PART II BASIC ASSUMPTIONS

CHAPTER 3 AIR TRAFFIC DEMAND FORECAST

3.1 Background

Air traffic volume in Indonesia has been growing steadily in the past 10 years, reflecting the fast growing economic activities and increased interactions between regions both domestic and international. At the national level, passenger traffic measured by number of passengers carried by air transport has grown by 20 percent annually on the international routes and by 16 percent annually on the domestic routes since 1972. Air freight traffic has also increased sharply. International air freight volume has increased by some 15 percent annually since 1972, while domestic cargo traffic has grown by 17 percent per annum.

During the period, 1972 - 1979, G D P of Indonesia has expanded by 7.0 percent annually on average. Elasticity of air traffic volume with respect to G D P is estimated as follows:

Table 3.1.1 : INCOME ELASTICITY OF AIR TRAFFIC VOLUME

Passengers		
	International	2.9
	Domestic	2.3
Cargoes		
	International	2.1
	Domestic	2.4

3.1.1 Basic Thinking

In the present projections, no single methodology was adopted, however various analyses were used combined with the informed judgement concerning the future air transport growth in Indonesia. Broadly speaking projections are made based on the following steps: First, the past trend of the national air transport was analysed. Then, the population and GDP growth rates were analysed and projected. They will form a basis for air traffic projections. Third, some qualitative assessment of factors which may affect the future air transport growth were made. Fourth, an international comparison of the domestic air traffic volume and the level of economic development was made. Fifth, combining the results so far obtained, the national domestic air transport volume was projected for both passenger and cargo transport. Sixth, based on the analysis of regional development prospects in West Sumatra and Padang, air transport volume at Padang was projected within the overall framework of the national projections.

3.2 Assumptions for Future Economic growth and Traffic Forecast

Air traffic volume is assumed to increase as the level of general economic activities increases. In the following, in order to forecast the future air traffic volume, it was assumed that air traffic volume is a function of Gross Domestic Product. The functional form will be specified later. In addition to this quantitative analysis of the traffic volume, qualitative analysis on the air traffic was made, which will supplement the quantitative analysis.

3.2.1 Population growth

In January 1981, the results of the 1980 population census were announced. The population of Indonesia was 147,331,000 in 1980. Using this as the base year population and applying the projected growth rate used in Proyeksi Penduduk Indonesia Seri K No. 2 (Population Projection of Indonesia) by Central Bureau of Statistics, the population for 1980 - 2010 is projected as follows:

Table 3.2.1 POPULATION PROJECTION

(thousand)

1971	119,233
1980	147,331
1981	150,410
1982	153,388
1983	156,426
1984	159,523
1985	162,681
1986	165,902
1987	169,187
1988	172,537
1989	175,953
1990	179,437
1991	182,990
1992	186,359
1993	189,786
1994	193,278
1995	196,834
1996	200,456
1997	203,864
1998	207,329
1999	210,854
2000	214,439
2001	218,084
2002	221,791
2003	225,562
2004	229,396
2005	233,296

Source: BPS and JICA estimates

3.2.2 GDP Projection

GDP is used as a basic indicator to measure the level of economic development. In Pelita III, 1979/80 - 83/84, GDP growth target was set at 6.5 percent annually. The growth targets for other sectors are given as follows.

Growth Targets for Pelita III

(1979/80 - 1983/84)

Sectors	Annual Percentage Growth Rate
Agriculture	3.5
Mining	4.0
Manufacturing	11.0
Construction	9.0
Transport and Communication	10.0
Other	8.0
Total	6.5

Source : Pelita III

However, since the promulgation of Pelita III, some resource constraints which were perceived at the time of the plan preparation have since been relieved in the course of ensuing petroleum price increases during 1979/80; hence the GDP is now expected to grow at 7.5 percent annually during Pelita III.

Beyond 1983/84, there have been no official projections concerning the economic development. The economy of Indonesia is expected to show a basic healthiness exploiting its abundant natural resources. The main strength lies with its mineral, forest and agricultural resources.

On the other hand, the economy may face some difficulties arising from : the still fast growing population and resulting food supply problems; and an ever increasing demand for and an expected shortage of trained workers, and managerial and administrative skills. While Indonesia is expected to pursue agricultural development and food production as a first priority for coming decades, it also may have to diversify its exports into more manufactured goods in order to increase its foreign exchange earning capacity as well as to transform the economic structure into a higher level of industrialization.

Against this background, the GDP growth rate for the next few decades is assumed to follow the following path.

PROJECTED GDP GROWTH RATES 1980 - 2010

(Annual Percentage Growth Rate)

	1980 - 85	1985 - 90	1990-2000	2000-2010
GDP	7.5	8.0	7.5	7.0

Source: : JICA Estimates

Based on the above assumptions, GDP and per capita GDP are projected as follows.

Table 3.2.2. PROJECTED GDP

	Actuals		Projected		
	1978	1980	1990	2000	2005
GDP (bill 1978 Rp)	22,456	25,215	53,189	109,624	153,753
Population (1000)	137,801	147,331	179,431	214,439	233,296
Per Capita GDP (1000 1978 Rp)	162.9	171.1	296.4	511.2	659.0
Per Capita GDP (Constant 1978 US $)	376	395	685	1182	1524

1. Exchange rate at US $ 1 = Rp432.5 (average exchange rate in 1978).

Source : Table 3.2.1. and JICA Estimates

3.2.3. Qualitative Conditions Affecting the Air Traffic

Because of its geographical configuration and its size, air transportation is essential to the economic development of Indonesia. Although highway and railway transportation has developed and has been providing important infrastructure service for the economic activities, it is mainly limited to Java and Sumatra. Sea transportation is also another important mode of transportation connecting islands, however, the advancement of economic development requires a faster mode of transportation. Because of these factors, air transportation will remain vital or will even increase in importance to the economic development. In particular as the economy develops, the time factor will become more crucial to the general economic activities, hence the preference for air transportation compared to other modes of transportation is expected to increase further.

Despite the clear importance of air transport to the economy, competition with other modes of transportation needs to be assessed. In particular in Java and Sumatra, road and railway transportation will increase its services. In Java, superhighways will develop connecting the major cities, which may replace some short distance air transportation. In Sumatra, the Trans Sumatra highway will add some competition to the air traffic at least for the lower income group.

While the demand for air transportation may increase very rapidly in Indonesia in the next few decades, there are some factors which may constrain the rapid expansion of air traffic. While in most of airports around the country, runways are rather underutilized, peripheral facilities have already shown increasing overutilization. Terminal buildings are often crowded, and not suitable for further expansion. Transit facilities are too small; waiting rooms crowded; and check-in counters undersized for handling the increasing number of passengers. Access roads to the airports are inadequate and may increase significantly the travel time and cost by air transport users, who may be discouraged from using air transportation for this reason.

Another constraining factor to the expansion of air traffic may be the increasing cost of fuel. Although Indonesia produces and exports petroleum, and provides enough quantity of fuel to the domestic market, at relatively lower prices than the international market, in the future fuel prices are expected to increase on the international market, which will push up the domestic fuel cost in Indonesia. Although this will help rationalize the resource allocation more reflecting scarcity domestically and internationally, it will no doubt discourage the fast growth of air traffic, and in particular it will have significant negative impact on intertional tourist traffic.

3.2.4 International Comparison of Air Traffic Growth

Air traffic volume is determined based on the level of the economic activities of a country. It is assumed that there is an optimal level of air transportation activity for each country depending on its level of economic development and geographical characteristics. The optimality is determined in such a way that the level of air traffic activity is commensurate with the other sectors of economy in order to maximize the economic welfare at the least cost with given resource constraints and price structure. In the early stages of air transportation development, air traffic volume tends to increase rapidly in order to catch with the distance between the actual level of air transportation development and the optimum level. This process may accelerate as the overall economic development expands. In the course of this process, however, the air traffic may sometime overdevelop, in the sense that the air transportation sector may exceed the optimum level. In the final stage, the air transportation may adjust gradually to the optimum level.

The above scenario can be verified by comparing the air traffic development of various countries at different stages of economic development against the economic development indicators. In the following section, per capita domestic air traffic measured by number of passengers carried is compared against per capita Gross National Products (GNP).

Only domestic traffic is considered here as international traffic may be affected by factors other than the development of a particular country's economy, such as tourism assets, etc. The countries chosen here (India, Indonesia, Malaysia, the Philippines, Korea, Japan, Brazil, and USA) may form a representative group in terms of their geographical location and their level of economic development. Except for Japan and Korea, they are large in geographical size India may represent an early stage of economic and air transport development. Malaysia and Philippines may represent fast growing economies, and a stage of economic development, a few steps ahead of Indonesia U.S.A. represents an ultimate stage of development, within the economic and technological framework which will prevail in the next few decades. Japan and Korea are shown to underline the importance of geographical size to air transport.

Several regression lines are fitted to the above data. They are considered to represent the optimal level of air traffic as discussed above. Case (a) refers to the estimation based on all eight countries, and Case (b) refers to the estimation based on six countries, excluding Japan and Korea.

(i) Domestic Passenger Traffic

Case (a) $$\ln P/N = -3.3773 + \underset{(0.0919)}{1.0712} \ln GNP/N$$

$$s^2 = 0.3560$$

$$\bar{R}^2 = 0.8542$$

Case (b) $$\ln P/N = -4.1102 + \underset{(0.0940)}{1.2094} \ln GNP/N$$

$$s^2 = 0.2702$$

$$\bar{R}^2 = 0.9063$$

(ii) Domestic Air Cargo Volume

Case (a) $$\ln K/N = -1.8352 + \underset{(0.1608)}{1.1520} \ln GNP/N$$

$$s^2 = 1.0895$$

$$\bar{R}^2 = 0.6863$$

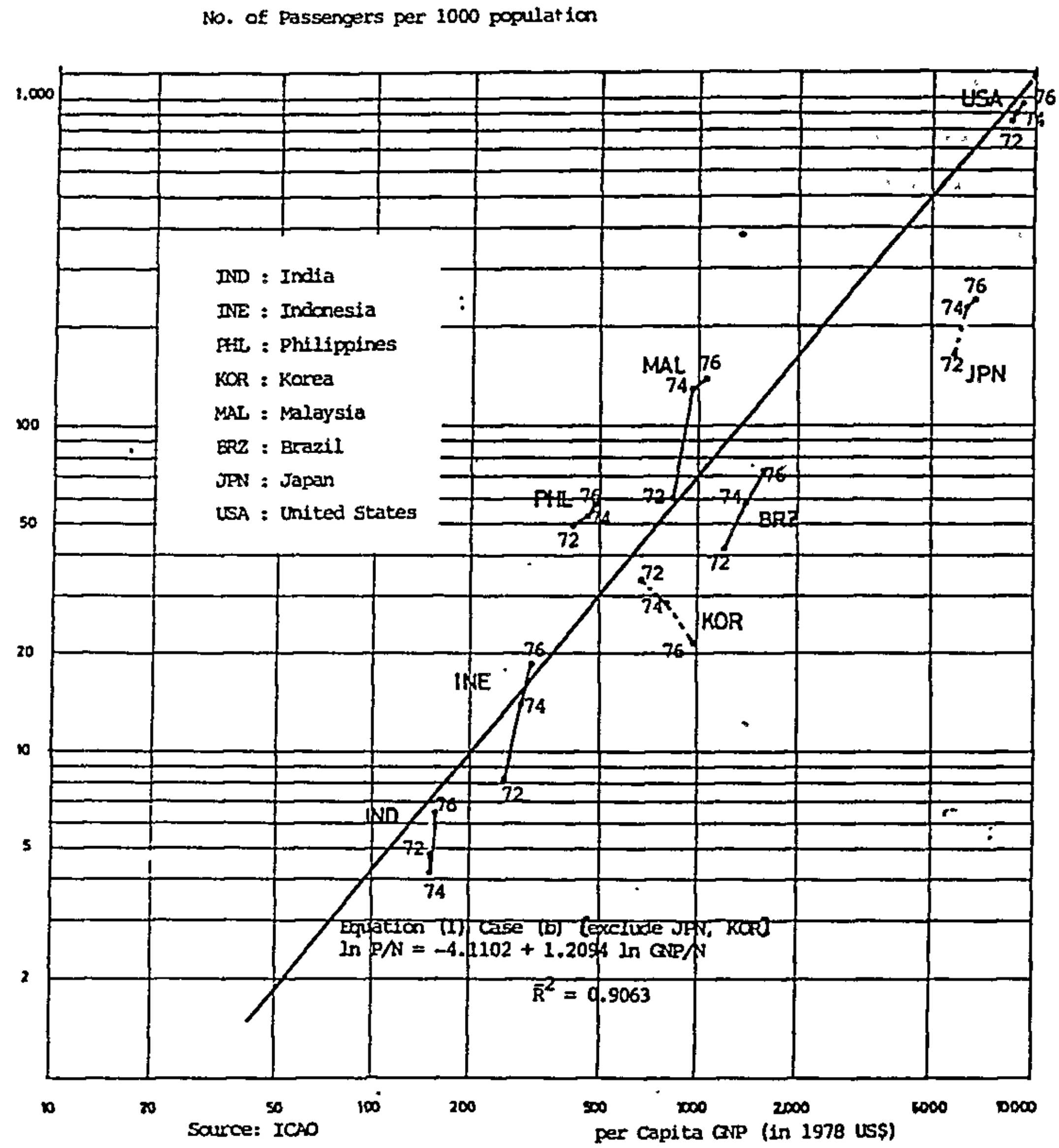


Figure 3.2.1 DOMESTIC PASSENGER TRAFFIC, 1972, 74, 76

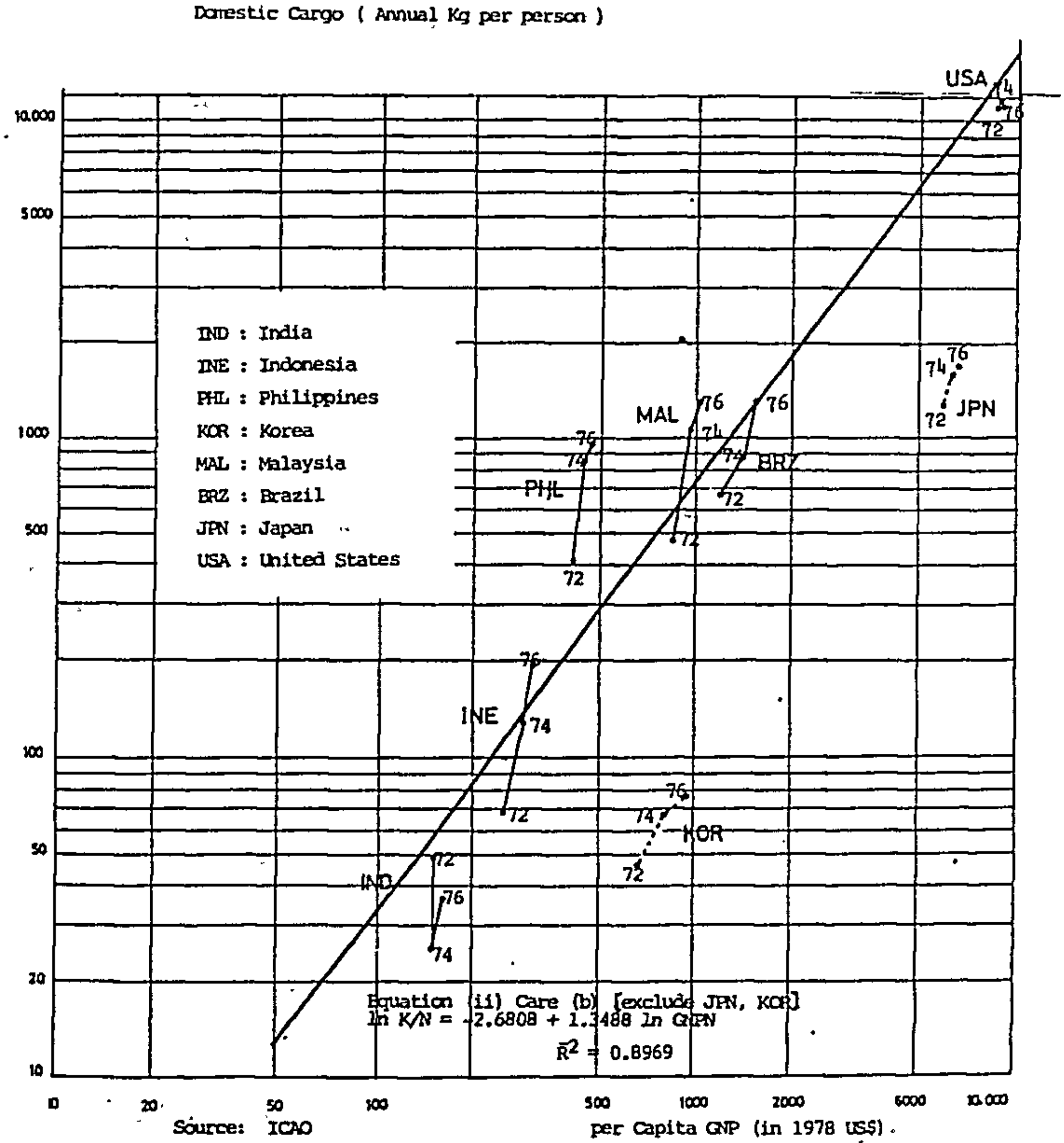


Figure 3.2.2 DOMESTIC CARGO TRAFFIC, 1972, 74, 76

Case (b) $\ln K/N = -2.6808 + 1.3488 \ln GNP/N$
$$(0.1105) \quad s^2 = 0.3741$$
$$\bar{R}^2 = 0.8969$$

In the above regression analysis, case (b) gives a better multiple correlation coefficient than case (a), which underscores the contention that Japan and Korea may be treated separately.

It has also been observed that the data on domestic cargo traffic shows better separation between large and small countries than those for passenger traffic. This is interpreted to indicate that cargo traffic may exhibit more economic rationality than passenger traffic. While passenger traffic may be attracted to the air transportation because of its novelity, cargo traffic will reflect more rational economic decision making on the part of consumers.

3.3. Air Traffic Forecast for Indonesia

Based on the analysis developed above, air traffic volume is projected in the following. In general, air traffic in Indonesia will continue to rise very rapidly in the next decade, after which it is expected to begin to slow down, gradually adjusting to the optimal level discussed earlier.

3.3.1 Domestic Passenger Traffic

To project the air traffic volume in Indonesia, the estimated regression line with the international comparisons is utilized here as representing the optimal level discussed in 3.2.4. They are equations (i) Case (b) and (ii) Case (b) for passenger and cargo traffic respectively. As for the projections GDP and GNP, the difference between them is small, and is assumed to remain small.

Projections are made by utilizing the relation shown in Figures 3.2.1 and 3.2.2.

Three different projections for the domestic passenger traffic are made: high, medium and low. In the high projection, domestic passenger traffic will continue to increase to reach the level of the Philippines, when Indonesia per capita GDP surpasses 500 dollars (in 1978 prices), then continues to grow to the late 1970's level of Malaysia when Indonesia per capita GDP surpasses 1,000 dollars. In the medium projection, the traffic level in the 1980's will follow the tendency of some declining growth rates experienced in the late 1970's, then reaches the level somewhat lower than the 1970's level of Malaysia when Indonesia per capita GDP reaches 1000 dollars. Afterwards the traffic will gradually adjust to the optimal level corresponding to the per capita GDP level. The low projection shows much faster adjustment to the optimal level, beginning the adjustment immediately.

The projected air traffic forecast are presented in the following summary table.

Table 3.3.1 : PROJECTED DOMESTIC PASSENGER TRAFFIC
(1000 and Percentage)

	1980	1990	2000	2005
High	-	16,150	34,303	48,993
Medium	4,449	12,917	30,016	41,994
Low	-	10,405	23,584	33,824
	(Annual Percentage Growth Rates)			
High	-	13,1	7,8	7,4
Medium	-	11,2	8,8	6,9
Low	-	8,9	8,5	7,5
	(Number of Passengers Carried per 1000)			
High	-	90	160	210
Medium	30	72	140	180
Low	-	58	110	145

3.3.2 Domestic Freight Traffic

As explained earlier freight traffic is more consistent reflecting economic rationality than passenger traffic. Therefore it is assumed that the adjustment of traffic from the current level to the optimal level will take a shorter time than in the case of passenger traffic. High, medium, and low projections are also made in a similar way as in the passenger projections, but reflecting a much faster adjustment process.

Table 3.3.2 PROJECTED DOMESTIC CARGO TRAFFIC

(1000 MT)

	1980	1990	2000	2005
High		139,932	321,600	466,600
Medium	44,480	118,404	274,432	408,275
Low		89,700	225,120	326,620
		(Annual Percentage Growth Rates)		
High	-	12,1	8,7	7,7
Medium		10,3	8,8	8,3
Low		7,3	9,6	7,7
		(Per Capita Cargoes Carried KG)		
High	302	780	1500	2000
Medium	302	660	1280	1750
Low	302	500	1050	1400

3.3.3 International Traffic

International traffic may show a different tendency from that of domestic traffic. International traffic does not depend on the level of economic development of the country, but on other factors such as its trading partners (including tourist business) and regional economic activities. Because of the tourist locations in Indonesia, international traffic will be expected to increase continuously with little relation to the level of Indonesia economic development. International traffic is in general expected to continue to grow very rapidly in the 1980's more or less following the trend in the 1970's, as the economic interelations between Indonesia and other countries are expected to grow very fast including business, trade, and tourism. But the expansion rate may decline in the following decades as the international traffic may become closer to a saturation level.

The following growth rates for international passenger and cargo traffic are assumed for the projections.

Table 3.3.3 : INTERNATIONAL TRAFFIC GROWTH

(Annual Percentage Growth Rates)

	Actuals	Projected		
	1970 - 80	1980 - 90	1990-2000	2000 - 05
Passenger	20.0	20.0	15.0	10.0
Freight	14.6	14.0	12.0	9.0

3.4 Air Traffic at Padang

3.4.1 Background

The air traffic at Padang has grown very rapidly since 1970. Total passenger volume, namely the number of arrival and departure passengers, and those in transit, increased by 17.5 percent per year on average, or quadrupled between 1971 and 1980. Freight volume increased more rapidly, expanding by 26.7 percent annually on average during the same period.

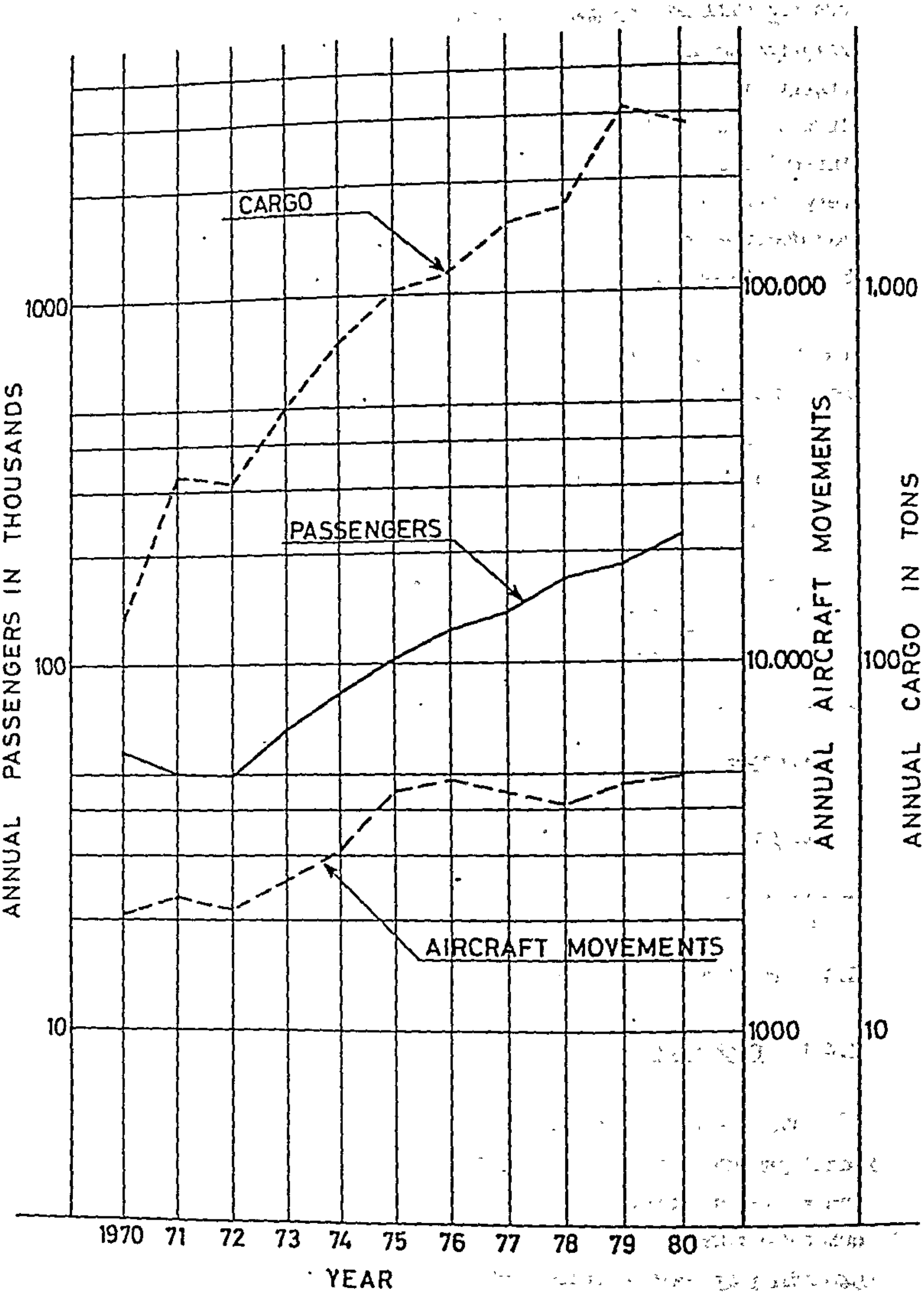


Figure 3.4.1. AIR TRAFFIC AT PADANG 1970 - 1980

SOURCE : DATA LALU LINTAS ANGKUTAN UDARA

Table 3.4.1 : AIR TRAFFIC AT PADANG

	Passengers (Number)	Cargoes (Tons)
1971	50,318	333.7
1975	104,322	1,016.2
1976	124,322	1,152.4
1977	138,941	1,556.6
1978	170,188	1,720.6
1979	185,261	3,128.9
1980	222,115	2,887.9

Source : Pelabuhan Udara Tabing / Padang.

Elasticities for both passenger and cargo traffic at Padang with respect to the national GDP are calculated as follows.

GDP ELASTICITIES OF AIR TRAFFIC
FOR 1971 - 80

Passenger Traffic	2.45
Air Freight Volume	3.73

As for the passenger traffic, the elasticity is similar to that of the national passenger traffic, but for the cargo volume, it is 40 percent higher than the national figure.

The air traffic through Padang in the next few decades may be influenced by various factors : first of all the over all development of the national economy, as discussed earlier ; second, regional development prospects; and third, international situations. The national economic development prospects are discussed in earlier sections.

The regional economic development prospects are an amalgam of various activities, programs, and projects in Padang and the West Sumatra region. They are also discussed earlier, but will be reviewed here, particularly those which are considered to influence strongly the air traffic movement.

Regional Development Prospects : Because of its abundance in natural resources and closeness to the areas where petroleum is produced, West Sumatra is expected to be one of the regions which will lead the Indonesian economy in the future. Not only the agricultural sector remains important both for food production and for plantation agriculture, the industrial sector is expected to play an increasingly important role in West Sumatra, centering around coal, cement, and abundant hydroelectric power. This tendency will add to the accelerating business activities through Padang, generating more air traffic at Padang airport.

People in West Sumatra are known for their tendency to move to other regions to earn a lving. The region sends particularly many enterprising merchants. This tendency will make the traffic level connecting West Sumatra and other regions much higher than for the rest of the country.

3.4.2 Air Traffic Forecast

Because of these conditions, the air traffic projections for Padang airport are made as follows. For both passenger and cargo traffic volumes, medium projections are made by applying the growth rates 20 percent higher than the medium growth rates of the national traffic; high projections with 40 percent higher growth rates; and low projections with the same growth rates as the medium projections for the national level.

Table 3.4.2: PROJECTED GROWTH RATES FOR AIR TRAFFIC AT PADANG

(Annual Percentage Growth Rates)

		1980-1990	1990-2000	2000-2005
Passengers:	High	15.0	12.0	10.0
	Medium	13.0	10.5	8.3
	Low	11.0	8.8	6.9
Cargoes :	High	14.4	12.3	11.6
	Medium	12.4	10.6	10.0
	Low	10.3	8.8	8.3

From the growth rates above, the air traffics are projected as follows.

Table 3.4.3 : PROJECTED AIR TRAFFIC AT PADANG

	1980	1990	2000	2005
Passengers (in thousand)				
High		900	2,800	4,500
Medium	222.1	750	2,000	3,050
Low		650	1,450	2,050
Cargoes (in metric tons)				
High		11,100	31,900	61,250
Medium	2,888.0	9,300	25,500	41,000
Low		7,700	17,900	26,650

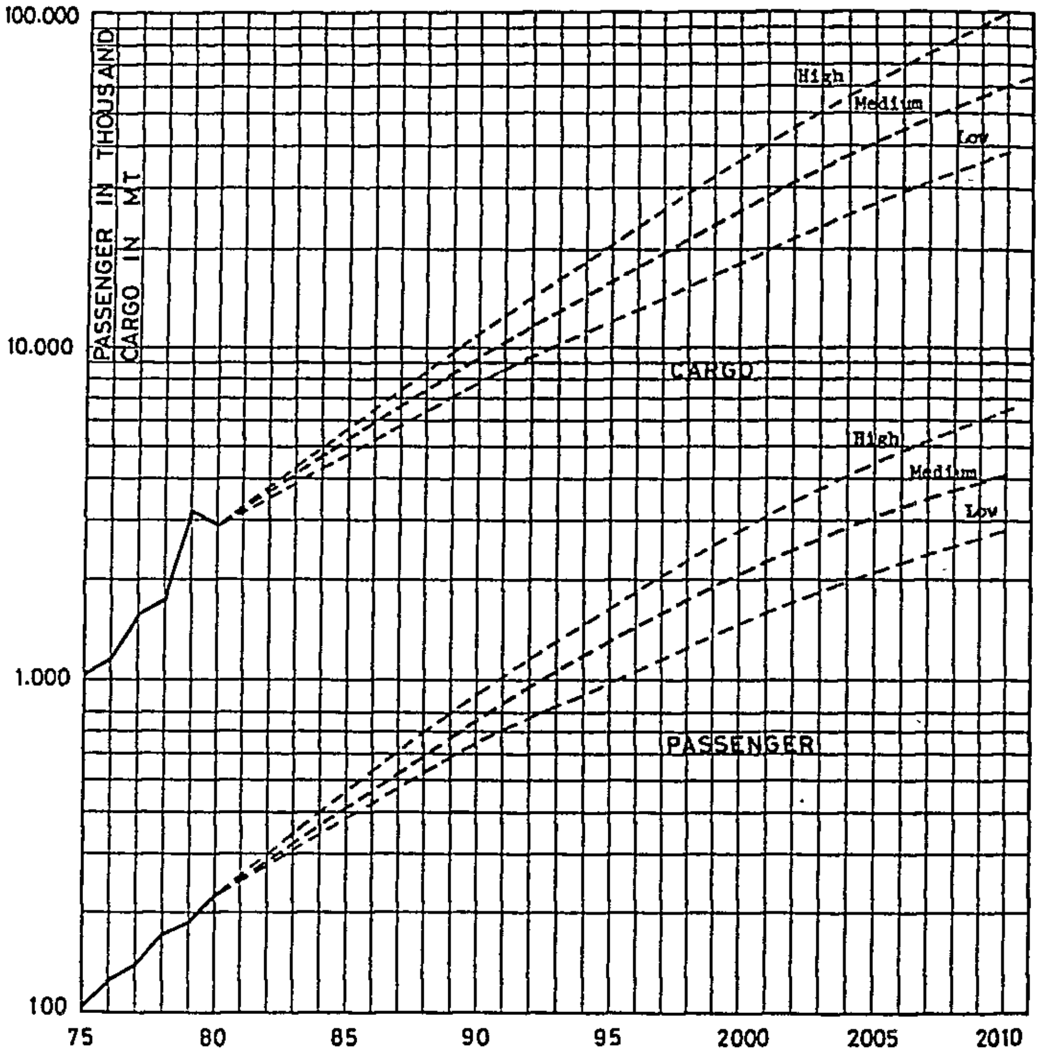


Figure 3.4.1 PROJECTED AIR TRAFFIC AT PADANG

3.5 Breakdown of air traffic volume

3.5.1 Methodology

The target annual air traffic demands for various key years are established as indicated in Table 3.5.1, the planning basis of this Study. They are based on the median values of air traffic demand projections tabulated in Table 3.4.3.

Table 3.5.1 TARGET ANNUAL AIR TRAFFIC

TRAFFIC	1985	1989	1990	1994	1995	2000	2005	2010
Passenger (1000)	400	650	750	1,100	1,300	2,000	3,000	4,000
Cargo (ton)	5,200	8,400	9,300	14,500	16,000	25,500	41,000	58,000

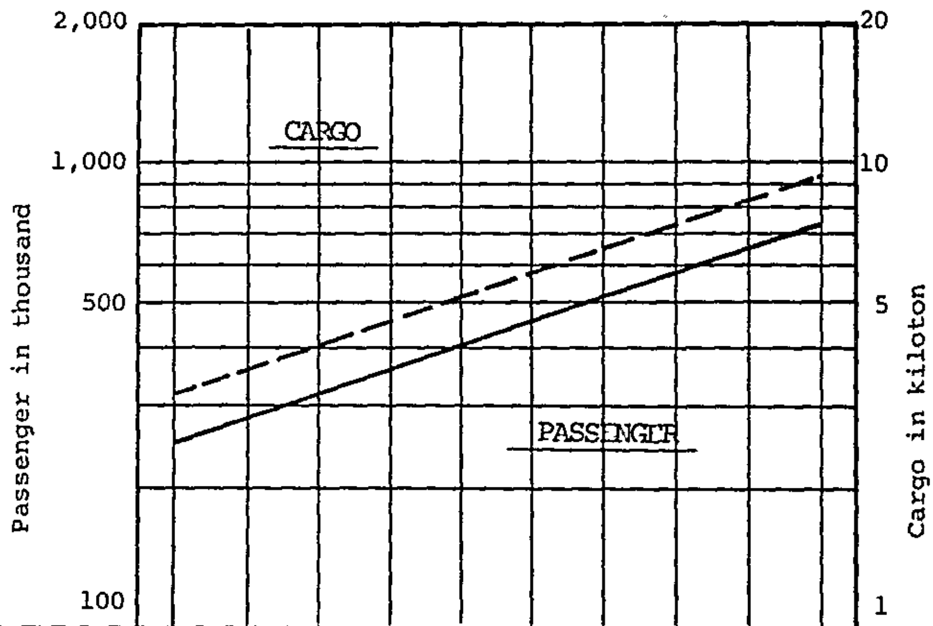
The airport masterplan for this Study was produced for short range, medium range and long range periods (approximately 5, 15 and 25 years ahead). In this Study, the respective range forecast are used as the planning bases as follows:

i) Short range forecast - to be utilized mainly as the basis for evaluating the existing airport facilities in terms of demand/capacity and to plan the necessary improvements. Hence the forecast was made for the year 1985 ;

ii) Medium range forecast - to be used as the planning basis for the first phase developments of both the existing airport and a new airport. The forecast year is established at 1995 which will be about 5 to 10 years after the most likely completion of the first development;

iii) Long range forecast - a rough approximation for visualizing the ultimate development scheme and to assure flexibility and ability to expand to suit future developments. The forecast year is established to be 2005.

For a reference, annual air traffic volumes between 1981 to 1990 are interpolated as indicated in Figure 3.5.1.



Passenger (x 1,000)	250	280	320	360	400	460	520	590	650	750
Cargo (ton)	3200	3600	4100	4600	5200	5800	6500	7400	8400	9300
Year	1981	82	83	84	85	86	87	88	89	1990

Figure 3.5.1 ANNUAL AIR TRAFFICS FOR 1980S

As the basis for the airport facility planning, the traffic demands expected for a peak hour of an average day of the peak month for the years 1985, 1995 and 2005 were used as recommended by ICAO and FAA.

In this section, the above annual air traffic demands for 1985, 1995 and 2005 was broken down for various planning values for daily and hourly bases as formulated in Figure 3.5.1.

3.5.2 Basic Assumptions

In this section, all the coefficients and ratios indicated as items (a) through (h) in Figure 3.5.2 are estimated.

1) Route Structure

Route structures and route shares for the major airlines are indicated in Appendix 3.5.1 to 3. The present route structure in Sumatra with some assumptions for future routes is summarized in Figure 3.5.3. The following assumptions are made for the Study based on the past traffic characteristics and interviews with the airlines.

i) The air route structure connecting Padang will be basically maintained during the Study period.

ii) Based on the past statistics summarized in Appendix 3.5.4, the future share of each route in terms of airport passenger traffic volume at Padang is assumed as follows.

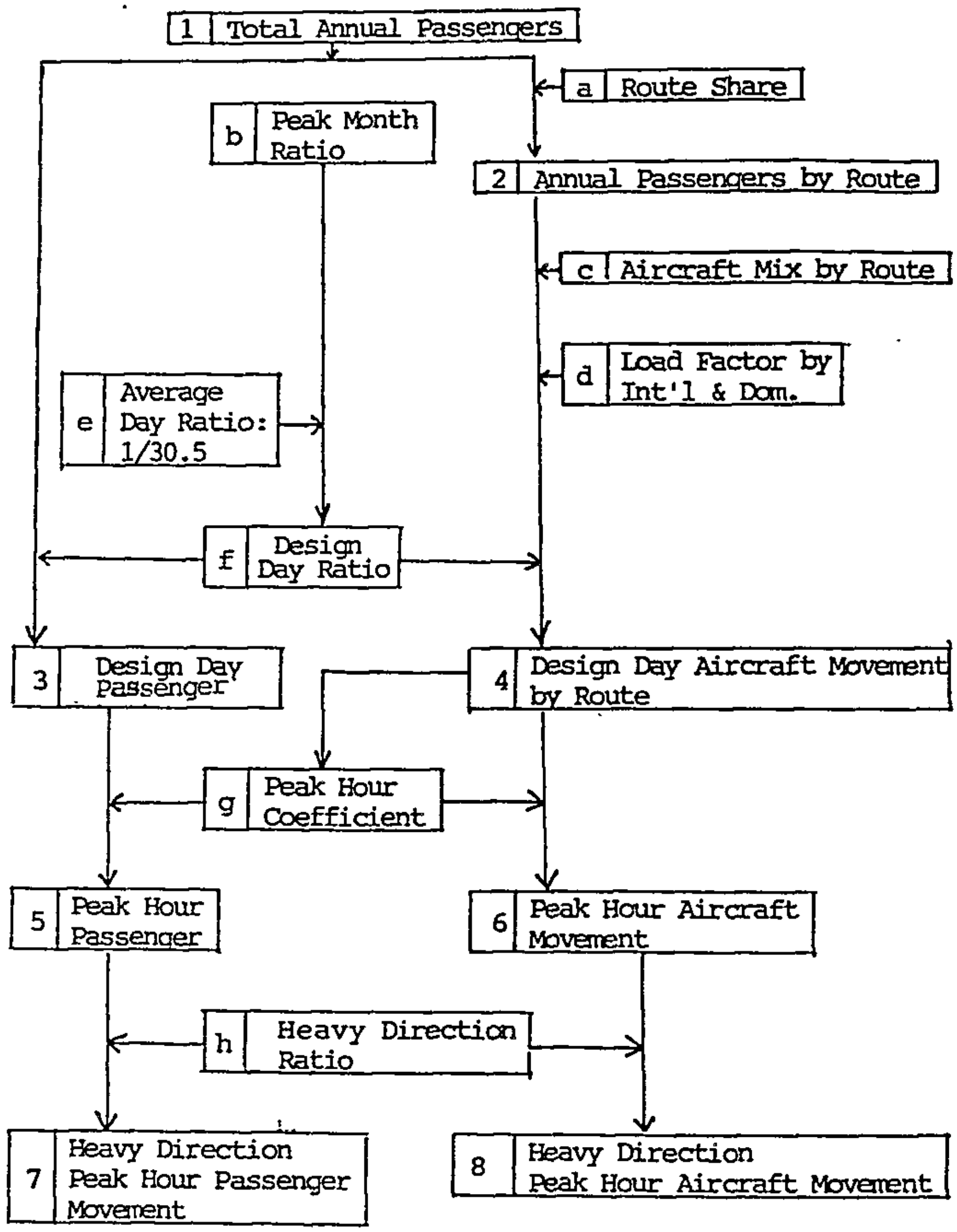
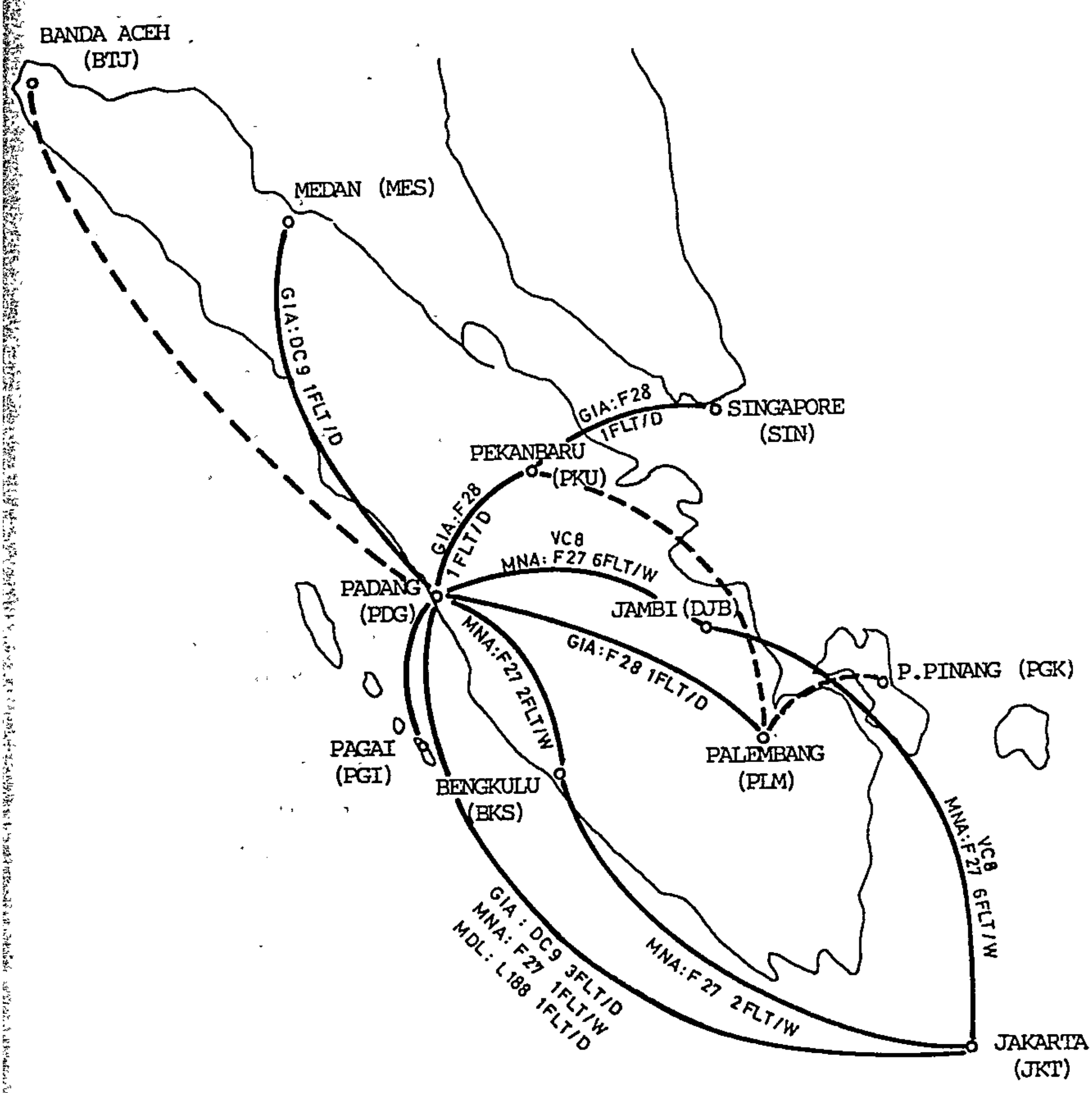


Figure 3.5.2 FLOW CHART FOR BREAKING DOWN AIR TRAFFIC VOLUME

Note: Design basis is peak hour traffic of an average day of the peak month.



LEGEND.

————	Present route indicated with Operator, aircraft and frequency of services.
- - - -	Possible future route.

Figure 3.5.3 AIR ROUTES CONNECTING PADANG AIRPORT

Table 3.5.2 ASSUMPTIONS OF ROUTE SHARE

ROUTE	Share in Passenger traffic
PDG - JKT (Jakarta)	67 %
PDG - MES (Medan)	16.5%
PDG - PKU (Pekanbaru)	6.5%
PDG - PLM (Palembang)	8.5%
PDG - Others	1.5%
Total	100 %

iii) The international traffic will be only generated on the PDG - PKU- SIN (Singapore) route as it is at present.

2) Peak month ratio and design day ratio

Monthly variations for air passengers in 1970 to 1980 are shown in Appendix 3.5.5 and 6. From this, the peak month traffic is seen to be generated by religious occasions such as Hadj, Ramadhan and Lebaran, and school vacations.

Especially for the most recent three years with the peak month in July or September, these peaking characteristics are indicated to be typical.

Peak month ratio (peak month passenger/annual passenger) as an planning value is established as 1/9.5 based on the five year average between 1976 and 1980. (Appendix 3.5.6)

Design day ratio is set at 1/290 as a product of peak month ratio and number of days in an average month.

Another interesting but important characteristic of the peak month is observed from the traffic record of September in 1980 (Appendix 3.5.7 and 8). Non-scheduled passengers, who account for about 65 percent of the monthly traffic, concentrate on 10 days and create peak day passengers twice as large as the average daily traffic used in the planning basis. Although it is difficult to utilize this limited data for the purpose of design, it is nontheless necessary to economically accomodate this unusually large excess traffic in the facility planning.

3) Aircraft Mix

i) Aircraft classification

Aircraft owned by Indonesian airline companies are classified by type and size in relation to other classification systems as shown in Table 3.5.3. Among them, DC-9-30, L-188, F-28-4000 , VC-8 and F-27 are operated at Tabing airport for scheduled flights.

For planning of Indonesian domestic airports, the aircraft can be classified by size in accordance with the following :

- Present characteristic of the actual fleet of Indonesia shown in the Table 3.5.3 will be basically maintained for this decade,
- The aircraft classification in the previous studies for Indonesian domestic airports should be modified by considering actual seating capacities of the aircraft owned by Indonesian airlines and the time factor.
- According to an airline in Indonesia, the number of Wide Body Jets and Small Jets such as F-28-4000 will be increased while DC-9-30 will tend to be gradually sold off.
- A New Medium Jet will fill the gap between the Wide Body and the Medium Jet so as to enable economical operation for some routes,
- It will become necessary to introduce an aircraft classified as between the New Medium Jet and the Small Jet, and
- The Large and the Medium Propeller aircraft will tend to be retired as airport developments progress.

AIRCRAFT CLASSIFICATION FOR THIS STUDY

i) Jumbo (J) - 545 seater
(the same capacity as the current B-747-203B) with all economy)

ii) Wide body (WB) - 285 seater (284 seats for mixed class use of A300, or average of 270 seats for DC-10-30 with first and economy classes and 302 seats for A300B 4-220 with all economy, for 1985 and 1990)
- 305 seater for 1995 (the same capacity as the current DC-10-30, A300 B4-200 with all economy)
- 350 seater for the years after 2000.

iii) New Medium Jet (NMJ) - 230 seater B767, DC9-80 class.

iv) Medium Jet (MJ) - 105 seater (DC-9-30 class) for 1990,
- 150 seater for the years after 1995.

v) Small Jet (SJ) - 65 to 85 seater F28-1000 to 4000 class.

vi) Large Propeller (LP) - 135 seater VC-9 class.

vii) Medium Propeller (MP) - 95 seater L-188 class.

viii) Small Propeller (SP) - 60 seater VC8 (44 seater), F27 (68 seater) class.

ix) STOL - 20 seater DHC-6, DC-3 class.

Table 3.5.3 AIRCRAFT CLASSIFICATIONS

FOR DOMESTIC FLIGHTS CURRENTLY USED

<table>
<tr><th colspan="4">CLASSIFICATION BY</th></tr>
<tr><th>Present fleet of Indonesia</th><th>Previous Studies for Indonesian Domestic Airports *</th><th>Japanese C.A.B Design basis for 1990</th><th>F.A.A.</th></tr>
<tr><td rowspan="2">Jumbo : B747
(425 - 544)
18F/ 407Y ↑ All economy ↑</td><td></td><td rowspan="2">Jumbo: B747
(525)</td><td>Special B747
(421 - 500)</td></tr>
<tr><td>B747 Type
(350)</td><td>B-747
(341 - 420)</td></tr>
<tr><td rowspan="3">LTJ (Wide Body):
DC10, A300,
(308) (302)
All economy
or
24F/246Y 8F/266Y
(270) (284)</td><td>Wide Body:
DC10, A300B
(250)</td><td>Airbus:
DC10, L1011
(370)</td><td>Special DC10/
(281 - 340)</td></tr>
<tr><td rowspan="2">Small Wide Body:
A310, B767
(180)</td><td rowspan="2">Medium Jet:
B767, DC9-80
(230)</td><td>DC-10, L1011,
A300
(211 - 280)</td></tr>
<tr><td>DC-861, NSA
(161 - 210)</td></tr>
<tr><td>LTP1 : VC9
(133)

MTJ: DC-9-30
(102)</td><td>Medium Capacity:
DC-9
(102)</td><td rowspan="2">Small Jet:
DC-9 (165)</td><td>DC8, B707,
B727, DC9-50
(111 - 160)</td></tr>
<tr><td>LTP2 : L188 (93)
STJ F-28
(65 - 85)</td><td rowspan="3">Low Capacity:
F28, F27
(65)</td><td>B737, B727-
100, DC9-30
(81 - 110)</td></tr>
<tr><td rowspan="2">MTP: VC8, F27
(44 - 68)</td><td rowspan="2">Propeller:
YS11
(64)</td><td>DC-9-10,
BAC111
(61 - 80)</td></tr>
<tr><td>CV580, YS-11,
M404, F227
(40 - 60)</td></tr>
<tr><td>STP: Cassa 212
DHC-6, DC-3
(10 - 30)</td><td>Light Aircraft:
DHC-6,
BN 2 A (30)</td><td>STOL:
DHC - 6
(19)</td><td></td></tr>
</table>

* Selected seven domestic airports study.

ii) Aircraft Mix in Padang

Aircraft mix expected. in Padang is projected by route for 1985, 1990,1995, 2000 and 2005 as summarized in Table 3.5.4 together with some supporting considerations. These expectations are made based on the above aircraft classification and the following general conside - rations :

- As of 1981, there is no commercial airline except GIA who operates jet aircraft. It is assumed, however, that other airlines will start jet service by the end of this decade.

- Those airlines operating propeller aircrafts have been making an effort to introduce larger propeller aircraft to meet the market growth. However, this effort may become more difficult because of the opposition to the general tendency of the aircraft industry.

- In the future, even large propeller aircraft will find it very difficult to compete with Jet aircraft on the same route although Jet transport charges are higher than those for propeller aircraft. Although propeller aircraft have higher direct operating costs, their charges must be lower because they are not attractive to customers.

- Direct operating costs of propeller aircraft are more than twice that of the current Jet aircraft,

- DC-9 of GIA are assumed to be gradually sold to other Indonesian companies,

- GIA intends to introduce A-300 to Padang after 1982 and this will require an extension of the existing runway to 2500 meters.

- When large Jet aircraft began service at Ujung Pandang, Medan and Surabaya, the annual air route passengers were respectively 0.25, 0.45 and 0.5 millions.

Table 3.5.4 AIRCRAFT MIX PORJECTION BY ROUTE

Year	Route PDG –	Annual Pax (1000)	Aircraft expected in Services	Average Seating Capacity	Modified Seating Capacity
1985	JKT	270	WB/MJ/LP 15/50/35	135	110
	MES	65	MJ	105	50
	PLM	35	SJ	85	40
	PKU	25	SJ	85	40
	OTHER	5	STOL/SP	35	20
	AVERAGE	Total 400		105	70
1990	JKT	500	WB*[1]/MJ*[2] 50 / 50	195	160*[4]
	MES	125	WB	285*[3]	140*[4]
	PLM	65	SJ	85	40*[5]
	PKU	50	SJ	85	40*[5]
	OTHER	10	STOL to SP	35*[6]	20*[7]
	AVERAGE	Total 750		145	95
1995	JKT	870	WB/NMJ 65/35	280	245
	MES	215	WB	305	200
	PLM	110	MJ	105	70
	PKU	85	MJ	105	50
	OTHER	20	STOL to SP	35	20
	AVERAGE	Total 1,300		190	145
2000	JKT*[8]	1,340	J and WB	425	425
	MES*[9]	330	WB/NMJ 65/35	280	280
	PLM	170	MJ	150	100*[10]
	PKU	130	MJ	150	100*[10]
	OTHER	30	STOL to SP	35	20
	AVERAGE	Total 2,000		240	215
2005	JKT	2,010	J/WB 55/45	455	455
	MES	495	WB/NMJ 50/50	290	290
	PLM	255	MJ	150	100
	PKU	195	MJ	150	75
	OTHER	45	STOL/SP	35	20
	AVERAGE	Total 3,000		245	220

* Footnotes : See next page.

* Footnote to Table 3.5.4

*[1] Although most flights between Jakarta and Padang will be shuttle transport, some of the flights connecting Jakarta and Medan are assumed to stop at Padang in accordance with current practice.

*[2] Merpati and Mandala, which fly VC 8 and L 188 respectively, are assumed to fly jet aircrafts maintaining the current 35 percent share of passenger carried on this route.

*[3] DC-10-30 with 270 seats of first and economy classes, and A 300 B4-220 with 302 economy class seats, are assumed to serve at equal frequency.

*[4] Half of the seating capacity of 285 is assumed to be occupied by JKT - MES passengers based on the present structure. The seating capacity for JKT route is also modified accordingly.

*[5] Considering the current route structure of PLM-PDG-PKU-SIN, half of the seating capacity of 85 is assumed to be occupied by transit passengers remaining on board as assumed in *[4].

*[6] From the weekly flight schedule as of 1981 (3 flights by VC 8 and 4 flights by F 27 to Jambi, 2 flights by F 27 to Bengkulu and 7 non scheduled flights by PA 23 to Pagai), an average seating capacity is estimated.

*[7] Considering possible the number and structure of routes and possible number of passengers whose origin and destination are not PDG, a seating capacity of 20 is assumed.

*[8] Shuttle services are assumed to be operated for JKT - PDG route.

*[9] Airlines' operational bases are considered to be distributed to such major domestic airports as Medan, etc. due to geographical charac - teristics of Indonesia. Therefore, most of the flights for PDG - MES are assumed to have a base at Medan and more than one airline company is assumed to serve on this route.

*[10] In addition to the existing route of PLM-PDG-PKU, the routes of PLM-PKU-PDG and PLM-PDG are assumed to be in service at the same frequency as PLM-PDG-PKU route.

Transit passengers (remaining on board) are considered for calculating a seating capacity as applied in *5.

4) Load factor

According to the available traffic data for the recent 7 months from November 1980 to May 1981, the average load factor was 60.6 percent and the average load factor of the highest month was 70.6 percent. Therefore, the average load factor of the peak month is set at 65 to 70 percent for the Study in the light of also the various studies previously made for Indonesian domestic airports.

5) Peak Hour Coefficient

Based on aircraft movements scheduled by time tables at the various Indonesian airports, the range of the relation between daily aircraft movements and peak hour coefficient (peak hour movements divided by daily aircraft movements) is plotted together with the average characteristic of Japanese airports in Figure 3.5.4. In this Study the lower limit of the range is utilized to obtain a peak hour coefficient, considering that the future traffic tends to be scattered over a longer day as night flights becomes popular.

6) Heavy direction ratio during peak hour. Heavy direction ratio is defined as the ratio of the aircraft movements of the heavier direction (arrival or departure) divided by total peak hour movements. It is observed from time tables at several airports in Indonesia that heavy direction ratio is about 0.6 on average.

3.5.3 Summary of Air Traffic Demands

As the results of the calculations according to the procedure indicated Figure 3.5.2 and the basic assumptions in 3.5.2, the planning values are summarized in Table 3.5.5 and 6.

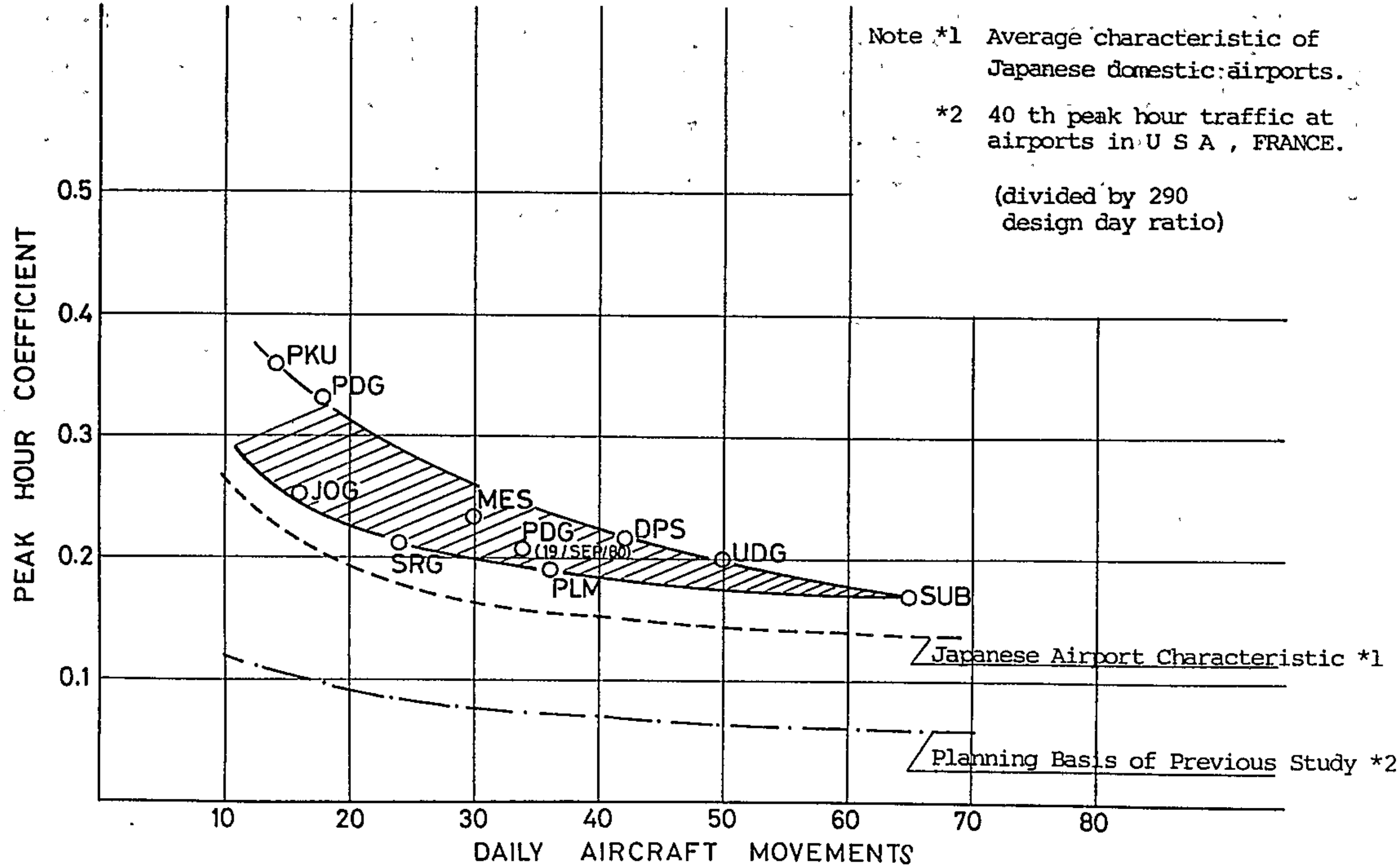


Figure 3.5.4 PEAK HOUR COEFFICIENT

Table 3.5.5 SUMMARY OF AIR TRAFFIC VOLUME

YEAR		PASSENGER			CARGO (Ton)	AIRCRAFT MOVEMENT					
		DOM	INT'L	TOTAL		WB	MJ	SJ	LP/MP	STOL/SP	TOTAL
1985	ANNUAL	386,000	14,000	400,000	5,200	590	3,478	2,318	1,160	590	8,136
	PEAK MONTH	40,600	1,500	42,100	550	62	366	244	122	62	856
	DESIGN DAY	1,330	50	1,380	20	2	12	8	4	2	28
	PEAK HOUR	270	30	300		0.4	2.4	1.6	0.8	0.4	5.6
	HEAVY DIRECTION PEAK HOUR	160	30	190							3.4
		DOM	INT'L	TOTAL		JUMBO	WB	MJ	SJ	STOL/SP	TOTAL
1990	ANNUAL	724,000	26,000	750,000	9,300	-	3,478	2,318	4,636	1,160	11,592
	PEAK MONTH	76,200	2,700	78,900	980	-	366	244	488	122	1,220
	DESIGN DAY	2,500	90	2,590	30	-	12	8	16	4	40
	PEAK HOUR	460	40	500		-	2.2	1.5	3.0	0.7	7.4
	HEAVY DIRECTION PEAK HOUR	280	20	300							4.4
		DOM	INT'L	TOTAL		JUMBO	WB	NMJ	MJ	STOL/SP	TOTAL
1995	ANNUAL	1,255,000	45,000	1,300,000	16,000	-	5,226	1,748	4,636	1,748	13,358
	PEAK MONTH	132,100	4,700	136,800	1,700	-	550	184	488	184	1,406
	DESIGN DAY	4,330	150	4,480	55	-	18	6	16	6	46
	PEAK HOUR	770	80	850		-	3.2	1.1	2.8	1.1	8.2
	HEAVY DIRECTION PEAK HOUR	460	40	500							4.9
		DOM	INT'L	TOTAL		JUMBO	WB	NMJ	MJ	STOL/SP	TOTAL
2000	ANNUAL	1,930,000	70,000	2,000,000	25,500	2,318	3,478	590	5,226	2,318	13,930
	PEAK MONTH	203,200	7,400	210,600	2,690	244	366	62	550	244	1,466
	DESIGN DAY	6,660	240	6,900	90	8	12	2	18	8	48
	PEAK HOUR	1,170	130	1,300		1.4	2.1	0.4	3.2	1.4	8.5
	HEAVY DIRECTION PEAK HOUR	700	60	760							5.1
		DOM	INT'L	TOTAL		JUMBO	WB	NMJ	MJ	STOL/SP	TOTAL
2005	ANNUAL	2,895,000	105,000	3,000,000	41,000	3,478	4,066	1,160	6,954	3,478	19,136
	PEAK MONTH	304,700	11,100	315,800	4,320	366	428	122	732	366	2,014
	DESIGN DAY	9,990	360	10,350	140	12	14	4	24	12	66
	PEAK HOUR	1,680	120	1,800		2.0	2.4	0.7	4.0	2.0	11.1
	HEAVY DIRECTION PEAK HOUR	1,010	60	1,070							6.7

Table 3.5.6 DAILY AIRCRAFT MOVEMENT

YEAR	ROUTE	ANNUAL PAX (x 1000)	DAILY A/C MOVEMENT						L/F
			WB	MJ	SJ	LP/MP	STOL/SP	TOTAL	
			285	105	85	110	35		
1985	JKT	270	2	6		4		12	70%
	MES	65		6				6	75%
	PLM	35			4			4	75%
	PKU	25			4			4	55%
	OTHER	5					2	2	45%
	TOTAL	400	2	12	8	4	2	28	70%
			JUMBO	WB	MJ	SJ	STOL/SP	TOTAL	
			545	285	105	85	35		
1990	JKT	500		8	8			16	65%
	MES	125		4				4	75%
	PLM	65				8		8	70%
	PKU	50				8		8	55%
	OTHER	10					4	4	45%
	TOTAL	750		12	8	16	4	40	65%
			JUMBO	WB	NMJ	MJ	STOL/SP	TOTAL	
			545	305	230	105	35		
1995	JKT	870		12	6			18	70%
	MES	215		6				6	60%
	PLM	110				8		8	65%
	PKU	85				8		8	75%
	OTHER	20					6	6	60%
	TOTAL	1,300		18	6	16	6	46	65%
			JUMBO	WB	NMJ	MJ	STOL/SP	TOTAL	
			545	305	230	150	35		
2000	JKT	1,340	8	8				16	65%
	MES	330		4	2			6	65%
	PLM	170				10		10	65%
	PKU	130				8		8	75%
	OTHER	30					8	8	65%
	TOTAL	2,000	8	12	2	18	8	48	65%
			JUMBO	WB	NMJ	MJ	STOL/SP	TOTAL	
			545	350	230	150	35		
2005	JKT	2,010	12	10				22	70%
	MES	495		4	4			8	75%
	PLM	255				12		12	75%
	PKU	195				12		12	75%
	OTHER	45					12	12	65%
	TOTAL	3,000	12	14	4	24	12	66	70%

CHAPTER 4 AIRPORT FACILITY REQUIREMENTS

4.1. Summary

This chapter sets forth the airport facility requirements which are estimated based on the volume of air traffic forecast reported in the previous chapter, and also in compliance with the relevant standards, recommended practices and/or regulations of ICAO (International Civil Aviation Organization), JCAB (Civil Aviation Bureau of Japan) and FAA (Federal Aviation Administration).

Table 4.1.1. indicates the result of the airport facility requirements used later in the plans and studies on Padang Airport Development, in 5 year stages up to the year 2005.

Table 4.1.1 AIR TRAFFIC DEMANDS AND FACILITIES REQUIREMENTS

	ITEM / YEAR	Present Condition as of 1980	1985	1990	1995	2000	2005	REMARKS
AIR TRAFFIC FORECAST	1. Annual Passenger (x1000)	Dom. 217	386	724	1,255	1,930	2,895	
		Int'l 5	14	26	45	70	105	
		Total 222	400	750	1,300	2,000	3,000	
	2. Annual Cargo Volume (Ton)	2,888	5,200	9,300	16,000	25,500	41,000	
	3. Annual Aircraft Movement	4,960	8,150	11,600	13,350	13,950	19,150	
	4. Peak Hour Passenger	(300)	300	500	850	1,300	1,800	( ):estimate figure
	5. Peak Hour Aircraft movement	6	5,6	7,4	8,2	8,5	11,1	
	6. Largest Aircraft	DC-9	A-300	DC-10	DC-10	B-747	B-747	
	7. No. of Airport Staff	160	290	550	950	1,470	2,220	
FACILITY REQUIREMENT	8. Runway	1850mx45m	2,500m x 45m	2,500m x 45m	2,500m x 45m	2,500m x 45m	2,500m x 45m	
	9. Runway Strip	1970mx150m	2,620m x 300m	2,620m x 300m	2,620m x 300m	2,620m x 300m	2,620m x 300m	
	10. Taxiway	1450m x 60m (not in use at present)			Parallel TWY justified		Parallel TWY necessary	
	11. Passenger Terminal Apron	4 : DC-9 235m x 90m	1:A-300 3:DC-9 235m x 90 m	3:DC-10 3:DC-9 353m x 190 m	4:DC-10 2:DC-9 1:STOL/SP 385m x 190 m	2:B-747 2:DC-10 2:DC-9 1:STOL/SP 401m x 190 m	3:B-747 2:DC-10 2:DC-9 1:STOL/SP 469m x 190 m	
	12. Passenger Terminal Building	1528 m^2	5,300m^2	8,800m^2	14,900m^2	22,800m^2	31,500m^2	
	13. Cargo Terminal Building	No facility	1,600m^2	2,900m^2	2,900m^2	3,800m^2	6,200m^2	
	14. Administration Building		1,800m^2	1,800m^2	1,800m^2	2,800m^2	2,800m^2	
	15. Air Navigation Systems		Precision Approach CAT-1					
	16. Car Parks	95 cars	150 cars 5,300m^2	250cars 8,800m^2	430cars 15,100m^2	650cars 22,800m^2	900cars 31,500m^2	
	17. Access Road	1 lane, for each direction	1 lane for each direction	1 lane for each direction	1 lane for each direction	1 lane for each direction	2 lanes for each direction	
	18. Fuel Supply		910 kl 4,800m^2	1820 kl 6,700m^2	2520 kl 7,700m^2	3115 kl 8,500m^2	4270 kl 10,500m^2	
	19. Rescue and Fire-fighting		5 cars 400m^2	5 cars 400m^2	5 cars 400m^2	6 cars 500m^2	6 cars 500m^2	
	20. Utilities							
	Electricity		1000 KVA	1400KVA	1800KVA	2500KVA	3300 KVA	
	Water (ton/month)		4,910	7,700	12,400	18,500	25,300	
	Waste deposit (ton / month)		22	36	50	70	110	

4.2. Obstacle Limitation Surfaces

The obstacle limitation surfaces are established in compliance with the obstacle limitation requirements defined in ICAO Annex 14-Aerodromes, so that the precision approach Category-I operation could be obtained.

Table 4.2.1. OPERATIONAL REQUIREMENTS

Runway Classification	Phase 1	Phase 2
	A	A
Operational Category	Precision Approach Category - I	Precision Approach Category - I

The dimensions and slopes are depicted and tabulated in Figure 4.2.1. and Table 4.2.2. respectively.

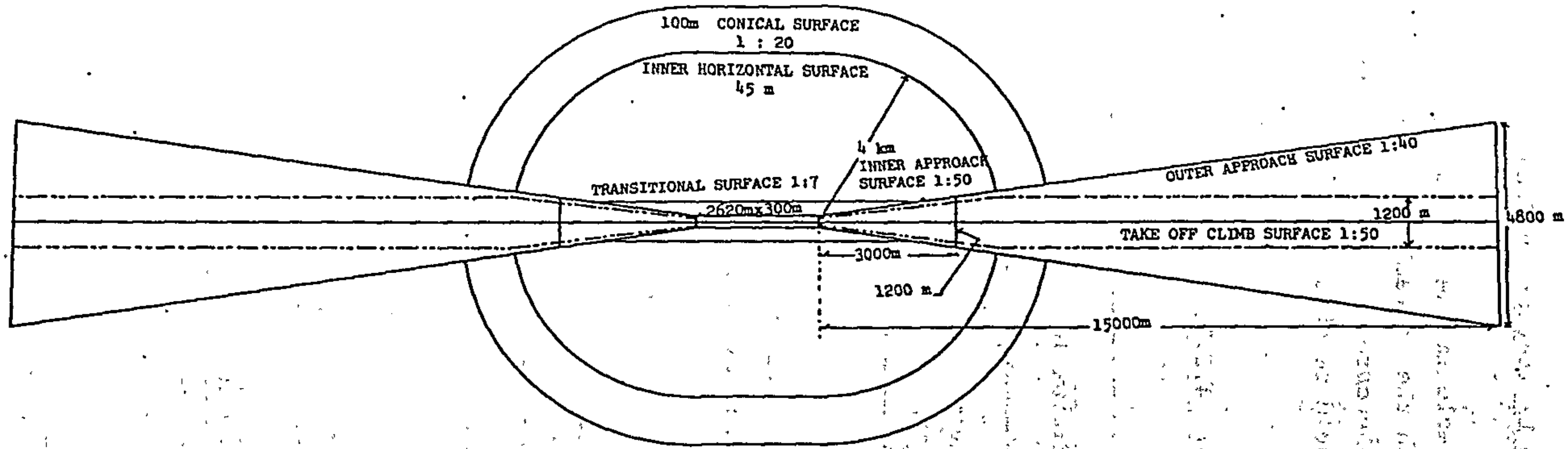


Figure 4.2.1 OBSTACLE LIMITATION SURFACE

Table 4.2.2 DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES
APPROACH RUNWAY

Runway Classification / Surface and Dimensions	Precision Approach
	Category I
	Code Letter A
CONICAL	
Slope	5%
Height	100 m (350 ft)
INNER HORIZONTAL	
Height	45 m (150 ft)
Radius	4,000 m (13,000ft)
APPROACH	
Length of inner edge	300 m (1,000ft)
Distance from threshold	60 m (200 ft)
Divergence (each side)	15 %
First Section	
Length	3,000 m (10,000ft)
Slope	2 %
Second Section	
Length	3,600 m (12,000ft)
Slope	2.5 %
Horizontal Section	
Length	8,400 m (28,000 ft)
Total Length	15,000 m (50,000 ft)
TRANSITIONAL	
Slope	14.3 %

(continued)

TAKE - OFF RUNWAY

Runway Classification / Surface and Dimensions	Main take-off runways A B C
TAKE-OFF CLIMB	
Length of inner edge	180 m (600 ft)
Distance from runway end	60 m (200 ft)
Divergence (each side)	12.5 %
Final width	1,200 m (4,000 ft)
Length	15,000 m (50,000 ft)
Slope	2 %

4.3. Airside Facilities

4.3.1. Runway

The length of runway is estimated based upon the following assumptions for the critical aircraft anticipated in every 5 years.

Assumptions

a. Design Route (Longest);

- Take-off: PDG ——→ JKT (Destination) – – – – – – – → SUB (Alternate); 553 NM, 382 NM

- Landing ; JKT ——→ PDG – – – – – – – → MES; 530 NM, 301 NM

b. OAT (Out of Airport Temperature); 33 °C

c. Payload; Maximum for both passenger and cargo

d. Elevation; Zero feet

e. RWY Slope; Zero percent

As the result of the calculations summarized in Table 4.3.1 a 2,500 m x 45 m runway shall be planned for A-300-B4, for the 1st phase development. For the 2nd phase development no runway extension will be necessary since forecast B-747 service in the PDG - JKT route can be operated on 2500m long runway as shown in the Table. However, provision of adequate space at the 1st phase for further runway extension is recommended from the long term viewpoints. By doing so the runway can easily be extended when unexpected demands such as a direct flight services from Padang to Jeddah for haji trip call for its extension to be 3500m or more in total length.

Thus, although the runway of 2500m will suffice the requirement of B-747 assuming the longest route to be Jakarta to Padang, a provision of the runway extension up to 3500m shall be made for further development in the future.

Table 4.3.1. RWY LENGTH REQUIREMENTS

AIRCRAFT	RWY REQUIRED			REMARKS
	TAKE-OFF	LANDING		
		WET	DRY	
DC-9-32	2,370 m			
A-300-B4	2,080 m	2,420 m	2,110 m	
DC-10-30	2,120 m	2,200 m	1,910 m	
B-747-200B	1,990 m	2,480 m	2,150 m	

For the detailed calculations, refer to the Appendix 4.3.1 to 4.3.4.

4.3.2. Runway Strip

The runway strip is established laterally to a distance of 150 m on each side of the center line of the precision approach runway Category-I.

Table 4.3.2. RUNWAY STRIP

	PHASE 1	PHASE 2
Dimensions of Runway Strip	300 m x 2620 m	300 m x 2620 m

4.3.3. Taxiway

The instrument approaches will exceed scarcely four flights during the peak hour after 1990 and the operation of the wide bodied jet aircraft will become frequent.

Therefore, a complete parallel taxiway with perpendicular exits may be justified in Phase - I and will be necessary in Phase - II.

The width of the taxiway shall be 23 m with 7.5 m shoulders on each side.

Table 4.3.3. TAXIWAY REQUIREMENTS

	Phase-1	Phase-2
Taxiway Requirement	If economically justified complete parallel taxiway with perpendicular exits may be provided.	Complete parallel taxiway with perpendicular exits to be provided.

4.3.4. Apron

1) Calculation method for required number of aircraft stands.

The following formula is used to obtain the required aircraft stands for the key years.

$$S = \sum_{1}^{n} \left(\frac{Ti}{60} \times Ni \right) + \alpha$$

Where S : Required number of aircraft stands,

Ti: Gate occupancy time of aircraft of Category (i) in minutes,

Ni: Number of arriving aircrafts of Category (i) during the peak hour,

α : One extra stand for the largest aircraft of the planning year for unexpected peaking occasion. (1 extra for each 10 stands)

2) Classification of aircraft

Apart from the aircraft classification by seating capacity, the following classification is made for the planning of aircraft parking area taking into account wing span, overall length, etc. of aircraft. (For dimensions of aircraft, refer to APPENDIX 4.3.5.)

Table 4.3.4. AIRCRAFT CLASSIFICATIONS FOR APRON

Category	Classification		Wing Span in metres		Overall Length (m)	
A	B 747		60		70	
B	DC10, A 300, B 767		51		56	
C	up to 1995	after 1995				
	DC 9, F 28	DC -9-80	29	33	37	46
D	L-188, VC-8, F-27		30		32	

3) Gate occupancy time

The gate occupancy time for each category is estimated as tabulated in Table 4.3.5, by considering the present parking time according to the current time tables, with a margin for delay.

Table 4.3.5. GATE OCCUPANCY TIME

Category	Gate occupancy time (min)	Actual parking time based on the time tables (min)
A	70	60
B	70	60
C	55	DC-9:50 , F 28:50
D	50	VC-8:40 ,L-188:50 F-27:30

4) <u>Required number of aircraft stands</u>

Number of stands is calculated in APPENDIX 4.3.6 based on the aforementioned assumptions and are summarized in Table 4.3.6.

Table 4.3.6. REQUIRED NUMBER OF AIRCRAFT STANDS

YEAR	A	B	C	D	Total
1985		1	3		4
1990		3	3		6
1995		4	2	1	7
2000	2	2	2	1	7
2005	3	2	2	1	8

It is assumed that adoption of nose-in and pushout parking configuration for the aircraft Category A and B will become gradually popular in Indonesia, and self-maneuvering configurations will become out of fashion.

Accordingly, a possibility of boarding bridge installation shall be taken into consideration for the aircraft gate positions, Category A and B.

5) <u>Parking space requirements</u>

Linear parking configuration will be adopted for the terminal judging from the number of stands required for 2005.
The dimensions of parking spaces for aircraft types are planned as indicated in Table 4.3.7.

Table 4.3.7 AREA OF PARKING SPACE

Aircraft Classif-cation	Nose-in Push-out		Nose out self - Maneuvering
A	68 m x 190m		-
B	60 m x 160m		93 m x 110m
D	up to 1995 37m x 75m	after 1995 41m x 90m	55 m x 100m
E	-		55 m x 70m

Note: Wing tip clearance of 7.5 m is considered in accordance with ICAO.

4.4. Passenger Terminal Building

4.4.1. Floor Area Requirement

The floor area required for the passenger terminal building in the phased years is calculated by multiplying the number of the hourly peak passengers by the unit floor area.

The unit floor area per hourly peak passenger at Padang Airport is established to be 15 m^2 at minimum and 20 m^2 at maximum taking into consideration the rather high well-wisher to passenger ratio existing at Tabing. The detail is explained in Appendix 4.4.1.
The floor area is calculated and tabulated in Table 4.4.1. and an intermediate figure is applied for planning purposes.

Table 4.4.1. FLOOR AREA REQUIREMENT FOR PASSENGER TERMINAL BUILDING

Year	1985	1990	1995	2000	2005
Peak hour passenger	300	500	850	1,300	1,800
Min. floor area (m^2)	4,500	7,500	12,750	19,500	27,000
Max. floor area (m^2)	6,000	10,000	17,000	26,000	36,000
Adopted floor area (m^2)	5,300	8,800	14,900	22,800	31,500

4.4.2. Terminal Building Concept

It is reasonable to plan the passenger terminal building in a simple linear concept, since the number of the aircraft gate positions is estimated as 7 in the year 1995 and 8 in the year 2005.

One and half level* will be also the most adequate floor configuration considering such factors as the number of passengers processed, world-wide tendency of services to passengers and the investment cost.

*One and half level means a terminal building configuration consisting of one floor for land-side passenger processing and two floors for airside passenger processing utilizing boarding bridges.

4.5. Cargo Terminal Building

In case of manual handling, the cargo handling capacity is generally considered to be 5 tons/sq.m. and JCAB recommends 20 tons/sq.m. for the planning of handling area. Therefore, the required cargo handling area is accordingly calculated on the assumption that manual handling (0.2 sq.m./ton) be applied before 1990 and the capacity will be increased gradually up to at least 0.1 sq.m./ton level after 1995.

The floor area of the cargo terminal building is usually required to be 1.5 times that of the cargo handling area, in order to accomodate the office area of airlines, cargo agents, etc.

Table 4.5.1. CARGO TERMINAL BUILDING REQUIREMENTS

Year	1985	1990	1995	2000	2005
Annual Cargo Volume (ton)	5,200	9,300	16,000	25,500	41,000
Cargo handling Area (m^2)	1,050	1,900	1,900	2,550	4,100
Cargo Teminal Building (m^2)	1,600	2,900	2,900	3,800	6,200

4.6. Other Buildings

4.6.1. Air Traffic Control Tower

A control tower with a floor area of about 60 m^2 will be provided for in the 1st Phase considering the positions for aerodrome control, approach and FIS control, visual aids control and a provisional surface movement.

The height of the tower cab will be set at 20 to 25 m based on FAA standard.

4.6.2. Administration Building

An independent administration building is required for the airport administration unit, the air traffic control and airport operational unit, and also for air navigational equipment. The required floor area will be 1,800 m^2 in Phase-1 in the light of JCAB standard.

4.7. Land Side Facilities

4.7.1. Access Road

The traffic surveys carried out at Tabing Airport in Aug. 1981 showed that the ratio of the incoming/outgoing cars to passengers is 0.9 in the peak hour and the heavy direction ratio is 0.6.

The car traffic volumes is estimated in Table 4.7.1. based on the survey result above.

Table 4.7.1. PEAK HOUR CAR TRAFFIC VOLUME

Year	1985	1990	1995	2000	2005
Peak hour Pax	300	500	850	1,300	1,800
Peak hour car traffic in both directions	270	450	765	1,170	1,620
Peak hour car traffic in heavy direction	162	270	460	702	972
Lane of Access Road (one direction)	1	1	1	1	2

4.7.2. Car Parking

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

$$V = P \times C/R$$

Where, V: Required number of parking spaces

P: Number of peak hour passengers

C: Number of parking spaces per peak hour passenger (0.4 by survey)

R: Peak hour occupancy rate (0.8 for planning purpose)

The required number of parking spaces is calculated based upon the aforementioned survey, which resulted in C = 0.383 (74 parked cars/193 passengers).

Table 4.7.2. PARKING LOT REQUIREMENTS

Year	1985	1990	1995	2000	2005
Peak hour Pax	300	500	850	1,300	1,800
No. of Parking spaces	150	250	430	650	900
Required Space (m^2)	5,300	8,800	15,100	22,800	31,500

(35 m^2/lot)

4.8. Airport Utilities

The airport utilities requirements are calculated based on the unit demand established here as shown in Table 4.8.1.

Table 4.8.1. UNIT DEMAND

Utilities		Unit demand / m^2
Electricity	Passenger Terminal Building	: 100 VA / m^2
	Cargo Terminal Building	: 60 VA / m^2
	Administration Building	: 80 VA / m^2
	Equipment	: Calculated by items
Water	Passenger Terminal Building	: 0.023 ton/m^2/day
	Cargo Terminal Building	: 0.003 ton/m^2/day
	Administration Building and others	: 0.01 ton/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	: 0.024 kg/m^2/day

Source: average unit demand of airports in Japan

The utlities demand is calculated for every 5 years and tabulated in Table 4.8.2.

Table 4.8.2. AIRPORT UTILITIES DEMAND

Year	1985	1990	1995	2000	2005
Electricity (KVA) Demand	-	1,400	1,800	2,500	3,300
Water (ton/month) Demand	-	7,700	12,400	18,500	25,300
Waste (ton/month) Deposit	-	36	50	70	110

4.9. General Services

4.9.1. Rescue and Fire - Fighting

The facility requirements for the rescue and fire-fighting services are estimated in compliance with the ICAO AIRPORT SERVICE MANUAL, Part I.
The facilities are calculated and tabulated in Table 4.9.1. airport category is determined by the largest aircraft movements for the busiest 3 months.

Table 4.9.1. REQUIRED FIRE FIGHTING FACILITIES

	1985	1990	1995	2000	2005
Airport Category	6	8	8	9	9
Extinguishing Agents					
Water for Aqueous Film Forming Foam (1)	7,900	18,200	18,200	24,300	24,300
Dry Chemical Powder (kg)	225	450	450	450	450
CO_2 (kg)	450	900	900	900	900
Vehicles					
Rapid Intervention Vehicle	1	1	1	1	1
Major vehicle	2	2	2	2 or 3	2 or 3
Ambulance	1	1	1	1	1
Command Car	1	1	1	1	1
Floor Space (m^2)	400	400	400	500	500

4.9.2. Aviation Fuel

The daily fuel consumption is accumulated by multiplying the trip fuel including that for an alternate airport, by the number of departing aircraft in respective type. The required fuel storage capacity is estimated as tabulated in Table 4.9.2. on the condition that the airport is provided with a 7 days storage capacity.

Table 4.9.2. AVIATION FUEL STORAGE REQUIREMENT

	1985	1990	1995	2000	2005
Daily Fuel Consumption (kl)	130	260	360	445	610
7 days storage capacity (kl)	910	1,820	2,520	3,115	4,270
Area required	4,800 m^2	6,700 m^2	7,700 m^2	8,500 m^2	10,500 m^2

4.10. Air Navigation Systems

Air navigation systems include; (1) Radio navigational aids, (2) Air traffic control systems, (3) Aeronautical telecommunications system, (4) Visual aids and (5) Meteorological system.

Table 4.10.1. OPERATIONAL REQUIREMENT FOR AIR NAVIGATION SYSTEMS

	PHASE 1	PHASE 2
Air Navigation Systems	Precision Approach Category - I	Precision Approach Category - I

As for the phase-2 requirement, it will be rather conventional to plan the precision approach category-1, since the modern R - NAV (Area Navigation) and MLS (Microwave Landing System) will be operated in this stage.

It is, however, impractical at this moment to apply the developing MLS instead of the ILS because such criteria as aircraft operations procedures, siting criteria and equipment configurations etc. have not been standardized.