 % [d]

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1,800m when the intended track includes changes of heading greater than 15° for operations conducted in LMC, VMC by night
d See 4.2.24 and 4.2.26



Note : Height above aerodrome elevation

Figure 5.3.1 Obstacle Limitation Surfaces for Code Number 4 of Precision Approach Runway

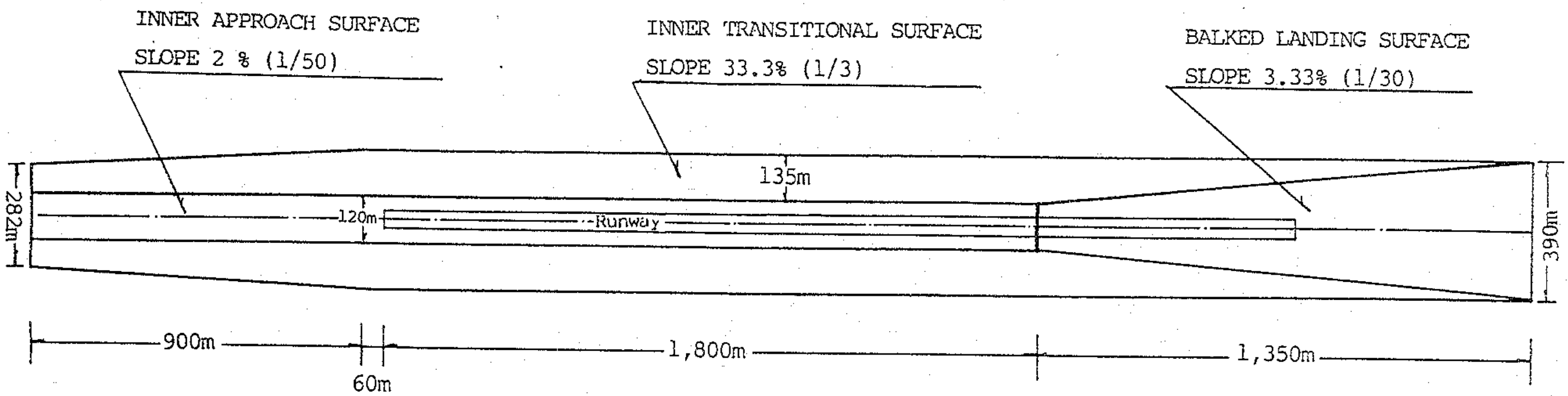


Figure 5.3.2 Inner Approach, Inner Transitional and Balked Landing Surfaces for Code Number 3 and 4 of Precision Approach Category I, II, or III

5.4 Taxiway and Apron

5.4.1 Taxiway

A complete parallel taxiway with right angle exits is economically justified where the number of instrument approaches exceeds four during the peak hour of the average week. Table 5.4.1 shows peak hour aircraft movements of an average week.

Table 5.4.1 Peak Hour Aircraft Movements of Average Week

Item	1990	1995	2000	2005	2010
Annual Aircraft Movements	6,710	5,320	7,120	9,150	10,000
Peak Hour (Heavy Direction)	3	3	3	3	3

As seen on Table 5.4.1, no parallel taxiway will be required up to 2010. Two stub taxiways connecting the runway and apron will be sufficient to handle anticipated movements of aircraft. However, the land area required for the future parallel taxiway is recommended to be reserved at an early stage.

5.4.2 Apron

The necessary number of aircraft stands for jet aircraft flights will be determined by peak hour movements. Considering reserving extra stands for unexpected occasions such as delay or technical trouble of aircraft, the number of aircraft stands up to 2010 are estimated as shown in Table 5.4.2.

The apron location should be planned so that any part of the parked aircraft may not infringe on the transitional surface for safe aircraft operations. It is also necessary to determine the apron location with sufficient provisions for future operation. In this respect, the apron location is determined by considering the possible future introduction of MD-11 and B747 so that they would not infringe the transitional surface.

Table 5.4.2 Required Number of Aircraft Stands

Item	1990	1995	2000	2005	2010
DC-10 Class	-	-	1	1	1
A300 Class	2	2	2	2	3
B737 Class	-	2	1	2	1
Total	2	4	4	5	5

5.5 Airfield Pavement

The required strength of airfield pavement should be determined from the aircraft classification number (ACN). The ACN is shown in Table 5.5.1.

Table 5.5.1 Aircraft Classification Number

Item		1990	1995	2000	2005	2010
Maximum Aircraft of Scheduled Flight		A300-B4	A300-B4	A300-B4	A300-B4	DC-10-30
ACN	Rigid Pavement	52	52	52	52	59
	Flexible Pavement	48	48	48	48	63

Note: Subgrade Category : Low

The pavement should be designed so that the pavement classification number (PCN) is equal to or larger than the above ACN. The required PCN is shown in Table 5.5.2.

Table 5.5.2 Required PCN

Item		1990	1995	2000	2005	2010
PCN	Rigid Pavement	52	52	52	52	59
	Flexible Pavement	48	48	48	48	63

5.6 Passenger Terminal Building

The floor area required for the passenger terminal building has been calculated at five (5) year intervals by multiplying the number of the peak hour passengers by the unit floor area.

For a domestic passenger terminal, the unit floor area of 10sq.m per peak hour passenger is applied as the planning practice based on other projects.

An international passenger terminal requires C.I.Q. (Customs, Immigration and Quarantine) facilities and large passenger amenities as compared to a domestic passenger terminal. The unit floor area of 20sq.m per peak hour passenger is used as the planning practice for the international passenger terminal.

The required floor areas for the passenger terminal building are shown in Table 5.6.1.

Table 5.6.1 Required Floor Area for Passenger Terminal Building

Passenger Terminal	Item	1995	2000	2005	2010
Domestic	Peak Hour Passengers	460	620	660	740
	Required Floor Area (sq. m)	4,600	6,200	6,600	7,400
International	Peak Hour Passengers	30	200	200	250
	Required Floor Area (sq.m)	600	4,000	4,000	5,000
Total Floor area (sq. m)		5,200	10,200	10,600	12,400

5.7 Cargo Terminal Building

The cargo handling area for the cargo terminal building has been estimated at five (5) year intervals by multiplying the annual cargo volume tonnage by the cargo handling capacity. Total floor area for the cargo terminal building is generally estimated to be 1.5 times the cargo handling area, in order to include the floor area for airline offices, cargo agents, customs offices, etc.

The cargo handling capacity of 10 ton per sq.m and 20 ton per sq.m is used for the international and domestic handling area respectively, based on other projects.

The required floor areas for the cargo terminal building are shown in Table 5.7.1.

Table 5.7.1 Required Floor Area for Cargo Terminal Building

Cargo Terminal	Item	1995	2000	2005	2010
Domestic	Annual Cargo Volume (ton)	30,800	43,800	57,100	72,400
	Cargo Handling Area (sq.m)	1,540	2,190	2,860	3,620
International	Annual Cargo Volume (ton)	0	1,600	5,300	11,900
	Cargo Handling Area (sq.m)	0	160	530	1,190
Subtotal Floor Area (sq.m)		1,540	2,350	3,390	4,810
Office Floor Area (sq.m)		760	1,150	1,710	2,390
Total Floor Area (sq.m)		2,300	3,500	5,100	7,200

5.8 Other Buildings

5.8.1 Administration Building

An independent administration building is required for airport administration, operation and maintenance. The required floor area is shown in Table 5.8.1 based on the planning practices used in Japan.

Table 5.8.1 Required Floor Area for Administration Building

Year	1995	2000	2005	2010
Require Floor Area (sq.m)	1,800	1,800	1,800	1,800

5.8.2 Control Tower Building

A control tower cab with a floor area of about 60sq.m is generally required for air traffic controllers and control consoles. The height of the tower cab depends on the tower location based on FAA standards, but it is anticipated that the tower is to be 20m high which is equal to a 6-storied building. Total floor area for the control tower building will be about 360sq.m.

The control tower building is planned to be combined with the administration building so as to manage the airport operation and maintenance effectively.

5.8.3 Fire Station Building

The floor area required for the fire station building is about 550sq.m based on the floor area adopted in other projects.

5.9 Access Road, Curbside Road and Car Parking

5.9.1 Access Road

The rate of the number of cars per one passenger is 1.2, according to the traffic survey.

It is said that the capacity of a one-lane car road is approximately 1,000 cars per hour. Thus, 1 lane per direction is required up to 2010 as shown in Table 5.9.1. After 2010, 2 lanes per direction will be required.

Table 5.9.1 Number of Lanes

	1992	1995	2000	2005	2010
Peak Hour Passengers	340	460	620	660	960
Number of Cars	410	550	740	790	790
Number of Lanes	1	1	1	1	2

5.9.2 Curb Length of Passenger Building

The required curb length of the passenger building is calculated by the following formula as shown in Table 5.9.2:

$PBC = a \cdot t \cdot l/60$

where, PBC : Required length of curb in meters
a : Number of hourly cars
t : Average dwell time at curb (1 min.)
l : Length of parking slot per vehicle (6.5m)

Table 5.9.2 Required Curb Length

	1992	1995	2000	2005	2010
Peak Hour Cars	408	552	744	792	1,152
Curb Length (m)	44	60	80	90	130

5.9.3 Car Parking

The following formula is used to calculate the required number of parking spaces and paved area of car parking:

$N = P \times 0.5$

$A = N \cdot a$

where, N : Required number of parking spaces
P : Peak hour passengers
A : Required paved area
a : Unit area of paved area (20 sq.m)

The rate of number of parked cars per one passenger is 0.5, according to the traffic survey.

The required number of parking spaces and paved area of car parking is estimated as shown in Table 5.9.3.

Table 5.9.3 Required Number of Parking Spaces and Paved Area of Car Parking

	1992	1995	2000	2005	2010
Peak Hour Passengers	340	460	620	660	960
Number of Parking Spaces	170	230	310	330	480
Paved Area (m^2)	3,400	4,600	6,200	6,600	9,600

5.10 Air Navigation System

An air navigation system consisting of the following should be planned to satisfy the requirements of aircraft operations and air traffic control of precision approach runway category I.

a) Radio Navigational Aids System
b) Air Traffic Control System
c) Aeronautical Telecommunication System
d) Aeronautical Ground Light System
e) Meteorological Observation System

5.10.1 Radio Navigational Aids System

Radio navigational aids required for precision approach runway are;

a) ILS or MLS
b) VOR
c) NDB
d) DME

According to ILS/MLS transition plan by ICAO, ILS will cease to be an ICAO standard system for precision approach runways as of January 1, 1998, but can remain in service until 1999 on the basis of Regional Agreements. MLS is the sole ICAO standard system from 2000.

In this study, ILS is planned to be installed up to 2000 and it should be replaced by MLS after that time. VOR/DME and NDB will be retained as is.

5.10.2 Air Traffic Control System

The air traffic control system for aerodrome and approach shall be provided with the same functions as the existing.

5.10.3 Aeronautical Telecommunication Systems

Air to ground VHF communications and aeronautical fixed service shall be provided with the same functions as the existing. ATIS System (Aerodrome Terminal Information Service) will be planned for the upgrading of the service level.

5.10.4 Aeronautical Ground Light System

The aeronautical ground light (AGL) system required for the airport with a precision approach and non-precision approach runway will be planned as follows:

- Precision approach lighting system for main approach direction
- Simple approach lighting system for opposite side of main approach direction
- PAPI for both RWY 05/23
- Runway edge lights
- Runway threshold/end lights
- Taxiway edge lights
- Apron floodlights
- Aerodrome beacon
- Illuminated wind direction indicator
- Obstacle lights
- AGL control system

5.10.5 Meteorological Observation System

Wind speed, wind direction, atmospheric pressure, temperature, rainfall, visibility, cloud amount and cloud base should be observed at the airport. Runway visual range should be observed for precision approach operations. Forecast services covering en-route, terminal and area are also a basic requirement of metrological observation system at the airport. The provision of an automatic data processing system will be considered to ensure the smooth and accurate handling of data.

5.11 Rescue and Fire Fighting Services

The facility requirement for the rescue and fire fighting services will be estimated based on the busiest three months aircraft movement in compliance with ICAO Airport Service Manual. The standard levels of protection of the project will be Category-8 based on the estimation of traffic volume in 2000. The requirements of the extinguishing agent and vehicles are shown in Table 5.11.1.

Table 5.11.1 Requirements of Rescue and Fire Fighting Services

Category		Up to 1995	After 2000
		6	8
Extinguishing Agent	AFFF	8,270 (liter)	18,200 (liter)
	Dry Chemical Powder	204 (kg)	450 (kg)
Number of Vehicles	RIV	1	1
	Major Vehicle	2	2 or (3)

5.12 Airport Utilities

The airport utility requirements are calculated based on the unit demand shown in Table 5.12.1.

Table 5.12.1 Unit Demand

Utilities	Unit Demand		
Electricity	Passenger Terminal Building	:	100 VA/m^2
	Cargo Terminal Building	:	60 VA/m^2
	Administration Building and others	:	120 VA/m^2
Water	Passenger Terminal Building	:	23 liter/m^2/day
	Cargo Terminal Building	:	3 liter/m^2/day
	Administration Building and others	:	10 liter/m^2/day
Sewage	Passenger Terminal Building	:	23 liter/m^2/day
	Cargo Terminal Building	:	3 liter/m^2/day
	Administration Building and others	:	10 liter/m^2/day
Waste	Passenger Terminal Building	:	0.072 kg/m^2/day
	Cargo Terminal Building	:	0.144 kg/m^2/day
	Administration Building and others	:	0.144 kg/m^2/day

Sauce : Average unit demand in Japan

The demand of airport utilities at the airport is estimated by multiplying the above unit demand by the required floor area of each building as shown in Table 5.12.2.

Table 5.12.2 Airport Utilities Demand

		1995	2000	2005	2010
Electricity Demand	(KVA)	1,200	1,800	2,000	2,300
Water Demand	(liter/day)	140,000	260,000	280,000	320,000
Sewage Discharge	(liter/day)	140,000	260,000	280,000	320,000
Waste Deposit	(kg/day)	1,000	1,500	1,800	2,200

5.13 Fuel Supply System

The fuel requirements are calculated by multiplying the trip fuel by the number of departing flights for each route and aircraft type. The required fuel storage capacity is estimated based on the calculated fuel requirements and the seven day reserve policy (JCAB standard practice). A 20% allowance on tank capacity is also considered. The aviation fuel storage requirements, as well as the required area for the fuel farm up to 2010, are shown in Table 5.13.1.

Table 5.13.1 Requirements for Fuel Supply System

Jet-Al	1995	2000	2005	2010
Seven-day Consumption (KL)	690	970	1,300	2,300
Required Tank Capacity (KL)	860	1,210	1,630	2,880
Number of Tanks	500 KL x 2	500 KL x 3	500 KL x 4	500 KL x 6
Fuel Farm Area (m^2)	5,400	6,300	6,300	7,700

CHAPTER 6 EVALUATION OF EXISTING DAVAO INTERNATIONAL AIRPORT

CHAPTER 6 EVALUATION OF EXISTING DAVAO INTERNATIONAL AIRPORT

6.1 General

The development of the existing airport, in general, requires large-scale construction with substantial capital investment. To achieve optimum capital utilization, the development to be made must have an adequate useful life. The development should also ensure safe and efficient aircraft operations, minimum adverse environmental impact on the airport surroundings and the future expansion capability.

The starting point to accomplish the above objective is the evaluation of the existing airport facilities against current and future traffic demands. This chapter discusses the present condition of airport facilities and evaluate capacities against future facility requirements estimated in Chapter 5. A summary of the evaluation for existing airport facilities at Davao International Airport is shown in Table 6.1.1.

Table 6.1.1 Summary of Evaluation for Existing Facilities

Legend, ━━━ : The existing capacity is sufficient for demend.
x : Demand already exceeds the existing capacity

Facilities		1990	1995	2000	2005	2010	Remarks
Runway	-Number	━━━	━━━	━━━	━━━	━━━	-A single runway can handle aircraft movements up to 2010.
	-Length	━━━	━━━	━━━	━━━		
Runway Strip	-Width	x					
Obstacle Limitation Surfaces	-Approach Surface	x					
	-Transitional Surface	x					
Taxiway	-System	━━━	━━━	━━━	━━━	━━━	-No parallel taxiway is required for aircraft movements up to 2010.
Apron	-Aircraft	x					-There is no space to accommodate **any additional** aircraft for unexpected peaks or flight delays
Airfield Pavement	-Strength	x					
Passenger Terminal Building	-Domestic	x					
	-International	x					
Cargo Terminal Building		x					
Administration and Operations Building		x					
Access Road		━━━	━━━	━━━	━━━		-Two lanes for two-way road is sufficient for vehicular traffic up to 2005.
Car Parking		x					
Air Navigation System	-VOR/DME	━━━	━━━				-Life span will expire before 2000.
	-NDB	x					-NDB will reach its operational life soon.
	-ATC&COM	━━━					-Life span will expire before 1995.
	-AGL	x					-Life span already expired.
	-MET	x					-Life span already expired.
	-Emergency Generator	x					-Life span already expired.
Rescue and Fire Fighting		x					-Number of fire-fighting vehicles are not sufficient for present demand.
Airport Utilities	-Power Supply	x					-Life span already expired.
	-Water Supply	x					
	-Sewage Disposal						-Capacity of the existing septic tank is unknown.
	-Solid Waste Disposal	x					-No incinerator is available at the airport.
Aviation Fuel Supply		x					

6.2 Airspace Use

6.2.1 Flight Information Region (FIR)

Manila Flight Information Region consists of the airspace over the Republic of the Philippines and its adjacent high seas as shown in Figure 6.2.1, detailed dimensions of the FIR boundary are given in Table 6.2.1.

Table 6.2.1 Dimensions of Manila Flight Information Region

	UPPER LIMIT / LOWER LIMIT	UNIT PROVIDING SERVICE	RADIO CALL SIGN	REMARKS
MANILA FLIGHT INFORMATION REGION From 21°00'00"N 130°00'00"E To 06°00'00"N 130°00'00"E To 06°00'00"N 132°00'00"E To 04°00'00"N 132°00'00"E To 04°00'00"N 120°00'00"E To 07°30'00"N 117°30'00"E To 10°30'00"N 114°00'00"E To 16°40'00"N 114°00'00"E To 21°00'00"N 117°30'00"E To point of beginning	Unlimited Surface	ACC MANILA	RTF: Manila Control (En)	No VFR allowed a) from sunset to sunrise b) above FL200; c) at transonic and supersonic speed, unless authorized by the appropriate ATS authority (See chart RAC 3-1)

Source: AIP Philippines

Manila FIR is surrounded by the Taipei, Hong Kong, Singapore, Kota Kinabaru, Ujung Pandang, Oakland Oceanic and Naha FIRs and occupies a very important area for the international civil air transport network in Southeast Asia.

Flight information, alerting and air traffic control (in the control areas) services within Manila FIR are provided by the Manila Area Control Center (ACC) and Mactan Area Control Center on a 24 hour basis within their respective areas of responsibility.

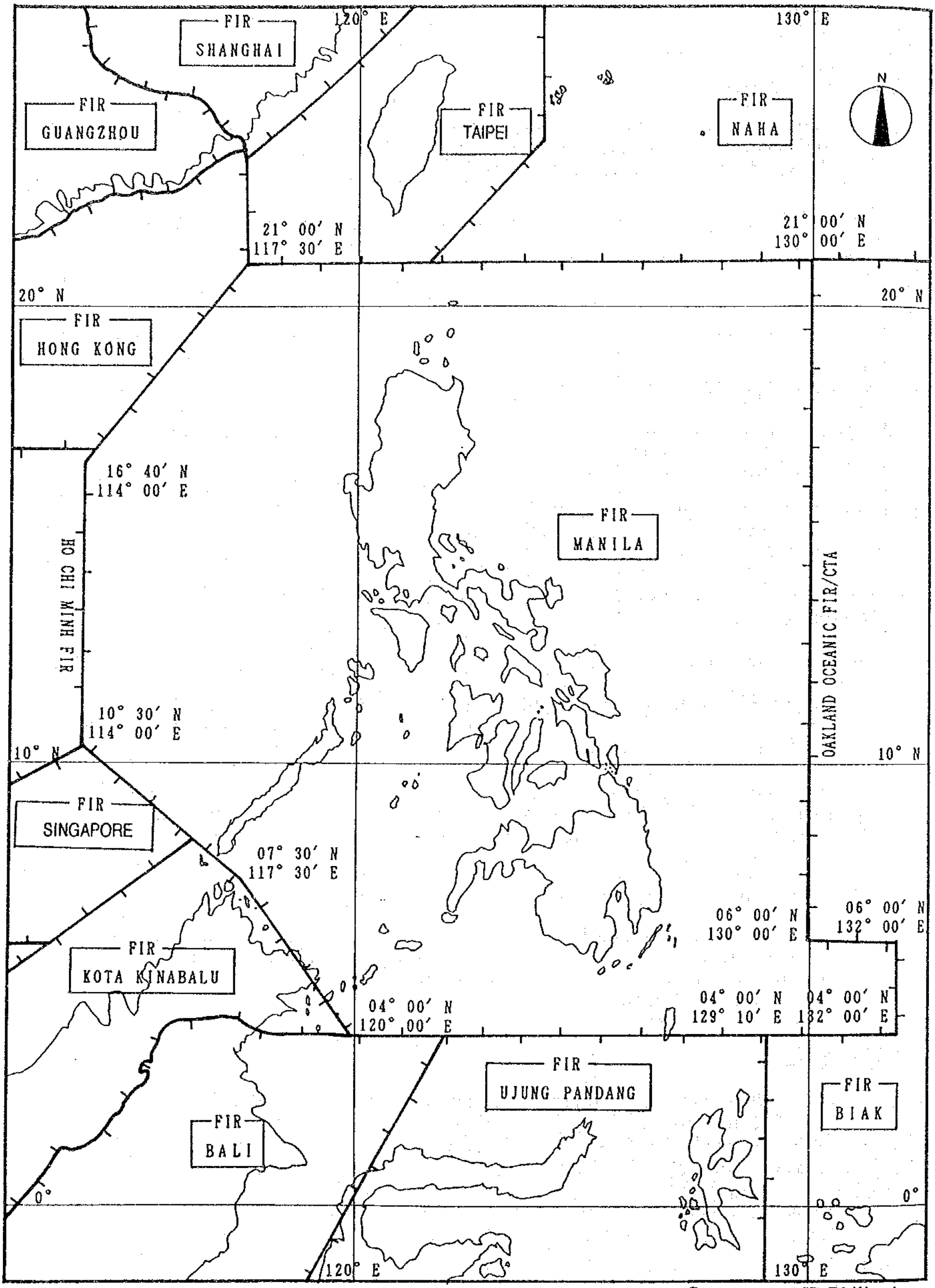
6.2.2 Control Area

All airways within Manila FIR are designated as control areas, and the airspaces over the main airports and its surroundings are also designated as control areas. The airspace over the Davao International Airport and its surroundings are designated as a terminal control area, with a radius of 20 nautical miles (NM) centered on DavaoVOR/DME.

6.2.3 ATS routes

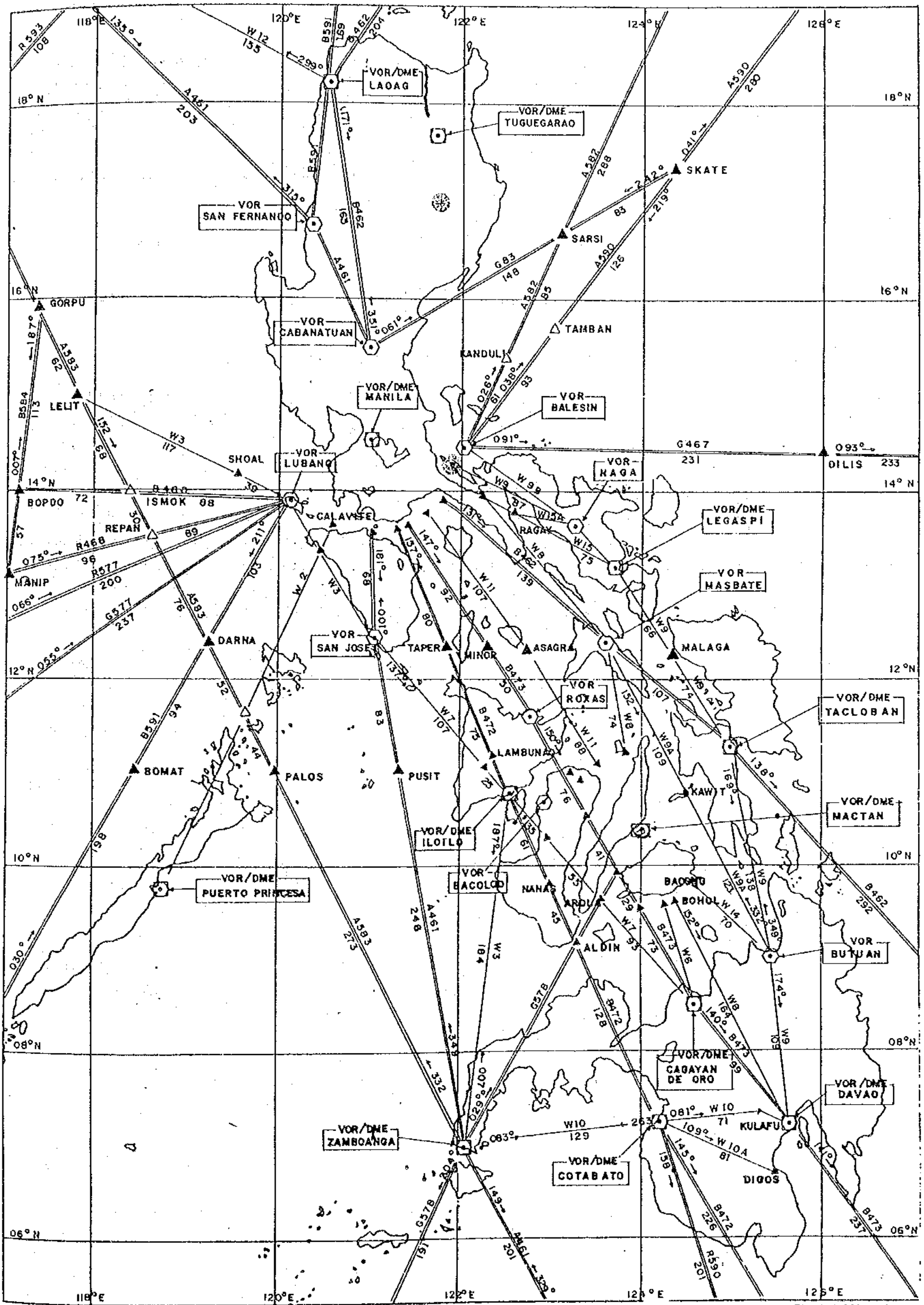
The international ATS routes of A (Alpha) 341, 461, 582, 583, and 590, B (Bravo) 460, 462, 472, 473, 584, and 591, G (Golf) 467, 577, and 578 run in all directions within Manila FIR and most of them converge in the Manila Area. The W (Whisky) airways, mainly used for domestic flights, are established throughout the country.

Figure 6.2.2 shows the configuration of ATS routes within Manila FIR.



Source: AIP Philippines

Figure 6.2.1 Manila Flight Information Region



Source: AIP Philippines

Figure 6.2.2 Configuration of ATS Routes within Manila FIR

6.2.4 Special Use - Airspace

31 danger areas, 9 restricted areas and 1 prohibited area are designated within Manila FIR. Most of the areas mentioned above are established around Manila and Mactan international airports. Also, many training areas are established around the said airports.

At present, no danger or restricted areas are established around the Davao International Airport.

Figure 6.2.3 shows the special use-airspace within Manila FIR.

6.2.5 Airspace Utilization at Davao International Airport

(1) Terminal Control Area, Control Zone and Aerodrome Traffic Zone

The Terminal Control Area, Control Zone and AerodromeTraffic Zone at Davao International Airport are established as shown in Appendix-6.2.1 (detailed dimensions are given in Appendix-6.2.2).

(2) Aircraft Operation Procedures

There are one conventional VOR/DME, one NDB and one ILS/LLZ at Davao International Airport for aircraft operating under instrument meteorological condition. Instrument approach procedures, standard instrument approach procedures, and standard instrument departures are established using the facilities mentioned above except ILS/LLZ.

a) Instrument Approach Procedures

At present, the following instrument approach procedures using VOR/DME, VOR and NDB are established as shown in Appendices-6.2.3 to 6.2.6.

i) NDB RWY 05
ii) VOR RWY 05
iii) VOR/DME RWY 05
iv) VOR/DME RWY 23

b) Standard Instrument Departures

6 standard instrument departure routes are established for departure aircraft from this airport as shown in Appendix-6.2.7 (detailed dimensions are given in Appendix-6.2.8).

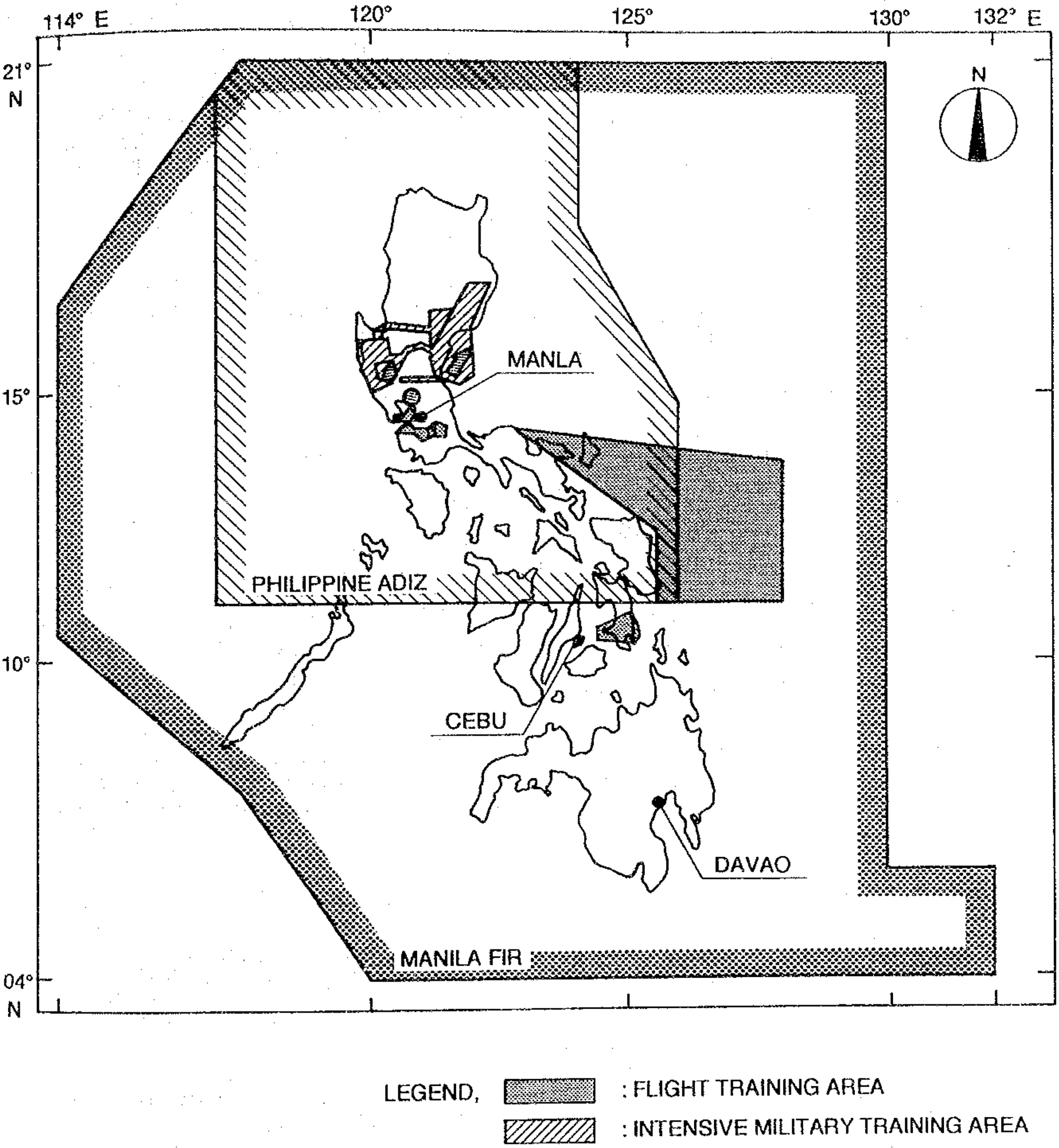


Figure 6.2.3 Special Airspace within Manila FIR

6.3 Runway and Runway Strip

6.3.1 Runway

(1) General

The existing runway of Davao International Airport is 2,500m in length and 45m in width. It is oriented in 050/230 directions for true north. The declared runway strength in the AIP is PCN 52.0 R/B/W/T, which is capable of accommodating aircraft up to A300 aircraft.

(2) Runway Usability Factor

Based on the meteorological data at the airport, usability factors of the runway was examined as shown in Table 6.3.1.

Table 6.3.1 Runway Usability Factor

Cross-wind Component	Usability Factor
Less than 13 kt Less than 20 kt	99.94 % 99.98 %

As shown in Table 6.3.1, the runway usability factor at the airport is more than 99% in both cases of cross-wind components which sufficiently exceeds the 95% usability factor recommended by ICAO. It represents very favorable meteorological conditions at the airport.

(3) Number of Runways

The existing single runway will face no capacity problem in terms of aircraft movements up to 2010 and it seems that it will remain so for quite a while even after 2010.

(4) Runway Length and Width

Length and width of the existing runway are 2,500m and 45m respectively which qualify the airport as a 4D aerodrome by ICAO Annex 14 definitions. As analyzed in section 5.2.1 (2), the existing 2,500m length runway is sufficient for requirements up to 2010. After 2010, required runway length is 3,000m. The existing runway width of 45m is adequate for all types of aircraft used for civil aviation at present.

(5) Runway Slope

Profile of the existing runway is as illustrated in Figure 6.3.1. The longitudinal slope of the runway, which is computed by dividing the difference between the maximum and minimum elevation by the runway length, is 0.16% based on the result of the topographical survey. This slope does not exceed 1.0% recommended by ICAO.

At a portion between Sta. 2 + 400 and Sta. 2 + 700, longitudinal slope is 1.28%. This slope exceeds 1.25% of the allowable maximum slope recommended by ICAO.

This steep slope does not pose serious problems for take-off operations from either runway end. For landing operations under strong cross-wind or wet runway, however, it does present some uneasy feeling for pilots since braking action should take place at this steep down slope when landing on runway 23. Nevertheless, it is not considered a very serious problem by Philippine Airlines.

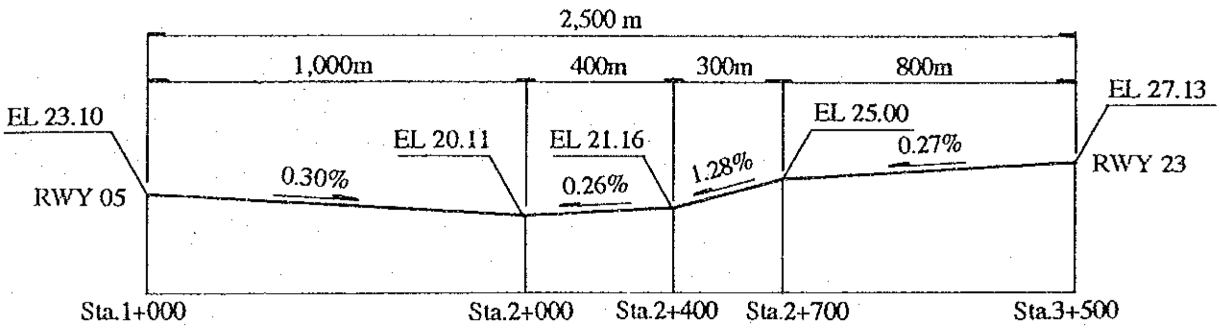


Figure 6.3.1 Runway Profile

6.3.2 Shoulder

There is no paved shoulder. The largest aircraft operating at Davao International Airport is the A300 which has a wing span of 45m. The 45m wide runway covers the wing span. Therefore, the unpaved shoulder is not a serious problem for protecting the ground from erosion due aircraft engine blasts. However, the provision of 7.5m wide paved shoulders is preferable for increasing the safety for aircraft running off the runway as recommended by ICAO.

6.3.2 Runway Strip

(1) Length

The length of the existing runway strip is 2,540m according to AIP. However, the length of the runway strip should be 2,620m.

(2) Width

The width of the existing runway strip is 200m. This is less than the 300m strip recommended by ICAO as for a non-precision approach. Moreover, some portion of the existing perimeter fences are located within 75m of the runway center line.

(3) Slope

Most of the strip's transverse slopes exceed 2.5% recommended by ICAO. The existing ground within at least 75m from the runway center line should be graded.

6.3.4 Runway End Safety Area

A runway end safety area as recommended by ICAO is not provided.

6.3.5 Clearway

There is no problem.

6.3.6 Stopway

The existing stopways are not paved. To protect the ground from being eroded by aircraft engine blasts, the stopways should preferably be paved.

6.4 Obstacle Limitation Surfaces

The obstacle limitation surfaces are established at Davao International Airport in accordance with Civil Air Regulations Part XIV as shown on Figure 6.4.1. The dimensions of the obstacle limitation surfaces and slopes described in the regulations are almost the same as the ICAO standards. However, at present, the width of the runway strip of this airport is only about 200m.

Figures 6.4.2 and 6.4.3 show the obstacle limitation surfaces for the non-precision approach runway at Davao International Airport in accordance with the standards of ICAO ANNEX 14 Aerodromes.

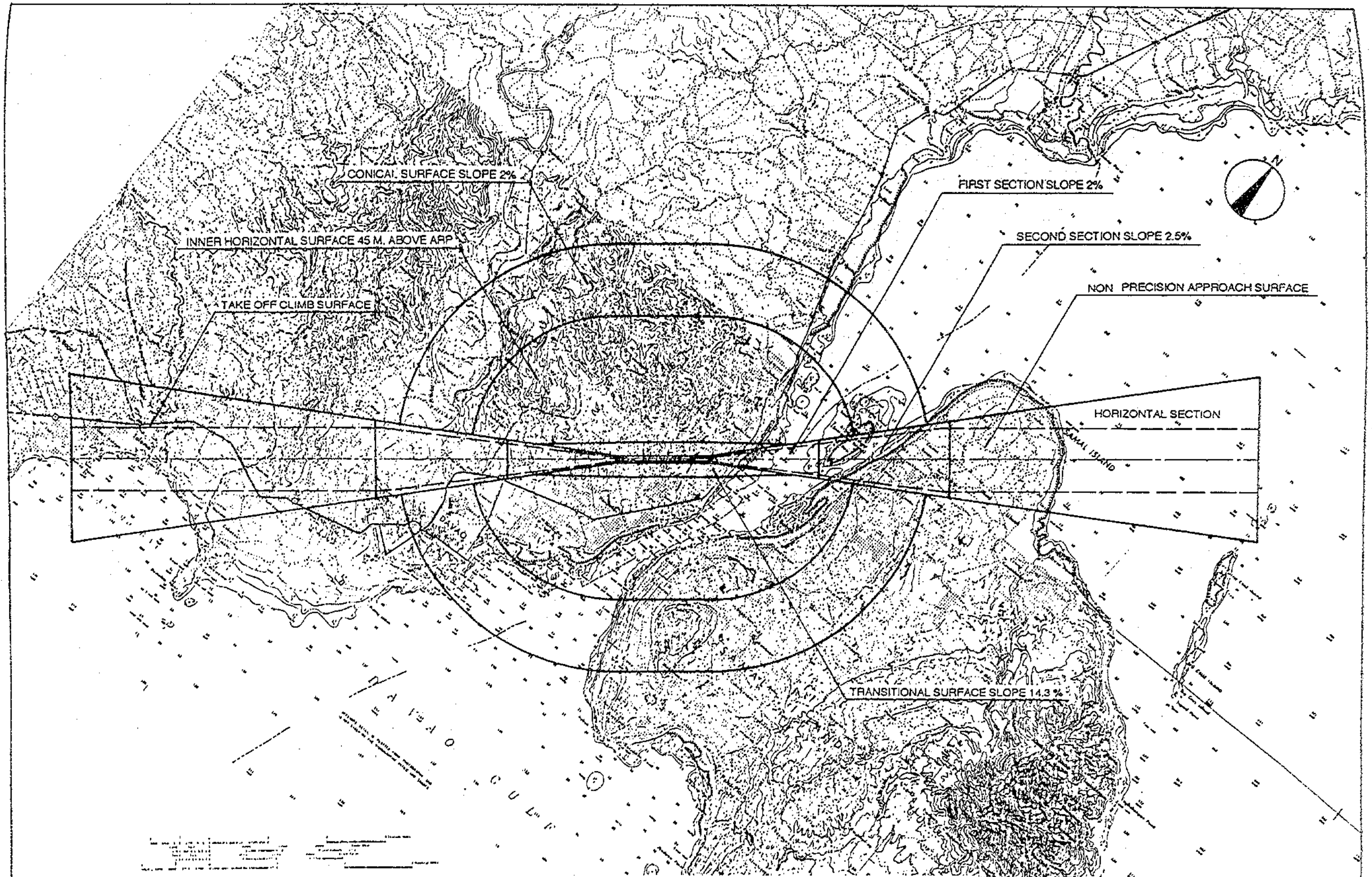


Figure 6.4.1 Obstacle Limitation Surfaces at Davao International Airport in accordance with Civil Air Regulations Part XIV

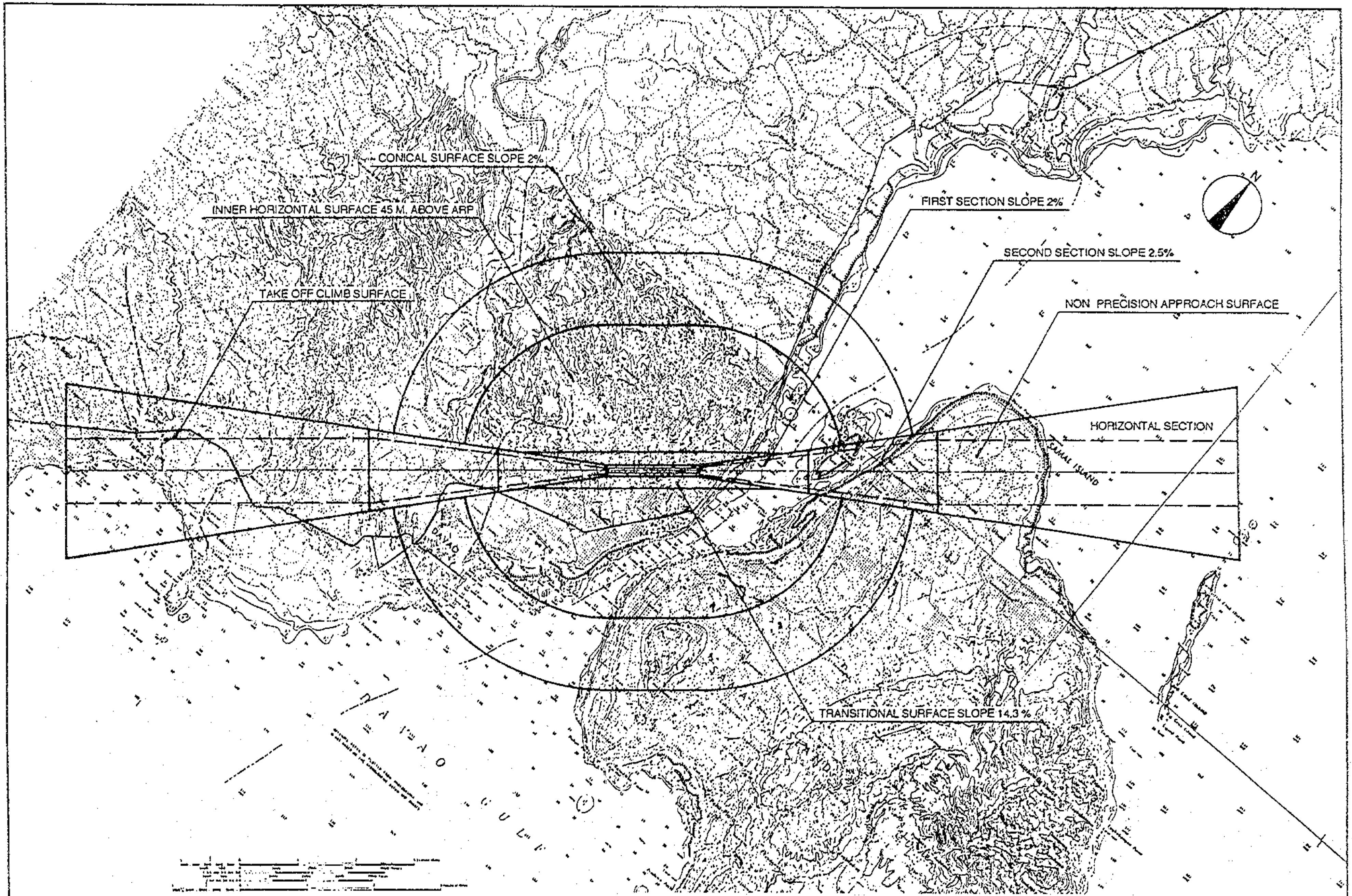


Figure 6.4.2 Obstacle Limitation Surfaces at Davao International Airport in Accordance with ICAO Annex 14

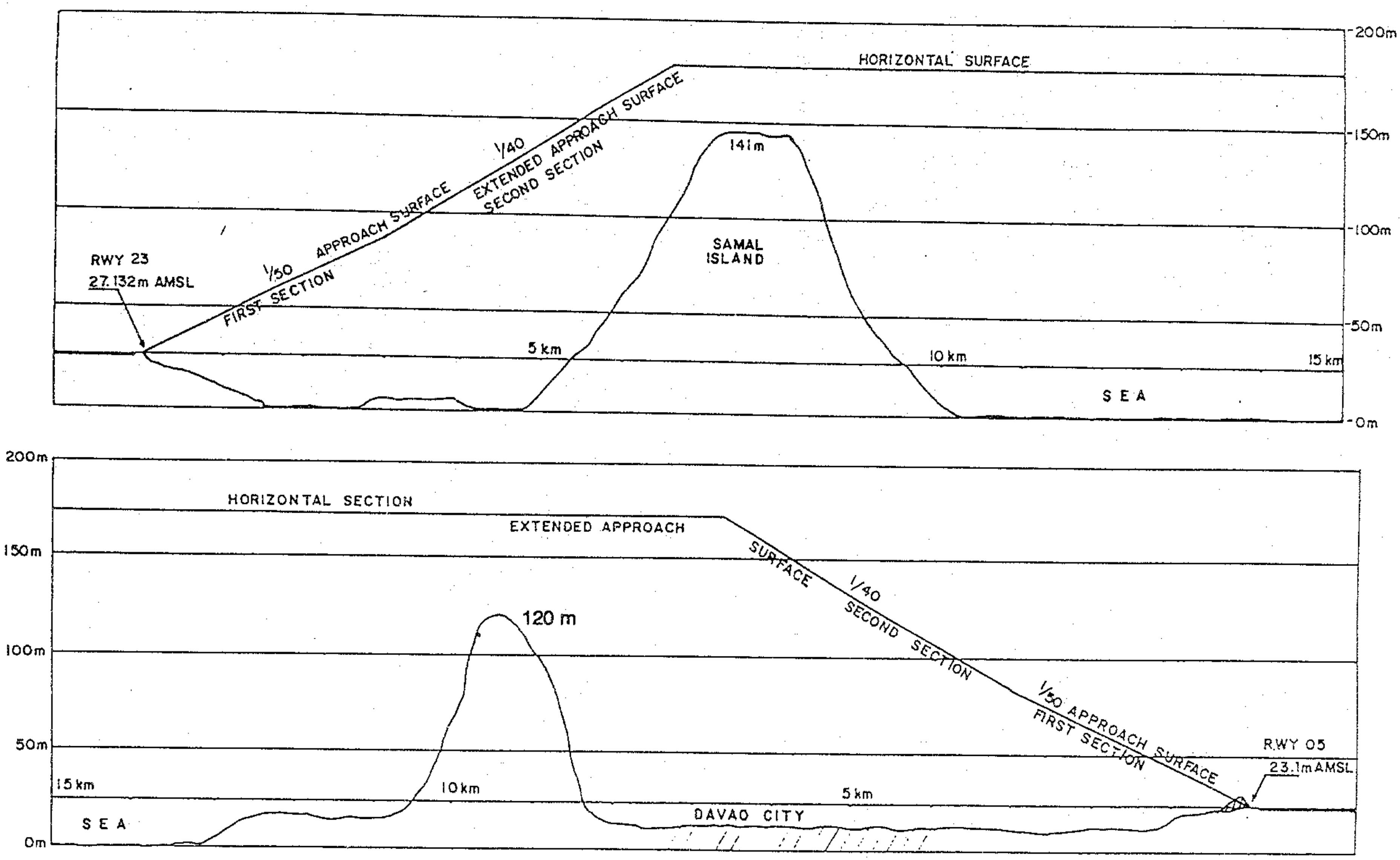


Figure 6.4.3 Profile of Approach Surface at Davao International Airport

6.4.1 Approach Surfaces

(1) Runway 05

The surface of ground proximity to Runway 05 threshold is swelled above the approach surface of first section in approach area as shown on Figure 6.4.4. However, no obstacle projects above the approach surfaces of second and horizontal section in the extended approach area.

(2) Runway 23

As the ground level in the approach end area (first section in approach area) to Runway 23 is lower than runway level, and the second section and horizontal section in the extended approach area are laid on the sea, the approach surfaces are mainly free from the obstacles as shown on Figure 6.4.5.

A 142m AMSL (above mean sea level) hill located at the northern part of Samal Island is included in the horizontal section in the extended approach area, but this hill does not project above the approach surface of this section in extended approach area.

6.4.2 Inner Horizontal and Conical Surfaces

Figure 6.4.6 shows the inner horizontal and conical surfaces for Davao International Airport. Some hills located 4,000m west of the airport are projected above the above-mentioned surfaces. Other parts of the surfaces are free from obstacles.

6.4.3 Transitional Surface

The ground surfaces are swelled above the transitional surface as shown in Figure 6.4.4.

Figure 6.4.7 shows the obstacles around the Runway 05/23. Table 6.4.1 shows the result of the obstruction survey. From Table 6.4.1 it is found that many obstacles, including main structures, such as passenger terminal building and control tower, are projected above the transitional surfaces for the existing 200m wide runway strip. In the future, when a category I approach is planned to be introduced at this airport, the above-mentioned obstacles will pose a more serious problem for the transitional surfaces of the 300m wide runway strip.

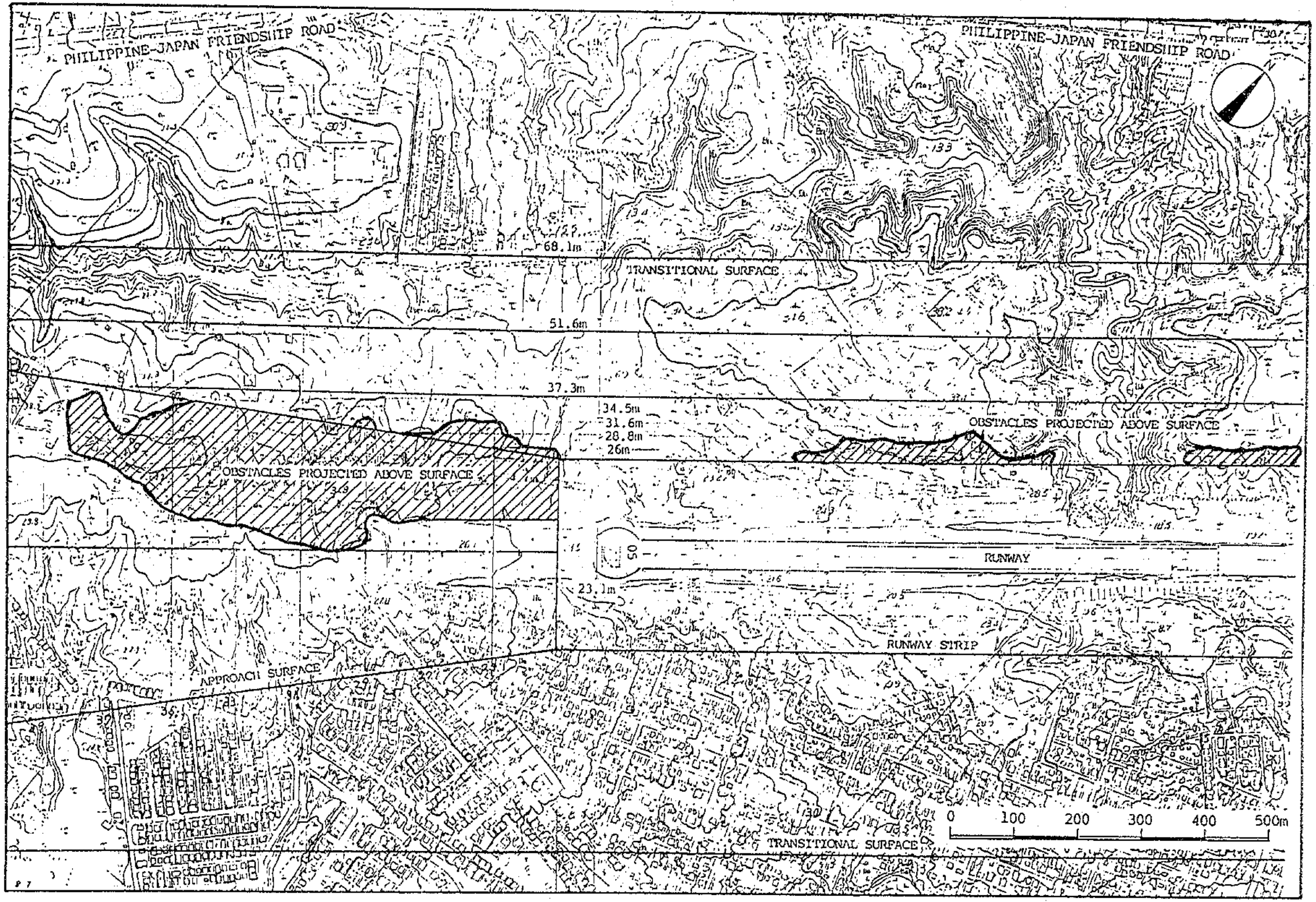


Figure 6.4.4 Blowup Map of approach and the Area in the Vincity of Runway 05 at Davao International Airport

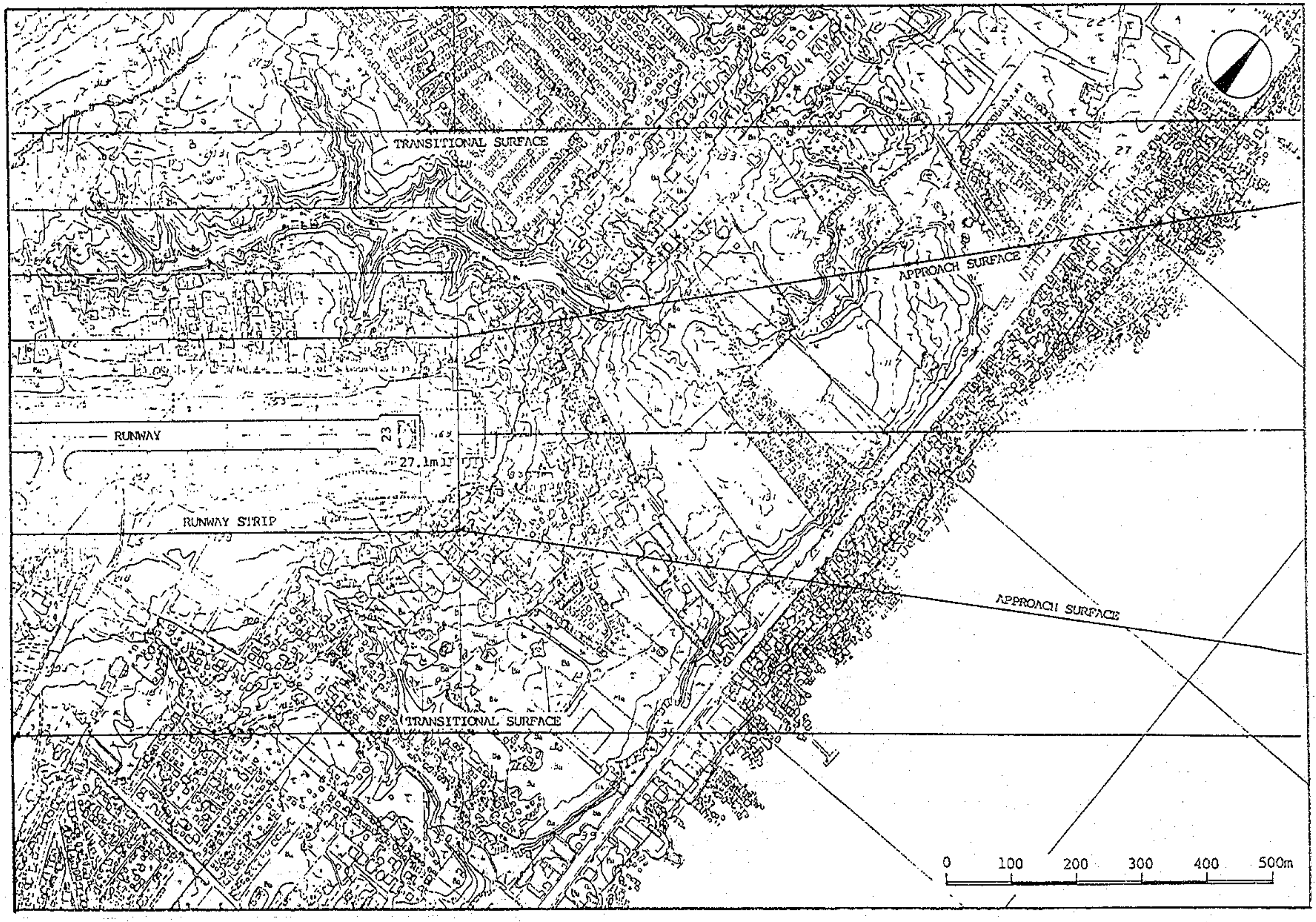


Figure 6.4.5 Blowup Map of Approach and the Area in the Vicinity of Runway 23 at Davao International Airport

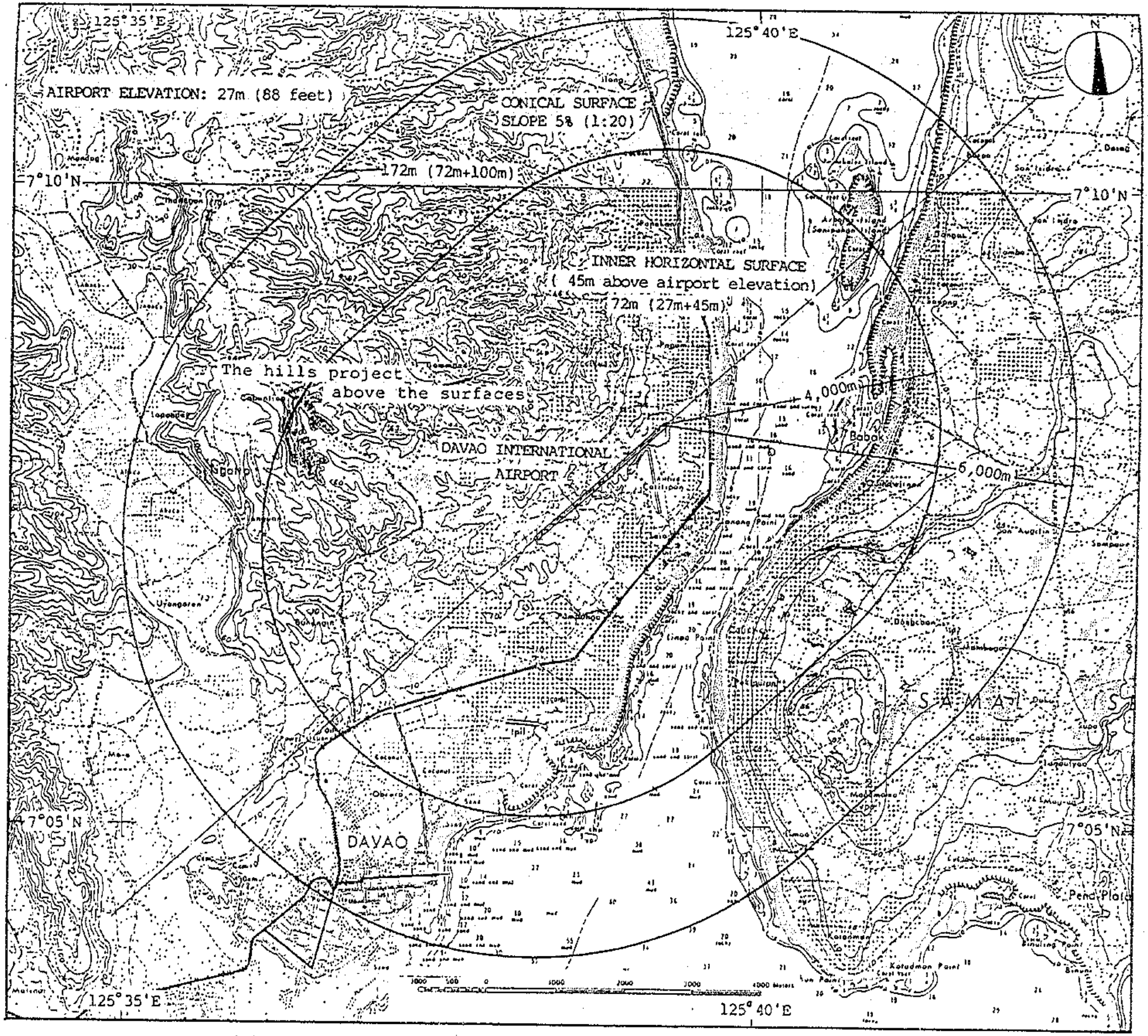


Figure 6.4.6 Inner Horizontal and Conical Surface at Davao International Airport

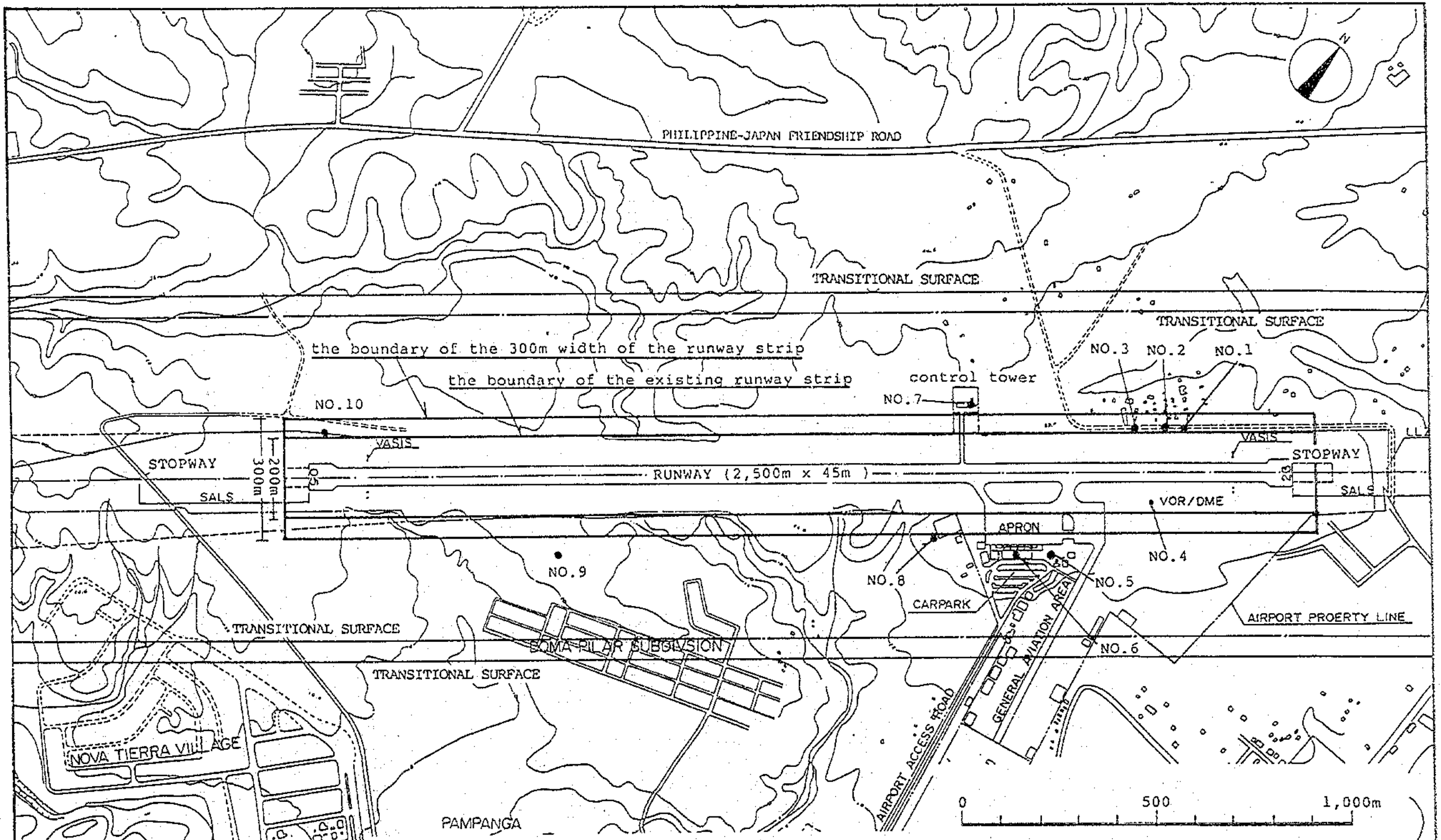


Figure 6.4.7 The Location of Obstacles around Runway 05/23 at Davao International Airport

Table 6.4.1 Details of Obstacles around Runway 05/23 at Davao International Airport

No.	Obstacle	Elevation of Obstacle (m)	Location		Elevation of RWY Center-line (m)	Elevation of Obstacle Limitation Surface		Projected Height above the Transitional Surface	
			Longitudinal Distance from RWYO5 Threshold (m)	Transverse Distance from RWY Center-line (m)		Case I* (m)	Case II** (m)	Case I* (m)	Case II** (m)
1.	IPIL IPIL TREE	40.65	2,240	102.50	27.15	27.51		13.14	
2.	IPIL IPIL TREE	42.23	2,189	100.00	27.15	27.15		15.08	
3.	IPIL IPIL TREE	42.29	2,134	107.50	27.11	28.18		14.11	
4.	VOR/DME ANTENNA	33.44	2,145	71.50	27.12	27.12		6.32	
5.	OLD TOWER	38.61	1,890	210.00	26.30	42.01	34.87	-3.40	3.74
6.	PASSENGER TERMINAL BLD.	42.53	1,767	197.00	25.67	39.53	32.38	3.00	10.15
7.	NEW TOWER	44.70	1,673	169.75	24.66	34.62	27.48	10.08	17.22
8.	ECJ HANGAR	34.11	1,594	162.00	23.65	32.51	25.36	1.60	8.75
9.	MANGO TREE	36.45	635	202.30	21.07	35.68	28.54	0.77	7.91
10.	COCONUT	40.01	539	105.60	21.40	22.20		17.01	

Note: * The width of runway strip is 200 m (existing condition)
** The width of runway strip is 300 m (for precision approach category I)

6.5 Taxiway and Apron

6.5.1 Taxiway

There are two taxiways which connect the runway with the apron. The South Taxiway is located about 1,700m from RWY 05 threshold and the North Taxiway is about 1,900m from RWY 05 threshold. The existing exit taxiway system is quite sufficient for the present traffic as well as future traffic. The width of the taxiways is 23m and adequate for DC10 aircraft. The shoulders are partially provided. The width of the shoulders as 2.0m to 2.5m with asphalt concrete pavement of 10cm (4 inches) thickness. This is not wide enough for DC10 aircraft which requires 38m for over-all width of the taxiway and its shoulders in accordance with ICAO recommendations. Adequate shoulder widths should be provided.

6.5.2 Commercial Apron

(1) Apron Location

As the present runway strip is 100m wide on each side of the runway center and the separation distance between aircraft parking position and the runway center line is 140m, a tail wing of A300 aircraft infringes on the transitional surface.

When the runway strip is widened to 300m, most of the existing apron area will fall within the strip and all of the aircraft parked on the apron will be regarded as obstacles to aircraft operations because they will infringe on the transitional surface.

(2) Aircraft Stands

The existing rectangular-shaped apron is a 200m wide and 100m deep and has a total area of 20,000 sq.m.

According to the present flight schedule, three aircraft, namely one A300, one B737 and one HS748, park on the apron simultaneously twice a week. However, there is no space to accommodate additional aircraft if appropriate clearances are to be maintained.

6.5.3 General Aviation Apron

The existing rectangular-shaped general aviation apron is a 80m wide and 100m deep and has a total area of 8,000sq.m. The general aviation aircraft stationed at Davao International Airport have their own hangars or parking areas along the existing general aviation taxiway. The general aviation apron is used mainly by the small aircraft flying from other airports. At present, the existing general aviation apron area is sufficient for the present traffic demand of general aviation.

Regarding the location of the existing general aviation apron, it has the same problem as the commercial apron.

6.6 Airfield Pavement

6.6.1 Runway Pavement

The existing 2,500m runway was constructed by extending the old runway 1,500m towards the southwest in 1970 and 1975. The old runway portion was overlaid by asphalt concrete of 10cm (4 inches) thickness in 1988 to 1989.

The pavement structure is as follows:

	Sta. 1 + 000 ~ Sta. 1 + 500	Sta. 1 + 500 ~ Sta. 1 + 970	Sta. 1 + 970 ~ Sta. 3 + 500
Asphalt Concrete			10 cm
Concrete Slab	28 cm	25 cm	20 cm
Subbase Course (Compacted gravel and black sand)	30 cm	30 cm	30 cm
Total Thickness	58 cm	55 cm	60 cm

As analyzed in section 5.5, the strength of existing runway pavement is not sufficient for the present demand. The very rough surface between Sta. 2 + 560 and Sta. 3 + 313 should be overlaid by asphalt concrete at the earliest opportunity to prevent loose aggregate from hitting and damaging aircraft.

6.6.2 Taxiway and Apron Pavement

The existing taxiways and apron were constructed in 1958 with 20cm (8 inches) thick concrete slabs. In 1970 the apron was expanded from a 60m depth to a 100m depth with 25cm (10 inches) thick concrete slabs.

The existing general aviation apron was constructed in 1975 with 25 cm (10 inches) thick concrete slabs.

The above pavement structures are summarized below:

	Old Apron	New Apron	General Aviation Apron
Concrete Slab	20 cm	25 cm	25 cm
Subbase Course (Compacted gravel and black sand)	30 cm	30 cm	30 cm
Total Thickness	50 cm	55 cm	55 cm

The existing general aviation taxiway was overlaid by 5cm (2 inches) thick asphalt concrete on the original macadam pavement.

There are many cracks in the existing concrete slabs at the taxiway, commercial apron and general aviation apron. The pavement strength is supposed to be insufficient for the A300 aircraft; however, the pavement strength will be evaluated based on the results of the soil investigation. There are no cracks in the existing pavement at the general aviation taxiway.

6.7 Passenger Terminal Builidng

6.7.1 General

The existing passenger terminal building completed in 1980 accommodates dominantly facilities for domestic passengers, PAL airline offices and the VIP lounge. The building is a reinforced concrete structure with two (2) stories and has a total floor area of 3,205 sq.m. The building stands along the apron facing parallel to the runway. However, there is a difference in elevation between the ground floor of the building and the apron: the apron is about 2.0m higher than the ground floor.

The boarding and disembarking of aircraft passengers is presently accomplished by use of movable staircases or the self-contained aircraft staircases. Passengers also must walk on the apron.

The floor plans of the building are shown in Figures 6.7.1 and 6.7.2.

The floor areas of the major functions of the building are summarized as follows:

a)	Domestic Departure Area (concourse, check-in, security pre-departure hall)	1,285 sq.m
b)	Domestic Arrival Area: (arrival hall, concourse, baggage claim area)	600 sq.m
c)	Others: (offices, kiosks, comfort rooms, stair cases)	880 sq.m
d)	PAL airline offices:	360 sq.m
e)	VIP Lounge:	80 sq.m
	Total	3,205 sq.m

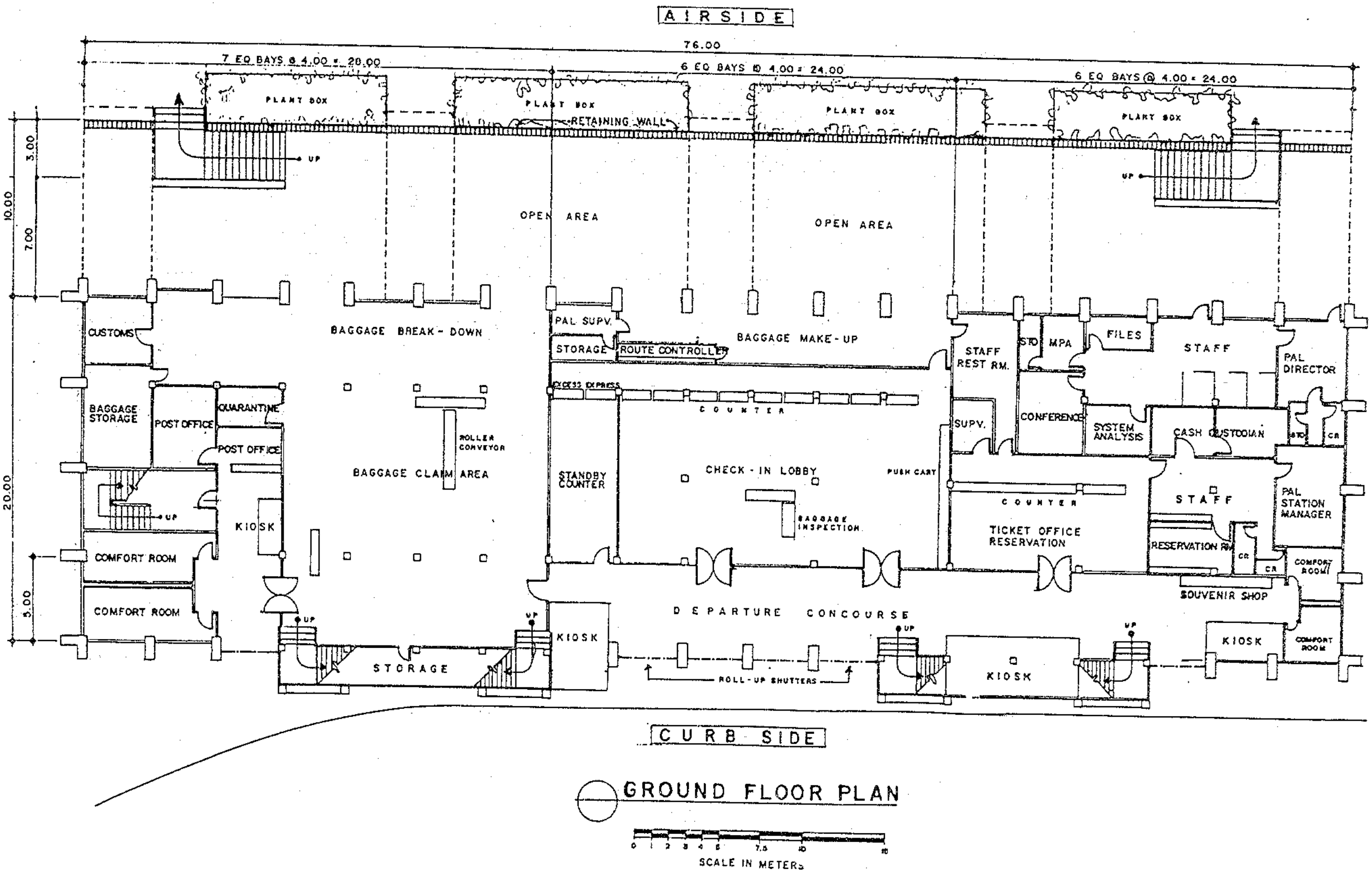


Figure 6.7.1 **Floor Plan of Existing Passenger Terminal Building - Ground Floor**

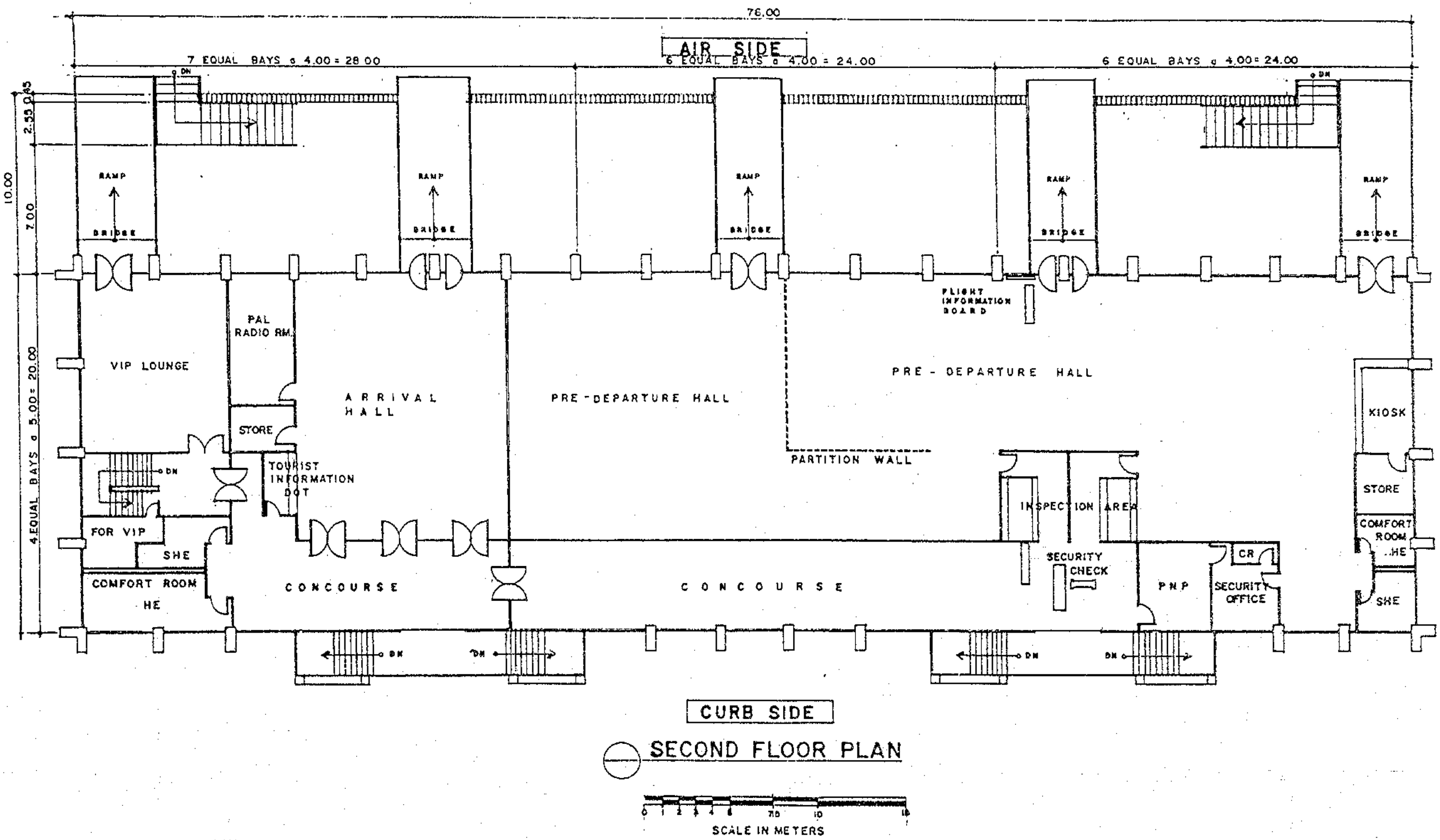


Figure 6.7.2 Floor Plan of Existing Passenger Terminal Building - Second Floor

6.7.2 Total Floor Area

The unit floor area of 10 sq.m/peak hour passengers for the domestic area and 20 sq.m/peak hour passengers for the international area are considered adequate to estimate the required total floor area. This can be expressed by the following mathematical formula:

Area = UFA x PAX

Where, Area : Required total floor area in sq.m
UFA : Unit floor area per peak hour passengers
PAX : No. of peak hour passengers

At Davao International Airport, the number of current peak hour passenger arrivals and departures are estimated to be 310 domestic and 30 international as explained in Appendix -6.7.1. Applying these figures to the above formula the required total floor area can be obtained as shown in Table 6.7.1.

Table 6.7.1 Comparison of Total Floor Area

	Required Total Floor Area	Existing Total Floor Area
International	600 sq.m	-
Domestic	3,100 sq.m	3,205 sq.m
Total	3,700 sq.m	3,205 sq.m

From the Table 6.7.1 above, the total floor area required for accommodating both domestic and international passengers is estimated to be 3,700 sq.m. Since the existing floor area is 3,205 sq.m, it does not meet the current demand.

6.7.3 Passenger Handling

(1) General

International and domestic passenger flows, including baggage, are shown in Figures 6.7.3 and 4. The passenger processing time survey carried out is summarized in Appendix-3.4.2. The required passenger handling capacity at each component of the international and domestic passenger terminal is estimated as shown in Appendix -6.7.9.

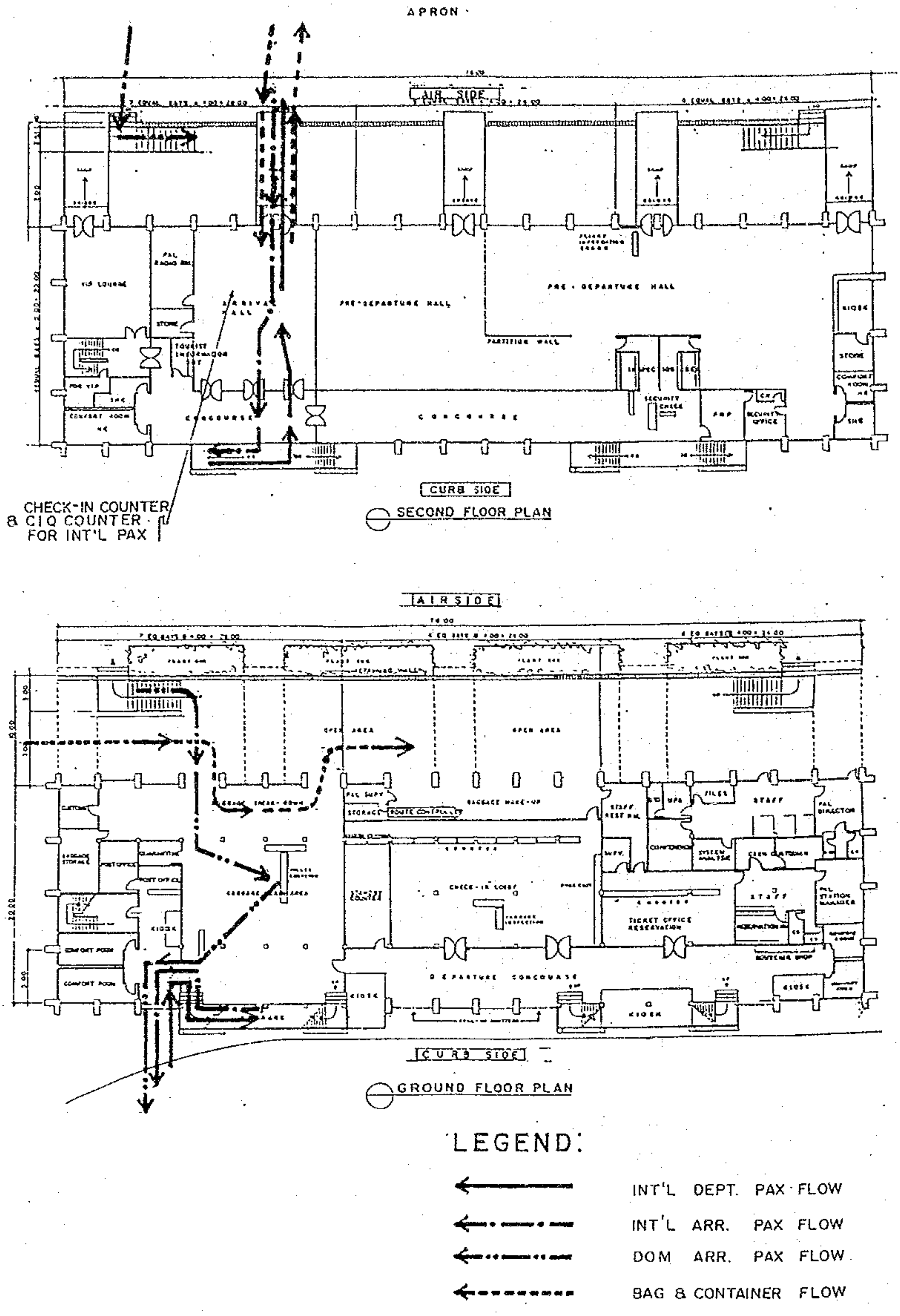


Figure 6.7.3 International Passenger and Baggage Flow in Existing Passenger Terminal Building

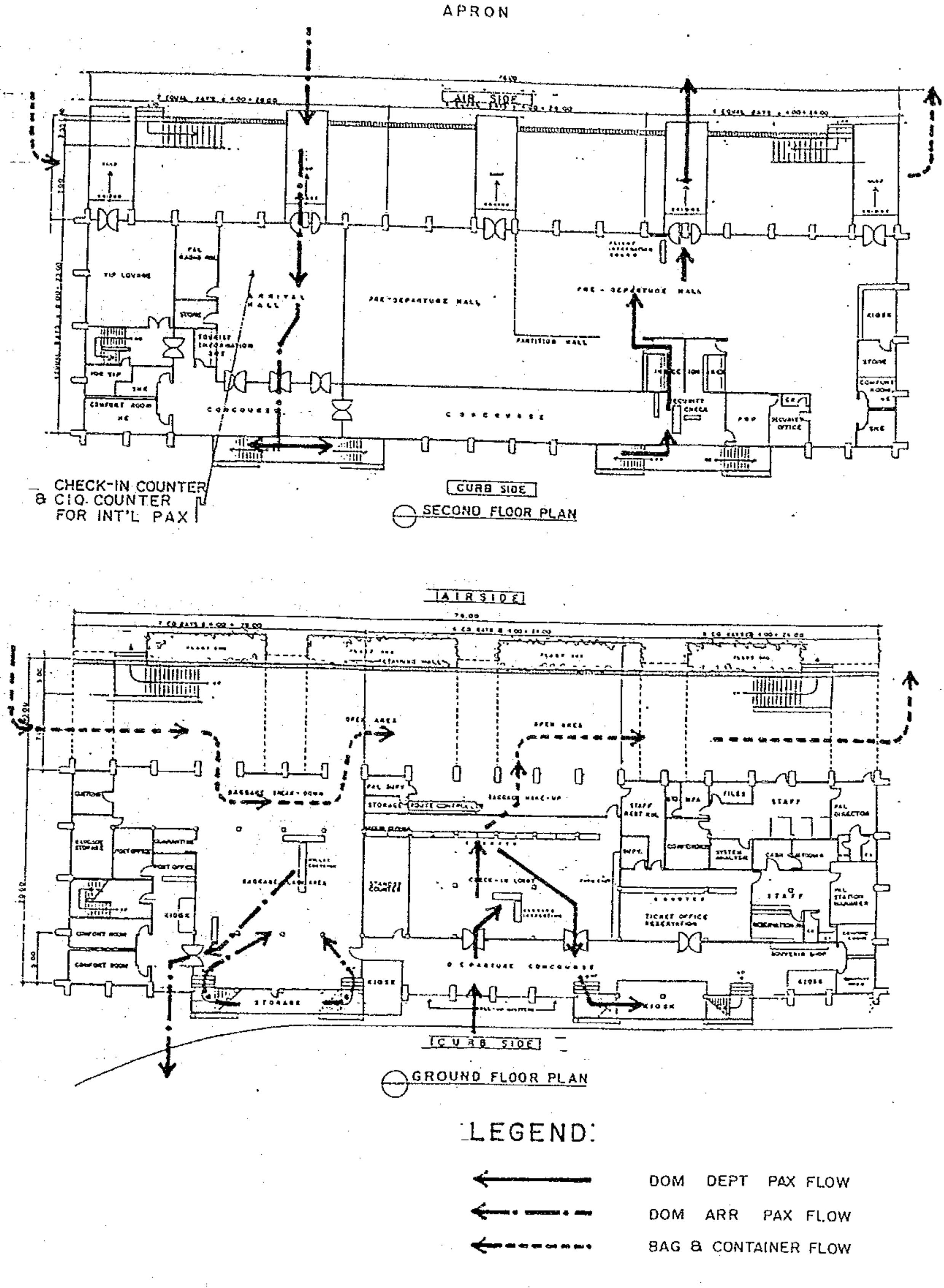


Figure 6.7.4 Domestic Passenger and Baggage Flow in Existing Passenger Terminal Building

(2) International Passenger Handling

Although since April 29, 1992 there has been an international scheduled flight between Manado and Davao (operated by Bouraq Airline), there had not been any international schedued flights at the airport. As a result, there are insufficient international subsystems and spaces at the existing passenger terminal building. This fact creates many problems in the passenger terminal building that are explained below:

a) There are insufficient facilities such as check-in counters, passport controls, customs inspections, quarantines at the building. At present, when the international scheduled flight is operating, the facilities are installed or arranged on a temporary basis at the arrival hall in the second floor of the building to handle the passengers.

b) There is neither departure/arrival halls nor a baggage claim area for exclusive use by international passengers at the building. As the number of international passengers increases, it is foreseen that the present poor service quality will further deteriorate in the near future.

(3) Domestic Passenger Handling

Most components of the building, except for the pre-departure hall, can barely cope with the current demand. There are also many problems in passenger processing mainly due to lack of places and facilities. These include the following:

a) Only an inadequate space is provided for domestic departure passengers and well-wishers in the departure concourse. The area around the concourse is especially crowded at the peak hour; thus it often interrupts the circulation of the departure passengers from/to the check-in lobby in the concourse.

b) No X-ray security equipment is provided before check-in. Baggage is inspected manually which takes a longer inspection time per passengers and results in a long queue of passengers.

c) No baggage belt conveyor is provided in the baggage claim area. Consequently, passengers are obliged to cluster around the baggage container to look for their baggage each time the container is delivered to the claim area from the apron.

d) No adequate arrival concourse is provided for welcomers for arrival passengers. Welcomers crowd around the exit door from the baggage claim area and at the access road during at the peak hours and often interfere with the circulation of vehicles at the curb side of the building.

e) No flight information systems are available for passengers in the building.

f) No restaurants or coffee stands are available for passengers and visitors in the building.

(4) VIP Lounge

The VIP lounge is located on the second floor at the western end of the building. The total floor area of the VIP lounge is 80 sq.m with an accommodating capacity of about 20 VIPs. The lounge is in good condition and is equipped with air-conditioning.

(5) Other Conditions

Other problem areas may be described briefly as follows:

a) Due to deteriorated condition of the electrical and mechanical systems there are problems in operating the building properly. Should the building still be utilized in the future, all piping and electrical wiring, mechanical and plumbing facilities will have to be renovated.

b) The existing curb length is insufficient for the present demand.

c) The structure and the finishing of the building are generally in good condition. However, some minor deteriorated conditions were observed at a few locations. A visual inspection revealed that the pitch roof steel covering is partially damaged and that under the eaves covered by the wooden boards are partially broken in the building.

6.8 Cargo Terminal Building

6.8.1 General

The existing cargo terminal building which belongs to PAL is located closely between the passengers terminal building and PAL fuel farm. Just like the passenger terminal building, the ground floor of the cargo building is some 2m lower than the apron elevation which hinders the movement of cargo trucks and the container cart between the cargo terminal and apron.

The cargo terminal building was built in 1988. It is a one-story steel frame structure. The building has a total floor area of 625 sq.m and is in generally good condition.

The floor plan of the existing cargo terminal building is shown in Figure 6.8.1.

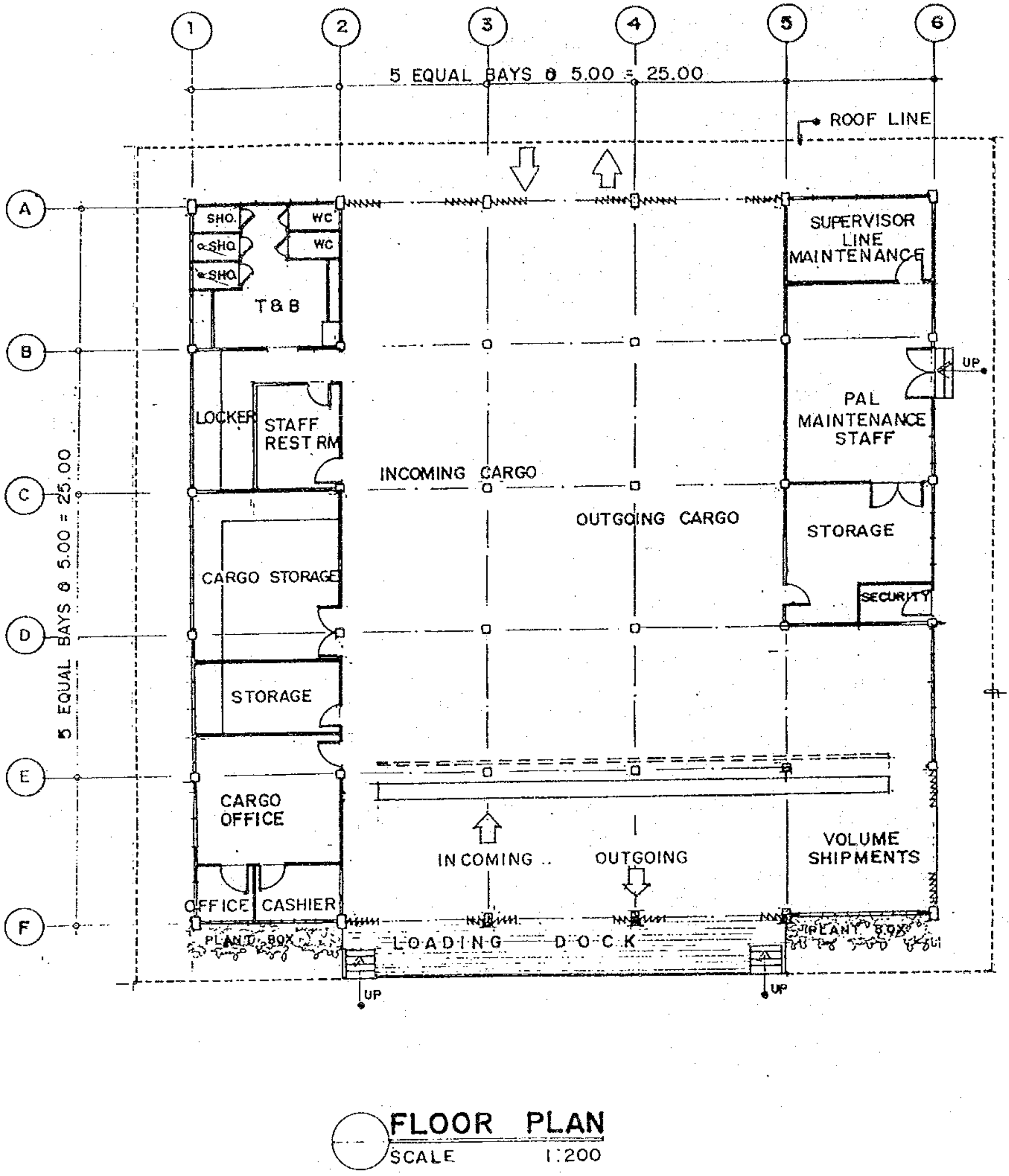


Figure 6.8.1 Floor Plan of Existing Cargo Terminal Building

6.8.2 Total Floor Area

The required floor area of a cargo terminal building can be estimated by utilizing the unit floor requirements established empirically for a certain amount of annual cargo volume to be handled. The formula established by JCAB for this purpose is as shown below:

Area = ACV/HN x F

Where, Area : Required total floor area in sq.m
ACV : Annual cargo volume tons
HN : Handlling unit tons per sq.m (20 ton per sq.m)
F : Factor for additional space for cargo agents and other offices (F=1.5)

Applying about 19,700 tons annual cargo volume handled in 1991 and the unit floor requirements of 20 ton per sq.m into the above formula, the required total floor area of the cargo terminal is estimated to be 1,480 sq.m as shown in Table 6.8.1

Table 6.8.1 Comparison of Total Floor Area

	Required Total Floor Area	Existing total Floor Area
Total	1,480 sq.m	625 sq.m

From the Table 6.8.1 above, it is obvious that the existing total floor area of 625 sq.m is far below the required floor area.

6.9 Other Buildings

6.9.1 Administration Building (Old Control Tower Building)

The administration building built in 1970 is located to the eastern side of the existing passenger terminal building. The building is a reinforced concrete structure with four (4) stories and has a total floor area of about 325 sq.m. The building accommodates the ATO administrative office, engineering staff office, flight service station, and the old VFR room on 4th floor which is now being used as a storage room.

A visual inspection revealed that the building condition is generally good and the available spaces seem to be sufficient for the current administration activities.

The floor plan of the administration building is shown in Appendix-6.9.1.

6.9.2 Control Tower Building

The control tower building is located on the northern side of the runway (almost on the opposite side of the apron across the runway). It is a reinforced concrete structure with five (5) stories. The building was built in 1983 and has a total floor area of 255 sq.m. The VFR room is a steel frame structure in a pentagonal shape and its floor elevation is 15.9 m above the existing ground. The view of the airfield from the VFR room is unobstructed and clear. The building condition is generally good, as determined by a visual inspection. The floor plan of the control tower building is shown in Appendix-6.9.2.