are defined with the following considerations.

- The reference maximum number of seats is considered 100 (DC-9 is an example of this class).
- The decreasing rate of the maximum number of seats is considered to be 33%, if the number of seats is less than 100.
- The increasing rate of the maximum number of seats is regarded to be 50%, if the number of seats is more than 100.
- Maximum number of seats here means the maximum of standard number of passenger seats .

Such classification of the aircraft could lead the following conclusions.

- The lower number of seats in each class of aircraft is approximately 67% of respective maximum number of seats , except the class of which maximum number of seats is 10.

(07) Provided that the initial number of passenger seats is estimated, the maximum number of seats closest to and not less than the initial required number of seats is selected to define the standard number of passenger seats. The standard number of passenger seats of aircraft belonging to the last two classes in paragraph (06) needs to be multiplied by(7/9) only for the calculation of flight frequency and adjusted passenger load factor, because for these classes of aircraft the ratio of the published standard number of passenger seats to the maximum number of seats for each model is about 7/9 as shown below.

Existing aircraft and its maximum number of seats		Published standard number of seats for existing aircraft
(A-300)	336	269
(DC-10)	380	270
(B-747)	548	452

The relation between the aircraft classification and maximum range with the maximum payload is given in the following table.

Maximum standard number of passenger Seats	Maximum range with raximum payload (km)
10	400
20	800
35	1,400
50	2,000
70	2,800
100	4,000
150	4,861
225	6,153
340	8,133
510	11,061

(08) Provided that the number of passenger seats is given, the takeoff field length at the maximum takeoff weight of an aircraft to be allocated to a specific air route can be calculated based on the following formulas.

1) $0 \leq SN < 80$, at maximum takeoff weight

$TL = 25 * SN$

Where,

TL : Takeoff field length (m)

SN : Number of passenger seats

2) $80 \leq SN < 225$, at maximum takeoff weight

$TL = (200 * SN + 42,000)/29$

3) $225 \leq SN$, at maximum takeoff weight

$TL = (298 * SN + 613,950)/227$

(09) Once the standard number of passenger seats is specified, the landing distance at maximum landing weight can be obtained by the following equations.

1) $0 \leq SN < 100$, at maximum landing weight

$LD = 13 * SN + 200$

Where,

LD : Landing distance (m)

SN : Number of passenger seats

2) $100 \leq SN$, at maximum landing weight

$LD = (609 * SN + 467,100)/352$

(10) In this study, the following types of aircraft are taken into account.

- Conventional airplane
- Short takeoff and landing (STOL) airplane
- Helicopter
- Amphibian

The type of aircraft is selected based on the following consideration.

- Conventional Airplane.

  Airports are existing or available in both origin and destination. Both airports have a runway long enough for an airplane to takeoff and land.

- Short Takeoff and Landing (STOL) Airplane

  Airports are existing or available in both origin and destination. At least, one airport has a runway too short for a conventional airplane to takeoff and land. An airplane should have a standard number of passenger seats not more than 70.

- Helicopter

  There exists no airport on an air route.
  The stage length of the air route is not more than 100 km.

- Amphibian

  There is no land based airport, or there is only one land based airport on an air route under consideration. The stage length of the air route is more than 100 km, and there is ,moreover, a suitable place for operation of amphibian, that is ; sea, large lake or river.

- Supplemental cases for introduction of conventional airplane
  * Airports are available in both origin and distination. One of airports has a runway too short for a conventional airplane to takeoff and land. But, the airplane should have more than 70 passenger seats.
  * There exists no airport in an air route under consideration. The stage length of an air route is more than 100 km, but there is no suitable place for takeoff and landing of amphibian.

(11) The following materials are taken into account for selection of types of aircraft.

- Availability of airports
- Available runway length

In Section 5.04, these data are tabulated as of 1987.

(12) The takeoff field length at maximum takeoff weight, calculated as described in para.(08) is refers to the available runway length of an airport. The landing distance at maximum landing weight is estimated as presented in Para.(09) and converted to the landing field length at maximum landing weight as given by the equation below.

$$LFL = LD / 0.6$$

Where,

LFL : Landing field length (m)

LD : Landing distance (m)

The takeoff and landing field lengths given by the above equations are those of a conventional airplane.
If the runway length of the airports concerned are equal or longer than those required by calculation, a conventional aircraft may be introduced in an air route beyond question. However, if the runway length of the airports is not long enough to operate a conventional aircraft, the following alternatives are considered to satisfy the demand.

- Extension of a runway to accommodate a conventional airplane.
- Introduction of short takeoff and landing (STOL) airplanes

(13) STOL airplanes with more than 70 passenger seats are not yet in practical use. Hence a STOL airplane with 50 seats is picked for the study.

(14) Helicopter with up to 10 passenger seats is taken up for the study. The average maximum range with not more than 10 passenger seats is about 350 km with seats full. Hence, a stage length of 175 km, a half of maximum range of 350 km, is adopted as a boundary for a helicopter.

(15) Under the condition that the stage length of the air route is more than 100 km , however, it seems that the direct operating cost of helicopter is more expensive than that of amphibian. From this point of view, amphibian should be introduced in a route such as a longer stage length than 100 km.

(16) Supplemental cases to introduce a conventional airplane mean that there is no way to satisfy the air traffic demand of an air route other than extension of runway or construction of a new airport for operation of a conventional aircraft.

(17) Once the standard number of passenger seats is defined, maximum cruising speed at maximum takeoff weight of an aircrafty to be allocated to a particular air route is estimated based on the following equations.

1) $0 \leq SN < 100$

$$MCS = 4.15 * SN + 100$$

Where,

MCS : Maximum cruising speed (KTAS)

SN : Number of passenger seats

2) $100 \leq SN$

$$MCS = 515 \text{ (constant, KTAS)}$$

(18) From the above equations, the maximum cruising speed of an aircraft is given at the maximum takeoff weight. Therefrom, the average cruising speed can be obtained from

the following relation.

ACS = 0.9 * MCS

Where,

ACS : Average cruising speed (KTAS)

MCS : Maximum cruising speed (KTAS)

And, the maximum speed of a helicopter with up to 10 passeger seats is about 120 KTAS. Thereby, the average cruising speed of helicopter is estimated at 108 KTAS, calculated as 0.9 x 120 KTAS, similarly conventional airplane stated above.

(19) The maximum cruising speed of STOL airplane was assumed to be 464 KTAS. The average cruising speed can be calculated as 0.9 x 464 KTAS = 418 KTAS similaly.

(20) The maximum cruiseing speed and average cruising speed of amphibian are assumed as below.

	50 seats	35 seats	20seats
Maximum cruising speed	287 KTAS	227 KTAS	170 KTAS
Average Cruising speed	258 KTAS	206 KTAS	153 KTAS

(21) The passenger load factor is assumed to prepare the aircraft specifications based on the computer program TCHART. After flight frequency or number of flights per week calculated on the air traffic demand of the specific air route, the number of passenger seats to be introduced and the initial value of passenger load factor be examined, the final passenger load factor is presumed on the basis of an equation stated in the subsequent paragraph (24). The initial passenger load factor of 0.67 is employed, which is nearly on the economic break-even point of airlines operation in Indonesia.

(22) Flight frequency or number of flights per week has been calculated as follows.

FPW = NP / (0.98 * 0.9 * NPS * PLF * 52)

Where,

FPW	:	Flight frequency per week
NP	:	Number of passengers per year
NPS	:	Standard number of passenger seats
PLF	:	Passenger load factor
0.98	:	ratio of the actual number of flight to the number of flights scheduled in timetables
0.9	:	Correction factor for actual number of seats in Indonesia

The number of passenger defined herein is the total of "going" and "returning" passengers per year for the air route. Flight frequency has been computed in consideration to the range of coefficient of 0.5 or more. The figure less than 0.5 is neglected.

(23) The adjusted passeger load factor is predicted by the following formula.

PLF = NPY / (0.98 * 0.9 * NPS * 52 * FPW)

Where,

PLF	:	Passenger load factor
NPS	:	Standard number of passenger seats
NPY	:	Number of passengers per year
FPW	:	Number of flights per week

(24) The flight frequency given by the above equation, is checked from the operational and practical viewpoint as stated below.

- Runway occupancy time, takeoff/landing required for the calculated frequency of flight
- Allowable minimum occupancy time limited by the safety of air traffic control

(25) The runway occupancy time has been estimated by the following formula.

ROT = AOT * NAR / FPW * 7

Where,

ROT : Runway occupancy time (hours)

AOT : Airport operation hours, 24 hours per day if the passenger is not less than 440,000 per year and 12 hours if the passenger is less than 440,000

NAR : A factor related to a number of air routes and given by the following equation.

NAR = annual number of passengers for an air route / total annual number of passengers for all air routes

FPW : Number of flights per week

(26) Number of flights per week, or flight frequency is calculated as shown in para.(22).
Minimum runway occupancy time is 10 minutes in general, taking existing aircraft size, aircraft performance and air traffic control capability into account.

(27) If the estimated runway occupancy time is equal to or longer than the minimum runway occupancy time, the flight frequency may be considered realistic or reasonable. However, in case that the estimated runway occupancy time is shorter than the minimum runway occupancy time, the flight frequency is regarded as too high and not realistic. In such case, the standard number of seats is changed to one corresponding to the next larger class of an aircraft as discrived para.(06). Then, the calculation is repeated in accordance para (07), maximum range with maximum payload is also calculated again.

(28) The annual average utilization hour of an aircraft is roughly determined by the stage length of the route to which the aircraft is allocated.
ATA (Air Transportation Associasion) gives the following rule.

$$AU = SL + 1500 \qquad 0 < SL \leq 700$$
$$AU = (SL - 700) / 4 + 2200 \qquad 700 < SL \leq 1900$$
$$AU = 2500 \qquad 1900 < SL$$

Where,

AU ; Annual utilization hour (in hours)
SL ; Stage length of air route (in km)

(29) The number of aircraft allocated to each route is determined by the following equation.

$$NAC = BT * FPW * 52 / AU$$

Where,

NAC ; Number of aircraft (in round number)
BT ; Block time (in hours)
FPW ; Number of flight per week
AU ; Annual utilization (in hours)

As the above equation gives the aircraft number in a round number, the annual utilization must be re-calculated, which is given by :

$$AU = 0.98 * FPW * BT / NAC$$

Where,

AU : Annual utilization of aircraft
FPW : Flight frequency per week
BT : Block time
NA : Number of aircraft

5.02 MODEL FOR AIRCRAFT OPERATING COST

(30) The estimation of aircraft operating cost is made by using a computer program of TCHART. The program TCHART consists of the following elements.

- In regard to the direct operating cost of an aircraft with turbofan engines, the standard Air Transportation Association model (ATA model) is to be applied after making some modifications to the 1976 cefficients.
- The direct operating cost of an aircraft with turboprop engines is to be estimated by Boeing short Haul Airplane Operating Cost Analysis model with modifications.
- The indirect operating cost is assumed based on Lockheed California company model modified as required.
- The operating cost of STOL is basically to be estimated using a model for a conventional airplane.
- The operating cost of helicopter is presumed base on a special model.
- For the operating cost of amphibian, a model for a conventional airplane is to be applied basically with some modifications.

5.02.1 MODEL FOR DIRECT OPERATING COST

(31) Direct operating costs consist of the following items.

- Crew cost
- Fuel and oil cost

- Airframe labor cost
- Material cost of airframe
- Engine labor cost
- material cost of engine
- Maintenance burden
- Depreciation
- Insurance cost

For the aircraft with turbofan, turboprop engines, the methods used in Indonesia to calculate these costs are described below.

(32) - Crew cost

The rate for pilots working for Indonesian airlines in US$ 20 / flight hour.

Therefore,

Crew cost = Rcrew * BT * Ncrew

Where,

Rcrew	:	US$ 20 / flight hour
Ncrew	:	Number of crew (Pilots and Co-pilots)
BT	:	Block time (in hours)

(33) - Fuel and oil

Fuel & oil cost = BF * PRICEf / 6.7
+ Neng * OILburn * PRICEo * BT / 8.1

Where

BF	:	Fuel consumed on one flight (US Gall)
BT	:	Block time (in hours)
PRICEf	:	Fuel price (= RP. 250 / lit.)
PRICEo	:	Oil price (= RP.2225 / lit.)
OILburn	:	Oil consumption (= 0.135 lb/hour/eng.)
Neng	:	Number of engines
6.7	:	Density of fuel (lb/US Gall)
8.1	:	Density of oil (lb/US Gall)

(34) - Airframe labor cost

The airframe labor cost is calculated on the basis of a certain number of man-hours per flight hour (MH/FH), plus a certain number of man-hours per flight cycle (MH/FC).

For the aircraft with turbofan engines, this is shown by ;

Airframe labor cost = (MH/FH * BT + MH/FC) * RATEmh

MH/FC = (Wempe/1000) / (0.0419 * (Wempe/1000) + 28.159)

MH/FH = (Wempe/1000) / (0.1035 * (Wempe/1000) + 17.919)

where,

BT : Block time (in hour)

RATEmh : Labor rate (= RP. 5,300/hour)

Wempe : Basic empty structural weight minus engine weight (in kg)

For the airplanes with turboprop engines, Boeing short haul model split costs into MH/FH and MH/FC, but MERPATI NUSANTARA AIRLINES has no conducts of data for MH/FC.

Consequently,

MH/FC = 0.0

MH/FH = 1.25 * 5.61 * ($Wempe/10^5$) + 0.68

1.25 is the ratio between costs of Boeing short haul models and Indonesian airlines

(35) - Material cost of airframe

Material costs are considered to be equal to the purchase costs, so the market price is taken for the airplane and engine costs. These figures are used unaltered for ATA models and Boeing short haul models when calculating the material cost of the airframe.

$$\text{Material cost of airframe} = MC/FH * BT + MC/FC$$

For the aircraft with turbofan engines :

$$MC/FC = 2.261 * (CSTaf/10^6) + 1.235$$

$$MC/FH = 1.736 * (CSTaf/10^6) + 2.508$$

For the aircraft with turboprop engines :

$$MC/FC = 2.01 * (CSTaf/10^6) + 4.36$$

$$MC/FH = 2.85 * (CSTaf/10^6)$$

where,

CSTaf : Airframe acquisition cost

(36) - Engine labor cost

It is assumed that engine maintenance will take effect in Indonesia, and Boeing short haul models are used, calculated at the Indonesia labor rate.

$$\text{Engine labor cost} = (MH/FH * BT + MH/FC) * RATEmh$$

For the aircraft with turbofan engines :

$$MH/FC = (0.0134 * (Tmax/10^3) + 0.142) * Neng$$

$$MH/FH = (0.0184 * (Tmax/10^3) + 0.178) * Neng$$

For the aircraft with turboprop engines :

$$MH/FC = (1.33 * (Pmax/10^5) + 0.68) * Neng$$

$$MH/FH = (0.41 * (Pmax/10^5) + 0.14) * Neng$$

where,

Tmax: Max. takeoff thrust (lbs)

Pmax: Max. takeoff power (SHP)

Neng: Number of engines

(37) - Material cost of engine

ATA models and Boeing short haul models are used in the same way as for the material cost of the airframe.

Material cost of engine = MC/FH * BT + MC/FC

For the aircraft with turbofan engines :

$$MC/FC = (5.5 * (CSTeng/10^6) + 2.7) * Neng$$

$$MC/FH = (10.81 * (CSTeng/10^6) + 1.78) * Neng$$

For the aircraft with turboprop engines :

$$MC/FC = (.24.3 * (CSTeng/10^6) + 14.0) * Neng$$

$$MC/FH = 28.0 * CSTeng/10^6 * Neng$$

Where,

CSTeng : Engine acquisition cost

Neng : Number of engines

(38) - Maintenance burden

The maintenance burden is considered to be twice the total airframe and engine labor cost.

Maintenance burden = 2.0 * (Airframe labor cost + Engine labor cost)

(39) - Depreciation

Depreciation is calculated with the costs of airframe and engine spares as:

SCSTaf = 0.08 * CSTaf

SCSTeng = 0.41 * CSTeng

Where,

0.08: Airframe spare rate

0.41: Engine spare rate

Depreciation = (CSTac + SCSTaf + SCSTeng) * BT / (Tutil * YEARdep)

Where,

CSTac : Aircraft acquisition cost

Tutil : Annual utilization (in hour)

BT : Block time (in hour)

YEARdep: Working life (10 years)

(40) - Insurance cost

The insurance cost is calculated as:

Insurance cost = (RATEins * CSTac) * BT / Tutil

Where,

RATEins: Insurance rate (= 1%)

CSTac : Aircraft acquisition cost

BT : Block time (in hour)

Tutil : Annual utilization (in hour)

(41) Direct operating costs are calculated on the basis of these equations as follows.

DOC/FLT = Crew cost + Fuel and oil cost
+ Insurance cost
+ Airframe labor cost
+ Airframe material cost
+ Engine labor cost

+ Engine material cost
+ Maintenance burden
+ Depreciation

DOC/mile = (DOC/FLT) / SL

DOC/seat-mile = (DOC/mile) / NS

where,

SL ; Stage length (in mile)

NS ; Number of seats

5.02.2 MODEL FOR INDIRECT OPERATING COST

(42) Indirect operating costs consist of the following items.

- System cost
  Labor, property, equipment
  Station maintenance cost (from ground facilities)
- Local cost
  Landing fees and servicing
- Aircraft control cost
  All aircraft handling charges
- Cabin attendant cost
  Stewardesses
- Cost of food
  All food and refreshments served without charge
- Passenger handling cost
  Cost of handling passenger's baggage
- Cargo handling cost
  Handling mail, freight and express cargo
- Other passenger service costs
  All activities related to passenger comfort, safety and convenience
- Freight commissions and advertising cost
  Expenses associated with creating a public preference for an individual air carrier, stimulating air travel, and providing timetables

- General and administrative cost
  Costs of overall corporate nature

The methods used in Indonesia to calculate these costs are described below

(43) - System cost

System cost = RATElabor * BT

where,

RATElabor : Average labor rate for airframe maintenance, engine maintenance (= RP. 5,300 / hour)

BT : Block time (in hour)

(44) - Local cost

Landing fees at domestic airports are as follows:

Aircraft weight		Landing fees
up to 40,000 kg	;	RP. 920/1,000kg
from 40,000 kg to 100,000 kg	;	RP. 36,800 + RP. 1,230/1,000kg (over 40,000kg)
over 100,000 kg	;	RP.110,600 + RP. 1,430/1,000kg (over 100,000kg)

(A further RP 14,800 is added for night flights between 6:00pm and 12:00pm)

The air navigation facility charge is RP. 280 / (route unit). The route unit value is calculated as (stage length) / 1,000.

(45) - Aircraft control cost

For international airports (Jakerta, Surabya, Ujungpandang, Medan, Biak, Denpasar, Manado, Balikpapan, Padan) ;

Aircraft handling charge = RP. 160 / 1,000kg
Parking = RP. 310 / 1,000kg
(No charge within 2 hours)

For Category-I airports :
75% of International airports

For Category-II and Category-III airports :
50% of International airport

For Category-IV, Category-V and pioneer airports :
No charge

(46) - Cabin attendant cost

Cabin attendant cost = RATEatt * Natt * BT

where,

RATEatt ; Rate of attendants (US$ 8 / hour)
Natt ; Number of attendants
BT ; Block time (in hour)

(47) - Cost of food

Cost of food = CSTfd * LF * NS

where,

CSTfd ; Cost of foods (US$ 2.01 / pax.) But this is increased by 20% to US$ 2.41 / pax., to cover non-food costs on board.
LF ; Passenger load factor
NS ; Number of seats

(48) - Passenger handling cost

Passenger handling cost = CSTph * LF * NS

where,

CSTph ; = RP 205 / pax.
LF ; Passenger load factor
NS ; Number of seats

(49) - Cargo handling cost

No charge is made for cargo handling in Indonesia.

(50) - Other passenger service costs

Other passenger service costs = CSTos * LF * NS

where,

CSTos differs according to the airport category as below.(only for domestic pax.)

International airports	:	RP.2,000 / pax.
Category - I airports	:	RP.1,800 / pax.
Category - II airports	:	RP.1,400 / pax.
Category - III airports	:	RP.1,200 / pax.
Category - IV airports	:	RP. 800 / pax.
Category - V airports	:	RP. 500 / pax.

(51) - Freight commissions and advertising cost

Commission cost =

0.02 * (Revenue/pax.km) * NS * LF * SL

Advertising cost =

0.015 * (Revenue/pax.km) * NS * LF * SL

where,

NS ; Number of seats

LF ; Passenger load factor

SL ; Stage length (in km)

(52) - General and administrative cost

General and administrative cost =

0.014 * (Revenue/pax.km) * NS * LF * SL

(53) Indirect operating costs are calculated on the basis of these equations as follows.

IOC/FLT = System cost + Local cost
+ Aircraft control cost
+ Cabin attendant cost + Cost of food
+ Passenger handling cost
+ Other passenger service costs
+ Freight commission and advertising cost
+ General and administrative cost

IOC/mile = (IOC/FLT) / SL

IOC/seat-mile = (IOC/mile) / NS

where,

SL ; Stage length (in mile)

NS ; Number of seats

5.03 OPERATING COST FOR OTHER AIRCRAFT

1) Helicopter

(54) Examples of helicopter DOC's are given for BO-105 (4 seats) and Bell 412 (13 seats). The DOC for a 10 seats helicopter has been calculated by interpolating these helicopters and shown by the following equations.

- Crew Cost

Crew Cost = RATEcrew * BT * Ncrew

where,

RATEcrew ; Rate of pilots and co-pilots (= US$ 60 / hour)

BT ; Block time (in hour)

Ncrew ; Number of pilots and co-pilots

- Maintenance Cost

Maintenance Cost = MH/FC * RATEmh * BT

where,

MH/FC ; Maintenance hour per flight (about 1.08 hours / flight)

RATEmh ; Man hour rate of maintenance (PR. 5,300 / hour)

- Reserve for MDC Overhaul

Reserve for MDC Overhaul = US$ 42.36 * BT

where,

MDC ; Major Dynamic Components

- Reserve for Engine Overhaul

  Reserve for Engine Overhaul = US$ 54.59 * BT

- Time Retirement Parts

  Time Retirement Parts = US$ 19.50 * BT

- Reserve for Engine/Airframe Spares

  Reserve for Engine/Airframe Spares = US$ 24.48 * BT

- Fuel & Oil

  Fuel & Oil = (FC * PRICEf + OC * PRICEo) * BT

  Where;

  PRICEf ; Fuel price (= RP. 250 / l)

  PRICEo ; Oil price (= RP. 2225 / l)

  FC ; Fuel consumption (= 550 lbs/hour)

  OC ; Oil consumption (= 0.135 lbs/hour/engine)

The DOC/FLT of a helicopter can be calculated by the following equation.

DOC/FLT = Crew Cost + Maintenance Cost
+ Reserve for MDC Overhaul
+ Reserve for Engine Overhaul
+ Time Retirement Parts
+ Reserve for Engine/Airframe Spares
+ Fuel and Oil

2) STOL

(55) The calculation of operating cost for a STOL is similar to that for a conventional airplane, and the equations for direct and indirect operating costs described in Section 5.02.1 and 5.02.2 can be applied.

3) Amphibian

(56) The maintenance cost constituting the direct operating cost is higher. The maintenance cost per flight cycle does not change, but the maintenance cost per flight hour is about 1.3 times higher.
The maintenance cost can be obtained by modifying the equations in Section 5.02.1 in the following manner.

- Airframe Labor Cost

  $MH/FH = 1.3 * (1.25 * 5.61 * (Wempe/1000) + 0.68)$

- Maintenance Cost of Airframe

  $MC/FH = 1.3 * 2.85 * (CSTaf / 10^6)$

- Engine Labor Cost

  $MH/FH = 1.3 * (0.41 * (Pmax/10^3) + 0.14) * Neng$

- Material Cost of Engine

  $MC/FH = 1.3 * 28.0 * (CSTeng/10^6) * Neng$

The equations for indirect operating cost discribed in section 5.02.2 can be applied.

5.04 AIRPORT DATA

(57) The data relating to the airports used for traffic demand forcast are shown on Table-5.1, compose of

- Airport city name
- City code
- Airport location
- Airport category
- Runway length
- Airport code

Talbe-5.1(1/5) Data of Airport

No.	Airport City Name	City Code	Airport Location		Airport Category	Runway Length(m)	Airport Code
			Longitude	Latitude			
1	Sabang	101001	95.21	-5.52	V	1250	3000
2	Banda Aceh	101002	95.25	-5.31	II	1850	3001
3	Lhok Seumave	101003	95.56	-5.13	V	800	3002
4	Meulaboh	101004	96.13	-4.15	IV	900	3003
5	Sinabang	101005	96.14	-2.25	IV	750	3005
6	Tapaktuan	101008	97.18	-3.18	IV	750	3004
7	P.Panjang	101009	97.19	-2.03	IV	1400	3160
8	Medan	102010	98.40	-3.33	I *	2900	3006
9	Sidikalang	102011	98.21	-2.43	IV	750	3007
10	Prapat	102012	98.56	-2.35	IV	750	3008
11	Rantauprapat	102013	99.42	-2.16	O	750	3009
12	Sibolga	102014	98.35	-1.33	IV	1400	3010
13	Padang Sidempuan	102015	99.27	-1.23	IV	750	3011
14	Gn.Sitoli	102016	97.37	-1.16	IV	750	3012
15	P.Tanah Bala	102017	98.27	-0.06	-	-	3161
16	Lubuksikaping	103018	100.02	-0.11	III	1300	3013
17	Padang	103021	100.21	0.53	II *	2150	3016
18	Siberut	103022	99.04	1.26	V	650	3017
19	Sipora	103023	99.41	2.05	V	750	3018
20	Dumai	104024	101.26	-1.35	II	1800	3015
21	Pakanbaru	104025	101.27	-0.28	II	2150	3014
22	Rengat	104026	103.19	-0.20	III	1300	3019
23	P.Batam	104027	104.06	-1.07	II	2500	3020
24	Natuna	104029	108.23	-3.57	III	1500	3021
25	Jambi	105030	103.39	1.38	II	1670	3022
26	Muara Bungo	105031	101.58	1.22	IV	815	3023
27	Sungai Penuh	105032	101.22	2.06	IV	650	3024
28	Lubuk Linggau	106033	103.09	3.09	IV	1000	3026
29	Palembang	106034	104.42	2.54	I	2200	3028
30	Kayu Agung	106035	104.52	3.19	IV	1300	3029
31	Muara Enim	106036	103.50	3.36	IV	900	3027
32	Bangka	106038	106.08	2.10	II	1520	3030
33	Tg.Pandan	106039	107.45	2.45	III	1650	3031
34	Bengkulu	107040	102.20	3.52	III	1800	3025

Talbe-5.1(2/5) Data of Airport

No.	Airport City Name	City Code	Airport Location Longitude	Latitude	Airport Category	Runway Length(m)	Airport Code
35	Kotabumi	108041	104.56	4.46	-	-	3162
36	Tanjung Karang	108042	105.11	5.15	II	1520	3032
37	Jakarta(CGK)	209043	106.39	6.08	I *	3660	3033
38	Pandeglang	210044	106.11	6.29	II	1800	3034
39	Tangerang	210045	106.34	6.18	II	1600	3035
40	Sukabumi	210049	106.58	6.55	-	-	3036
41	Bandung	210051	107.35	6.54	II	1959	3037
42	Cirebon	210052	108.23	6.35	O	725	3033
43	Tasikmalaya	210053	108.17	7.25	III	1200	3039
44	Tegal	211054	109.08	6.51	-	-	3040
45	Semarang	211055	110.23	6.59	II	1650	3043
46	Cilacap	211056	109.03	7.38	V	660	3041
47	Kebumen	211057	109.32	7.42	-	-	3042
48	Cepu	211058	111.32	7.12	IV	900	3046
49	Solo	211059	110.45	7.31	III	1850	3044
50	Yogyakarta	212060	110.26	7.47	II	1850	3045
51	Madium	213061	111.30	7.37	O	1800	3047
52	Kediri	213062	112.03	7.47	-	-	3048
53	Surabaya	213063	112.46	7.22	I *	3000	3049
54	Sumenep	213064	113.56	7.04	IV	850	3051
55	Malang	213065	112.44	7.54	II	2250	3050
56	Banyuwangi	213066	113.41	8.10	II	2000	3052
57	Denpasar	214067	115.10	8.45	I *	2700	3053
58	Ampenan	315068	116.04	8.32	III	1600	3054
59	Sumbawa Basar	315069	117.25	8.30	IV	1470	3055
60	Bima	315070	118.42	8.30	III	1400	3056
61	Ruteng	316071	120.29	8.35	IV	1300	3057
62	Ende	316072	121.39	8.52	V	900	3058
63	Maumere	316073	122.15	8.38	III	1470	3059
64	Lamatukang	316074	123.39	8.22	IV	750	3060
65	Alor	316075	124.34	8.13	V	850	3061
66	Tambolaka	316076	119.24	9.24	O	1300	3062
67	Waingapu	316077	120.18	9.40	III	1500	3063
68	Sabu	316078	121.50	10.30	V	800	3064

Talbe-5.1(3/5) Data of Airport

No.	Airport City Name	City Code	Airport Location Longitude	Airport Location Latitude	Airport Category	Runway Length(m)	Airport Code
69	Rote	316079	122.50	10.53	V	1100	3065
70	Naikliu	316080	123.50	9.30	O	1500	3066
71	Kupang	316081	123.40	10.10	II	1850	3067
72	Atambua	316083	124.54	9.20	IV	850	3068
73	Baucau	317084	126.23	8.37	III	3000	3070
74	Dili	317085	125.31	8.32	III	1750	3069
75	Singkawang II	418088	109.40	-1.05	IV	970	3071
76	Pontianak	418089	109.24	0.09	I	1655	3072
77	Sanggau	418090	110.31	-0.09	O	600	3073
78	Putusibau	418091	112.56	-0.50	IV	850	3074
79	Sintang	418092	111.29	-0.04	IV	900	3075
80	Ketapang	418093	109.58	1.51	IV	1000	3076
81	Muaratewe	419094	114.53	0.31	O	600	3077
82	Buntok	419095	114.50	1.44	IV	600	3078
83	Palangka Raya	419097	113.56	2.16	II	1650	3079
84	Sampit	419098	112.59	2.33	V	855	3080
85	Pangkalan Bun	419099	111.40	2.45	III	1600	3081
86	Rantau	420100	115.13	2.59	–	–	3082
87	Batu Licin	420101	115.59	3.28	O	1300	3085
88	Kotabaru	420102	118.26	3.17	III	900	3086
89	Banjarmasin	420103	114.45	3.27	I	1870	3083
90	Tanjung Selor	421104	117.26	-2.50	O	750	3089
91	Long Bawan	421105	115.41	-3.52	V	700	3087
92	Tarakan	421106	117.34	-3.20	III	1650	3088
93	Tg.Redep	421107	117.26	2.09	V	760	3090
94	Samarinda	421109	117.09	0.27	III	900	3091
95	Balikpapan	421110	116.54	1.16	I *	1800	3092
96	Tanah Grogot	421111	116.13	1.52	IV	640	3093
97	Melangguane	522112	126.42	-4.03	IV	850	3094
98	Tahuna	522113	125.25	-3.43	IV	850	3095
99	Manado	522114	124.55	-1.32	I *	2500	3096
100	Bolaang Mongondow	522115	124.22	-0.42	O	710	3097
101	Gorontalo	522116	122.55	-0.39	III	1650	3098
102	Toli-Toli	523117	120.48	-1.08	IV	850	3099

Talbe-5.1(4/5) Data of Airport

No.	Airport City Name	City Code	Airport Location		Airport Category	Runway Length(m)	Airport Code
			Longitude	Latitude			
103	Palu	523118	119.53	0.55	II	1625	3100
104	Poso	523119	120.43	1.24	IV	1117	.3101
105	Salea	523120	121.36	1.56	-	-	3102
106	Luwuk	523121	122.46	1.01	IV	850	3103
107	P.Banggai	523122	123.36	1.40	-	-	3104
108	Malili	524123	121.06	2.38	IV	850	3105
109	Mamuju	524124	119.02	2.35	IV	710	3106
110	Makale	524125	119.52	3.05	O	750	3107
111	Watampone	524127	120.05	4.55	-	-	3108
112	Ujung Pandang	524128	119.33	5.04	I *	2500	3109
113	Benteng	525130	120.33	6.06	-	-	3110
114	Kendari	525131	122.26	4.05	III	1650	3111
115	Kolaka	525132	121.32	4.18	IV	1050	3112
116	Kasiputo	525133	122.08	4.49	-	-	3113
117	Bau-Bau	525134	122.33	5.31	O	850	3114
118	Raha	525137	122.36	4.48	O	1200	3115
119	Morotai	626138	128.20	-2.04	V	1000	3116
120	Galela	626139	127.50	-1.49	IV	750	3117
121	Ternate	626140	127.26	-0.50	III	1400	3118
122	Buli Serani	626141	128.09	-1.12	-	-	3119
123	Labuha	626142	127.30	0.39	V	850	3120
124	P.Obi	626143	127.35	1.23	-	-	3121
125	P.Gebe	626144	129.48	0.13	-	-	3122
126	Mangole	626145	125.09	1.47	V	1200	3123
127	Taliabu	626146	124.33	1.37	O	900	3124
128	P.Burn	626147	127.05	3.15	IV	1400	3125
129	Seram	626148	128.53	3.21	V	850	3126
130	Ambon	626149	128.05	3.42	II	1850	3127
131	Bula	626150	130.30	3.06	O	985	3128
132	Geser	626151	131.23	4.01	-	-	3129
133	Bandanaera	626152	129.55	4.35	V	700	3130
134	Langgur	626153	132.43	5.40	O	1300	3131
135	Saumlaki	626154	131.18	7.57	O	850	3132
136	P.Babar	626155	129.38	7.50	-	-	3133

Talbe-5.1(5/5) Data of Airport

No.	Airport City Name	City Code	Airport Location Longitude	Airport Location Latitude	Airport Category	Runway Length(m)	Airport Code
137	P.Wetar	626156	126.05	7.40	-	-	3134
138	P.Waka	626157	134.33	5.53	V	850	3135
139	P.Waigio	727158	130.53	0.22	-	-	3136
140	P.Salawati	727159	130.44	0.13	-	-	3137
141	P.Misool	727160	130.03	1.46	-	-	3138
142	Sorong	727161	131.07	0.56	III	1650	3139
143	Manokwari	727162	134.03	0.53	III	1400	3140
144	Bintuni	727163	133.31	2.06	V	650	3141
145	Fak-Fak	727164	132.13	2.56	IV	630	3142
146	Kaimana	727165	133.41	3.39	V	1500	3143
147	Timika	727166	136.54	4.32	II	1800	3144
148	Paniai	727167	135.30	3.22	III	1150	3145
149	Enarotali	727168	136.25	3.55	IV	600	3146
150	Waren	727169	136.23	2.16	O	470	3147
151	Serui	727170	136.14	1.52	IV	650	3148
152	Sarmi	727171	138.45	1.51	IV	900	3149
153	Jayapura	727172	140.31	2.34	II	1850	3150
154	Oksibil	727173	140.36	4.51	V	600	3151
155	Jayawijaya	727174	138.57	4.04	III	1500	3152
156	Agast	727175	138.15	5.31	O	1000	3153
157	Kepi	727176	139.27	6.40	V	675	3154
158	Tanah Merah	727177	140.18	6.06	IV	1050	3155
159	Merauke	727178	140.28	8.37	III	1850	3156
160	Okaba	727179	139.42	8.06	V	600	3157
161	Kimaan	727180	138.51	7.52	O	600	3158
162	Biak	727181	136.07	1.12	II *	3570	3159

* : International Airport

\- : No Airport

Source : 1) AERONAUTICAL INFOMATION PUBLICATION INDONESIA (A.I.P)
Aeronautical Information Service, D.G.A.C

2) DIRECTORY OF AERODROMES FOR LIGHT AIRCRAFT, VOL. I & II
Ninth Edition, 1987 (DOK.PA.500.1.87),
Aeronautical Information Service, D.G.A.C

3) DATA DAN PRASARANA POKOK BANDAR UDARA
POSISI : NOVEMBER 1987 (D.G.A.C)

(58) The airport city name entered in the table is the name of the city where an airport is located.

(59) The city code consists of 7 digits. The first two digits stand for island names as defined below.

01 Sumatera
02 Jawa and Bali
03 Nusa Tenggara
04 Kalimantan
05 Sulawesi
06 Irian Jaya

The following two digits show the province an airport belong to.

01 DI. Aceh
02 Sumatera Utara
03 Sumatera Barat
04 Riau
05 Jambi
06 Sumatera Selatan
07 Bengkulu
08 Lampung
09 DKI. Jakarta
10 Jawa Barat
11 Jawa Tengah
12 DI. Yogjakarta
13 Jawa Timur
14 Bali
15 Nusa Tenggara Barat
16 Nusa Tenggara Timur
17 Timor Timur
18 Kalimantan Barat
19 Kalimantan Tengah
20 Kalimantan Selatan
21 Kalimantan Timur

22 Sulawesi Utara
23 Sulawesi Tengah
24 Sulawesi Selatan
25 Sulawesi Tenggara
26 Maluku
27 Irian Jaya

The last three digits are serial numbers.

(60) The location of an airport is presented in longitude and latitude in Table. The longitude is expressed as longitude east in degrees. A positive latitude correspondes to the latitude south degrees and a negative latitude means the latitude north degrees.

(61) The airport category is the airport classification according to DGAC (Directorate General of Air Communications), The airports which were classified from Category-I to Category-V is controled by DGAC.
The airports which have " O " in category column are owned by private companies or controled by Indonesian military.

(62) Runway length of an airport is given in meters. Runway length of an airport to be developed in future is not defined in this table.

(63) The airport code for computer calculation is use only for the relationship between estimation traffic demand forcast and basic aircraft specification estimation on data exchange.

5.05 EVALUATION OF MODEL PREPARATION OF AIRCRAFT SPECIFICATION

(64) To prepare the basic aircraft specifications, the computer program TCHART has been introduced. The variables to be input in the model are quoted from "Statistik Angkutan Udara, 1984". In addition, the following documents are referred to in the study.

- Directorat Jenderal Perhubungan Udara, Proyek Pengembangan Angkutan Udara
- Pengkajian Jaringan Trayek dan Pengguaan, Jenis Pesawat Untuk Rute Utama Term II
- Konsep Laporan Akhir (Draft Final Report), 1986, by PT. Lenggogeni

The actual block time to be compared with the estimated one has been extracted from the timetables of airlines.

(65) Cross checking has been made between an actual record and estimated one based on the model in respect to the following items.

- Flight frequency or number of flights per week
- Block time

The above two items have been focused on because of the reasons below. For estimate of flight frequency, the following factors have to be taken into account.

- Number of passengers per year
- Standard number of passenger seats of aircraft
- Passenger load factor

In the above, number of passengers per year and passenger load factor have been employed from the actual records. The standard number of passenger seats has been given by the relation stated in para.(6). As such, the number of passenger seats has been checked and evaluated relative to the actual and the estimated flight frequencies.

(66) For estimation of block time, the following figures are given.

- Air route stage length
- Average cruising speed

The air route stage length has been calculated based on the actual air route. The average cruising speed has been obtained from the equation presented in para.(18). The maximum cruising speed for estimation of the average cruising speed has been inferred from the equation in relation with the standard number of seats shown in para.(17). Thus, the comparison between the actual and the estimated block times corresponds to cross checking with the standard number of passenger seats.

(67) Cross checking has been made in respect of the following three types of aircraft since the data on other types of aircraft are deficient.

- Aircraft with up to 50 seats
- Aircraft with up to 100 seats
- Aircraft with up to 340 seats

In fact, the maximum number of seats of these three types of aircraft spread over those of types of aircraft. It is thus considered that cross checking on the above three types of aircraft is sufficient to evaluate the automation model. The results of cross checking are summarized in Table-6.4. The deviation between estimation and actuality is less than 10 minutes for block time and is within 7% for flight frequency. As a while, it is considered that the model can be applied for preparation of specifications of aircraft to be allocated in future to specific air routes.

Table-5.2 Result of Comparison between Actual and Estimated Flight Frequencies and Block Time

Air Route	Passenger Demand (Pax./Year)	Aircraft Model	No. of Passenger Seats		Flight Frequency (No.of Flights/Week)			Block Time (hr:min)		
			Actual	Estimation	Actual	Estimation	(EST-ACT)/ACT	Actual	Estimation	Difference
Jakarta-Denpasar	467,350	DC-10 A-300	226 244	340	10 44	55	+0.02	1:45	1:38	-0:07
Jakarta-Ujungpandang	200,698	A-300	244	340	28	29	+0.04	2:15	2:10	-0:05
Jakarta-Palembang	287,726	DC-9	97	100	70	75	+0.07	1:00	0:59	-0:01
Jakarta-Yogyakarta	179,846	DC-9	97	100	70	75	+0.07	1:05	1:02	-0:03
Jakarta-Banjarmasin	95,168	DC-9	97	100	28	30	+0.07	1:40	1:36	-0:04
Semarang-Surabava	62,440	F-28	85	100	28	26	-0.07	0:45	0:49	+0:04
Ujungpandang-Palu	52,726	F-28	85	100	28	26	-0.07	1:10	1:02	-0:08
Ujungpandang-Kendari	47,350	F-28	85	100	14	13	-0.07	0:50	0:53	+0:03
Medan-Banda Ache	37,320	F-28	85	100	14	13	-0.07	0:55	0:59	+0:04
Balikpapan-Banjarmasin	87,692	HS-748	47	50	52	54	+0.04	1:10	1:10	0:00
Balikpapan-Palu	41,148	HS-748	47	50	28	29	+0.04	1:10	1:09	-0:01
Bandung-Yogyakarta	7,575	HS-748	47	50	6	6	0	1:10	1:08	-0:02
Yogyakarta-Surabaya	21,116	F-27	44	50	14	14	0	1:10	1:06	-0:04

Source : * STATISTIK ANGKUTAN UDARA, 1984.
* PENGKAJIAN JARINGAN TRAYEK DAN PENGSUAAN JENIS PESAWAT UNTUK RUTE UTAMA TERM II, KONSEP LAPORAN AKHIR (DRAFT FINAL REPORT), 1986, PT. Lenggogeni

5.06 ESTIMATION OF BASIC AIRCRAFT SPECIFICATIONS

(68) Basic specifications of aircraft to meet the air traffic demand of the domestic airlines anticipated by the year of 1994 and 2004 has been studied on the projection of traffic demand in the previous section.

(69) The air traffic demand employed in the preparation of aircraft specifications is the total annual traffic demand assigned to the respective specific air route based on the traffic demand forcast presented in Section 4 in terms of the origin/destination trips numbers. (O-D tables of airport - airport air traffic demand are presented in Appendix-5.1 and -5.2.)

The air routes taken into account comprise the existing airways and the future potential air routes as discussed in Section 4.

The conceivable air routes will come up to 219 routes in the year 1994 with the projected passengers of about 12.8 million. In 2004, there will be 235 routes and 16.7 million passengers approximately.

(70) The route characteristics, which give the stage length and the annual passengers , can be classified as shown in Table-5.3. The average stage length and average number of passengers are classified into short (up to 300 km), medium (from 300 to 900 km), and long hauls (more than 900 km), and given in Table-5.4 .

(71) The aircraft to be allocated to each air route have been selected based on the minimum direct operating cost (DOC/seat-mile), but the type and size of aircraft selected in such manner are greatly affected by the runway length of the airports at both ends of route. Therefore, the following three scenarios have been assumed in selecting

Table-5.3 Route Characteristics

Year	Distance (km) / Demand ($X10^3$)	Short haul (~300)			Medium haul (300~900)			Long haul (900~)			Total		
		Route	Pax. ($X10^3$)	Pax-km ($X10^6$)	Route	Pax. ($X10^3$)	Pax-km ($X10^6$)	Route	Pax. ($X10^3$)	Pax-km ($X10^6$)	Route	Pax. ($X10^3$)	Pax-km ($X10^6$)
1994	~ 30	60	713	133	53	718	313	3	70	120	116	1502	570
	30 ~ 120	33	1600	344	30	1728	911	11	829	1283	74	4159	2539
	120 ~ 300	4	793	123	12	2024	1143	5	830	944	21	3647	2211
	300 ~ 900	0	0	0	4	1835	1064	4	1619	1973	8	3454	3037
	900 ~	0	0	0	0	0	0	0	0	0	0	0	0
	Total	97	3106	600	99	6305	3431	23	3348	4320	219	12763	8356
2004	~ 30	53	583	104	47	690	299	3	84	114	103	1356	516
	30 ~ 120	45	2495	527	35	2061	1098	18	1266	1606	98	5821	3231
	120 ~ 300	4	796	151	14	2710	1506	6	1019	1700	24	4526	3357
	300 ~ 900	1	331	31	4	2477	1419	5	2234	2606	10	5041	4056
	900 ~	0	0	0	0	0	0	0	0	0	0	0	0
	Total	103	4205	813	100	7938	4322	32	4603	6026	235	16742	11161

Table-5.4 Route Characteristics (Summing-up)

Year	Distance (km)	Route	Pax. ($X10^3$)	Pax-km ($X10^6$)	Average Stage Length (km)	Average Route Pax. ($X10^3$)
1994	Short haul (~300)	97	3106	600	193	32
	Medium haul (300~900)	99	6305	3431	544	64
	Long haul (900~)	23	3348	4320	1290	146
	Total Route	219	12763	8356	655	58
2004	Short haul (~300)	103	4205	813	193	41
	Medium haul (300~900)	100	7938	4322	544	79
	Long haul (900~)	32	4603	6026	1309	144
	Total Route	235	16742	11161	667	71

(72) SCENARIO - A

It is assumed in this scenario that the construction and extension of airports for each route are implemented in the most favorable way for the particular aircraft chosen for each route.
Therefore, the aircraft operating cost is minimum and the amount of investment on construction and extension of airports is maximum in this case.

(73) SCENARIO - B

Senario-B is a compromize plan between those in Scenario-A and Scenario-C. The investments on extension of existing airports and construction of new airports including hydroport in the period of the year 1994 and 2004 have been assumed as given in Para.(81), and fleets including amphibians, as well as conventional airplanes, have been studied.
It has been assumed that helicopters may be allocated when the stage length is not more than 100 km and there is no airport in either of ends of a route. It has also been assumed the STOL planes may be allocated when at least one of airports of a route has runway 3,000 feet or more in length, and it is constrained to use aircraft having 20 or 30 seats.

(74) SCENARIO - C

In this scenario, it is assumed that no new investment is made for construction of new airports and/or extension of existing airports. This is, the optimal aircraft (a conventional airplane, and with DOC minimum for a route) is selected in case that the runway length

of the airports at both ends of a route are sufficient for the takeoff and landing field length of the economically optimal aircraft.
Otherwise, that is, if the takeoff and landing field lengths of optimul aircraft is longer than the available runways, an aircraft having smaller number of seats and capable of takeoff and landing on available runways are selected.

These procedure for aircraft selection are illustrated in Figure 5.1.

1) In the case of SCENARIO - A

(75) A total of 162 airports have been studied for air net work among 181 zones to which the territory of the Republic of Indonesia is divided, including imaginary airports to be constructed in establishing the air traffic demand forecast as well as existing ones (presented in Table-5.1).
But, Scenario-A produces the data of new airports required and those of airports to be extend, including runway length required, when the optimal aircraft for each route is determined.

(76) The number of aircraft which required in meeting demand of each air route (airport to airport) for air traffic demand in the year 1994 and 2004 have been estimated, the size and number of aircraft were shown in Table-5.5.
In this scenario, it is assumed that the construction and extension of airports for each route are implemented in the most favorable way for the particuiar aircraft chosen for each route, therefore, there are necessity for construction and extension of airports shown in Table-5.6 (year : 1994) and Table-5.7 (year : 2004).

Figure-5.1 Procedure for Aircraft Selection

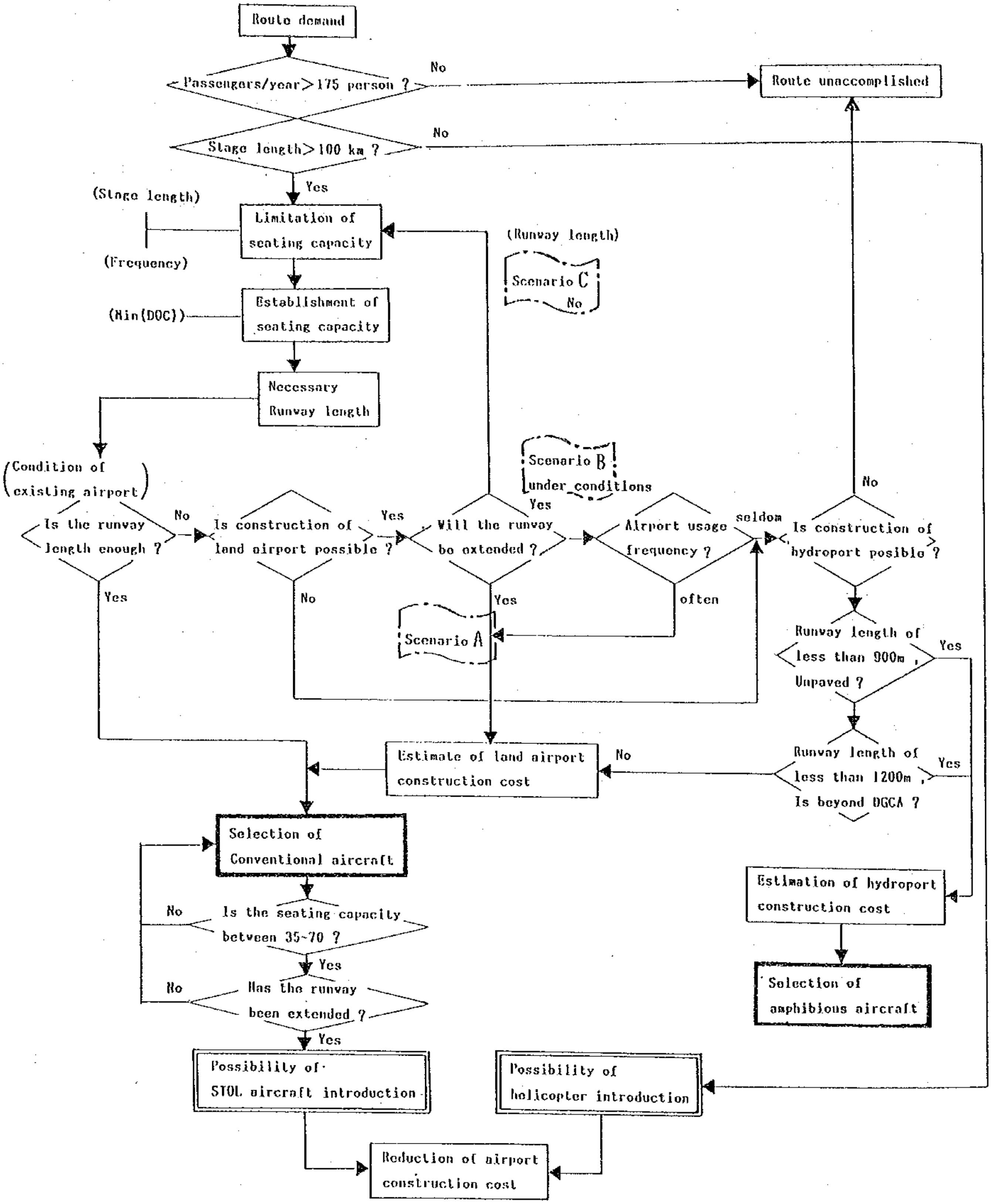


Table-5.5(1/2) Fleet in 1994 (Scenario-A)

Aircraft Type : Conventional

Seat	No.of A/C	Flt/Week	Pax(x10³)	Pax*Km(x10⁶)	Route
10	23	389	120	17.1	23
20	37	625	385	97.2	37
35	56	1206	1277	389.5	54
50	32	823	1266	424.0	32
70	15	394	847	401.8	15
100	19	519	1589	969.8	19
150	14	462	2127	1031.5	13
225	16	398	2744	2679.8	11
340	5	110	892	1239.5	4
510	4	124	1512	1105.2	4
Total	221	5050	12760	8355.4	212

Table-5.5(2/2) Fleet in 2004 (Scenario-A)

Aircraft Type : Conventional

Seat	No.of A/C	Flt/Week	Pax(x10³)	Pax*Km(x10⁶)	Route
10	21	389	120	16.9	21
20	33	602	370	88.4	33
35	46	1013	1072	310.7	45
50	40	1046	1608	552.8	40
70	23	684	1469	596.5	23
100	25	681	2085	1309.2	25
150	17	399	1849	1712.7	15
225	26	710	4881	3641.3	16
340	4	113	918	841.4	3
510	7	192	2349	2088.3	6
Total	242	5829	16720	11158.2	227

Aircraft Type : Helicopter

Seat	No.of A/C	Flt/Week	Pax(x10³)	Pax*Km(x10⁶)	Route
10	2	60	18	1.6	1
Total	2	60	18	1.6	1

Table-5.6(1/3) Airport Extension and Construction
(Year:1994 , Scenario-A)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
1	Banda Aceh	2	1850	2800	225
2	Sinabang	5	750	1400	50
3	Tapaktuan	8	750	800	20
4	Prapat	12	750	800	20
5	Sibolga	14	1400	1800	70
6	Padang Sidempuan	15	750	1100	35
7	Gunung Sitoli	16	750	1400	50
8	Padang	21	2500	2900	510
9	Sipora	23	750	1100	35
10	Pakanbaru	25	2150	2900	340
11	Pengat	26	1300	1800	70
12	P.Batam	27	2500	2800	225
13	Jambi	30	1670	2400	150
14	Muara Bungo	31	815	1100	35
15	Palembang	34	2200	2900	510
16	Muara Enim	36	900	1100	35
17	Bangka	38	1520	2400	150
18	Tanjung Pandan	39	1650	2400	150
19	Bengkulu	40	1800	2000	100
20	Tanjung Karang	42	1520	2800	225
21	Bandung	51	2000	2400	150
22	Cirebon	52	725	1400	50
23	Semarang	55	1650	2400	150
24	Cilacap	56	660	1800	70
25	Solo	59	1850	2000	100
26	Yogyakarta	60	1850	2800	225
27	Ampenan	68	1600	1800	70
28	Kupang	81	1850	2800	225
29	Atambua	83	850	1100	35
30	Singkawang II	86	970	1400	50

Table-5.6(2/3) Airport Extension and Construction
(Year:1994 , Scenario-A)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
31	Pontianak	89	1655	2900	510
32	Sanggau	90	600	1100	35
33	Putusibau	91	850	1100	35
34	Sintang	92	900	1400	50
35	Ketapang	93	1000	1100	35
36	Muaratewe	94	600	800	20
37	Buntok	95	600	800	20
38	Palangka Raya	97	1650	1800	70
39	Sampit	98	855	1400	50
40	Kotabaru	102	900	1800	70
41	Banjarmasin	103	1870	2800	225
42	Tanjung Selor	104	750	1100	35
43	Long Bawan	105	700	1100	35
44	Tarakan	106	1650	2000	100
45	Tanjung Redep	107	760	1100	35
46	Samarinda	109	900	2400	150
47	Balikpapan	110	1800	2900	340
48	Tahuna	113	850	1400	50
49	Manado	114	2500	2800	225
50	Toli-Toli	117	850	1100	35
51	Palu	118	1625	2000	100
52	Luwuk	121	850	1400	50
53	Malili	123	850	1100	35
54	Mamuju	124	710	800	20
55	Makale	125	750	2000	100
56	Ujung Pandang	128	2500	2900	340
57	Kolaka	132	1050	1100	35
58	Bau-Bau	134	850	1100	35
59	Ambon	149	1850	2900	340
60	Bandanaera	152	700	800	20

Table-5.6(3/3)   Airport Extension and Construction
(Year:1994 , Scenario-A)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
61	Sorong	161	1650	1800	70
62	Fak-Fak	164	630	1100	35
63	Paniai	167	1150	1400	50
64	Enarotali	168	600	800	20
65	Serui	170	650	1100	35
66	Jayapura	172	1850	2400	150
67	Oksibil	173	600	800	20
68	Agast	175	1000	1100	35

Airport Construction

No.	City Name	Zone No.	Runway Length (m)	Max Seats
1	Kotabumi	41	1100	35
2	Sukabumi	49	1100	35
3	Kediri	62	1100	35

Table-5.7(1/3) Airport Extension and Construction
(Year:2004 , Scenario-A)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
1	Banda Aceh	2	1850	2900	340
2	Sinabang	5	750	1400	50
3	Tapaktuan	8	750	1100	35
4	Prapat	12	750	800	20
5	Sibolga	14	1400	2000	100
6	Padang Sidempuan	15	750	1100	35
7	Gunung Sitoli	16	750	1800	70
8	Padang	21	2500	2900	340
9	Sipora	23	750	1400	50
10	Dumai	24	1800	2000	100
11	Pakanbaru	25	2150	2900	510
12	Rengat	26	1300	1800	70
13	Natuna	29	1500	1800	70
14	Jambi	30	1670	2800	225
15	Muara Bungo	31	815	1400	50
16	Palembang	34	2200	2800	225
17	Muara Enim	36	900	1400	50
18	Bangka	38	1520	2800	225
19	Tanjung Pandan	39	1650	2800	225
20	Bengkulu	40	1800	2000	100
21	Tanjung Karang	42	1520	2800	225
22	Bandung	51	2000	2400	150
23	Cirebon	52	725	1400	50
24	Semarang	55	1650	2900	510
25	Cilacap	56	660	1800	70
26	Solo	59	1850	2400	150
27	Yogyakarta	60	1850	2900	340
28	Malang	65	2250	2400	150
29	Ampenan	68	1600	2000	100
30	Kupang	81	1850	2400	150

Table-5.7(2/3) Airport Extension and Construction
(Year:2004 , Scenario-A)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
31	Atambua	83	850	1100	35
32	Singkawang II	86	970	1800	70
33	Pontianak	89	1655	2800	225
34	Sanggau	90	600	1100	35
35	Putusibau	91	850	1100	35
36	Sintang	92	900	1400	50
37	Ketapang	93	1000	1400	50
38	Muaratewe	94	600	800	20
39	Buntok	95	600	1100	35
40	Palangka Raya	97	1650	2000	100
41	Sampit	98	855	1800	70
42	Kotabaru	102	900	1800	70
43	Banjarmasin	103	1870	2800	225
44	Tanjung Selor	104	750	1100	35
45	Long Bawan	105	700	1400	50
46	Tarakan	106	1650	2400	150
47	Tanjung Redep	107	760	1400	50
48	Samarinda	109	900	2800	225
49	Balikpapan	110	1800	2900	510
50	Tanah Grogot	111	640	1400	50
51	Tahuna	113	850	1400	50
52	Gorontalo	116	1650	1800	70
53	Toli-Toli	117	850	1100	35
54	Palu	118	1625	2400	150
55	Luwuk	121	850	1400	50
56	Malili	123	850	1100	35
57	Mamuju	124	710	1100	35
58	Makale	125	750	2400	150
59	Ujung Pandang	128	2500	2800	225
60	Kendari	131	1650	2000	100

Table-5.7(3/3) Airport Extension and Construction
(Year:2004 , Scenario-A)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
61	Bau-Bau	134	850	1100	35
62	Galela	139	750	800	20
63	Ternate	140	1400	1800	70
64	Ambon	149	1850	2900	510
65	Bandanaera	152	700	1100	35
66	Sorong	161	1650	1800	70
67	Bintuni	163	650	800	20
68	Fak-Fak	164	630	800	20
69	Paniai	167	1150	1400	50
70	Enarotali	168	600	800	20
71	Serui	170	650	1100	35
72	Jayapura	172	1850	2800	225
73	Oksibil	173	600	1100	35
74	Agast	175	1000	1400	50

Airport Construction

No.	City Name	Zone No.	Runway Length (m)	Max Seats
1	Kotabumi	41	1400	50
2	Sukabumi	49	1100	35
3	Kediri	62	1100	35

(77) According to the assumption that the existing airports are usable for airliner completely, the airports to be constructed are only three by the year 1994, and three by 2004, however, the runway length to be extend are calculated at 68 airports by the year 1994 and 74 airports by 2004.

(78) In Scenario-A, the routes which have been allocated no aircraft, because of their few demand or insufficient range on the suitable aircraft, are only seven routes in both year 1994 and 2004, and were shown in Table-5.8.
The percentage satisfaction of routes and passengers are shown below.

	Demand	SCENARIO-A	Percentage Satisfaction
(Year : 1994)			
Routes	219	212	97 %
passengers ($x10^6$)	12.76	12.76	about100 %
(Year : 2004)			
Route	235	228	96 %
Passengers ($x10^6$)	16.74	16.74	about100 %

(79) The classification of aircraft in the aircraft deployment study are based on the following.

- Light planes		:	10 seats and less
- Small aircraft	Class I	:	35 seats and less
	Class II	:	50 seats and less
- Medium aircraft	Class I	:	100 seats and less
	Class II	:	150 seats and less
- Large aircraft	Class I	:	225 seats and less
	Class II	:	510 seats and less

(80) The airports were classified according to whether they are land based or water based, paved or not paved, and their runway length as below.

Table-5.8 Unaccomplished Air Routes

(Year:1994, Scenario-A)

No.	City Pair				Dist	Demand	Reason
				Zone No.	(Km)	/Year	
1	Lhok Seumawe	3	Meulaboh	4	112	126	*1
2	Padang	21	Dumai	24	299	508	*2
3	Atambua	83	Dili	85	112	22	*1
4	Tanah Merah	177	Merauke	178	280	756	*2
5	Seram	148	Langgur	153	497	116	*1
6	kaimana	165	Timika	166	370	720	*2
7	Timika	166	Jayapura	172	457	720	*2
Total						2968	

(Year:2004, Scenario-A)

No.	City Pair				Dist	Demand	Reason
				Zone No.	(Km)	/Year	
1	Lhok Seumawe	3	Meulaboh	4	112	158	*1
2	Padang	21	Dumai	24	299	678	*2
3	Atambua	83	Dili	85	112	26	*1
4	Tanah Merah	177	Merauke	178	280	944	*2
5	Seram	148	Langgur	153	497	148	*1
6	kaimana	165	Timika	166	370	896	*2
7	Timika	166	Jayapura	172	457	896	*2
Total						3746	

*1 Passengers (Demand) are less than 175 persons/year

*2 Insufficiency of range for suitable aircraft

- up to 600 m (include Heliport)
- More than 600 m (not paved , grass surface)
- More than 600 m (paved surface)
- More than 800 m (not paved , grass surface)
- More than 800 m (paved surface)
- More than 1100 m (paved surface)
- More than 1500 m (paved surface)
- More than 2100 m (paved surface)
- More than 2500 m (paved surface)
- More than 3000 m (paved surface)
- Hydroport

(81) The estimation for Scenario-A and aircraft distribution and airport required are presented in Table-5.9 (year : 1994) and Table-5.10 (year : 2004)

2) In the case of SCENARIO-B

(82) In Scenario-B, the domestic airports in Indonesia are classified into the following three categories.

- Major National Airport
  Airports which are particular importance in constituting a nation-wide, major air network, which are provided with sufficient facilities for allocation of large aircraft
  (The aircraft which have up to 510 seats with jet engines can takeoff and land on these airports.)

- National Airport
  Airports which are necessary in constituting a nation-wide air network, sufficiently equipped to allocate medium size aircraft.
  (The aircraft which have up to 150 seats with

Table-5.9 Aircraft Distribution and Required Airports for Air Traffic Demand (Year : 1994 , Scenario - A)

Airport				Aircraft								Air Traffic Demand				
Runway Condition	No.of Airport	T/O L/D x 10^3/Y	Extension (m)	Light Plane	Small Plane I	Small Plane II	Medium Plane I	Medium Plane II	Large Plane I	Large Plane II	Total	No.of Route	Stage Length(km)	Flight /Day	Annual Pax.x10^3	Pax.Km x10^6
~600m (Inc. Heliport)	0	0	0	0							0	0	0	0	0	0
Grass≧ 600m	5	4	0	5							5	5	805	12	28	4
Paved≧ 600m	0	0	0	0							0	0	0	0	0	0
Grass≧ 800m	9	10	590	3	8						11	11	2305	23	107	22
Paved≧ 800m	11	12	500	1	13						14	14	3467	29	144	32
Paved≧1100m	45	92	13495	21	54	14					89	89	24301	219	1668	458
Paved≧1500m	24	80	5565	9	29	12	18				68	67	24353	194	2363	951
Paved≧2100m	8	49	5560	2	16	6	7	8			39	38	14954	119	2414	912
Paved≧2500m	15	178	11305	5	58	24	30	6	13	8	144	137	71145	431	9420	6822
Paved≧3000m	4	95	0	0	8	8	13	14	19	10	72	63	49642	239	9371	7507
Sub Total	121	520	37015	46	186	64	68	28	32	18	442	424	190972	1266	25515	16708
at each class No. of Route Flight Annual Pax. Pax. Km				23 56 120 17	91 262 1662 487	32 118 1266 424	34 130 2436 1372	13 66 2127 1032	11 57 2744 2680	8 33 2404 2345						
Total	121	520	37015	23	93	32	34	14	16	9	221	212	95486	633	12757	8354

Table-5.10 Aircraft Distribution and Required Airports for Air Traffic Demand (Year : 2004 , Scenario - A)

Runway Condition	Airport: No.of Airport	Airport: T/O L/D x 10^3/Y	Airport: Extension (m)	Aircraft: Light Plane	Aircraft: Small Plane I	Aircraft: Small Plane II	Aircraft: Medium Plane I	Aircraft: Medium Plane II	Aircraft: Large Plane I	Aircraft: Large Plane II	Aircraft: Total	Air Traffic Demand: No.of Route	Air Traffic Demand: Stage Length(km)	Air Traffic Demand: Flight /Day	Air Traffic Demand: Annual Pax.x10^3	Air Traffic Demand: Pax.Km x10^6
~600m (Inc. Heliport)	1	3	0	2							2	1	89	8	18	1
Grass≧ 600m	3	2	0	3							3	3	541	5	15	2
Paved≧ 600m	0	0	0	0							0	0	0	0	0	0
Grass≧ 800m	8	10	400	3	7						10	10	1861	23	98	16
Paved≧ 800m	12	15	420	2	15						17	17	4341	35	175	43
Paved≧1100m	47	97	16450	16	46	22					84	83	22657	235	1898	519
Paved≧1500m	25	88	8465	13	23	14	20				70	69	23648	212	2671	1005
Paved≧2100m	7	49	4825	3	11	5	11	8			38	38	18260	120	2208	1156
Paved≧2500m	20	232	17315	4	51	29	48	13	27	8	180	166	91787	571	14347	9748
Paved≧3000m	4	112	0	0	5	10	17	13	25	14	84	69	58258	285	12042	9825
Sub Total	127	608	47875	46	158	80	96	34	52	22	488	456	221442	1494	33472	22315
at each class No. of Route Flight Annual Pax. Pax. Km				22 64 138 18	78 231 1442 399	40 149 1608 553	48 195 3554 1906	15 57 1849 1713	16 101 4881 3641	9 44 3267 2930						
Total	127	608	47875	23	79	40	48	17	26	11	244	228	110721	747	16736	11157

jet engines can takeoff and land on these airports.)

- Regional Airport

  Airports which are required in establishing intra- regional air routes and pioneer airlines, are suitable to small aircraft or light planes.
  (The aircraft which have up to 50 seats with turboprop engines can takeoff and land on these airports.)

(83) In accordance with the aircraft classification criteria based on regulations of DGAC, Existing airports in Indonesia are classified into CATEGORY-I to CATEGORY-V. Then, correspondance between two classicications are presented follows.

CATEGORY (by the Regulations)	Classifications on this study	Typical Aircraft
I	Major National	B-747,DC-10
II	National	DC-9
III		F-28
IV	Regional	F-27
V		CN-212

(84) It is assumed in this scenario that, while the existing land based airports are effectively utilized, the repletion of major national airports, national airports and regional airports are implemented by certain extent before and in the period from the year 1994 to 2004, corresponding to overall air traffic demand and growth of routes.

(85) Evaluation of Scenario-A indicate that the repletion of national and regional airports is important to meet the future air traffic demand. Therefore, it was assumed to establish the runway extension of national airports which have up to 1.0 million of passengers for departure and arrival, and regional airports which have more than 20 or 30 thousand of passengers for departure and arrival approximately.

(86) When the airports extension were established , it had been paid attention that the extended airports must be distributed impartially in the territory of Indonesia. Moreover, if some air route have no airports at both or either of the ends, or some airport have only one or two air routes and its runway is about 1,000 m and below in length, the hydroport system combined with amphibian airplanes was assumed instead of land airports, which will be able to be constructed for more low investments than land airport construction or extension.

(87) According to the above assumptions, the airports repletion until the year 1994 or 2004 is shown as below.

	Class of Airports	Number of airports 1994	2004
Airport Extension	* Magor national Airport	0	1
	* National Airport	6	13
	* Regional Airport	5	15
Airport Construction	* Land Airport	1	1
	* Hydroport	6	21

(Number of airports in 2004 include the number of airports which have been already constructed or extended until 1994)

(88) The airport repletion schedules on the year 1994 and 2004 is illustrated in Table-5.11, -5.12 and Figure-5.1, -5.2.

(89) The number of aircraft which required in meeting demand of each routes in the year 1994 and 2004 have been estimated, the size and number of aircraft are shown in Table-5.13.
In Scenario-B, the routes which have been allocated no aircraft, because of their few demand or insufficient range on the suitable aircraft, are 17 routes in the year 1994 and eight routes in 2004, were shown in Table-5.14.
The percentage satisfaction of routes and passengers are shown below.

	Demand	SCENARIO-C	Percentage Satisfaction
(Year : 1994)			
Routes	219	202	92 %
Passengers $(x10^6)$	12.76	12.49	98 %
(Year : 2004)			
Routes	235	227	96 %
Passengers $(x10^6)$	16.74	16.66	about100 %

(90) The estimation for Scenario-B and aircraft distribution and airports required are presented in Table-5.15 (year : 1994), Table-5.16 (year : 2004).
In these tables, It has been assumed that helicopters may be allocated when stage length is not more than 100 km and there is no airport on one end of the route. It has also been assumed the STOL planes may be allocated when at least one of airports of a route has runway 3,000 feet (914 m) or more in length, in addition, the allocated aircraft constraind having 20 to 35 seats.

Table-5.11 Airport Repletion Schedule
(Year:1994 , Scenario-B)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
1	Tanjung Karang	42	1520	1800	70
2	Buntok	95	600	1100	35
3	Yogyakarta	60	1850	2400	150
4	Pontianak	89	1655	2000	100
5	Banjarmasin	103	1870	2400	150
6	Long Bawan	105	700	1100	35
7	Tarakan	106	1650	1800	70
8	Samarinda	109	900	1400	50
9	Balikpapan	110	1800	2400	150
10	Bintuni	163	650	800	20
11	Serui	170	650	1100	35

Airport Construction

No.	City Name	Zone No.	Runway Length (m)	Max Seats
1	Kotabumi	41	1100	35

Hydroport Construction

No.	City Name	Zone No.	Max Seats
1	Sukabumi	49	35
2	Cilacap	56	50
3	Kediri	62	35
4	Singkawang II	88	50
5	Kotabaru	102	50
6	Bandanaera	152	20

Table-5.12(1/2) Airport Repletion Schedule
(Year:2004 , Scenario-B)

Airport Extension

No.	City Name	Zoon No.	Current Runway Length (m)	Runway Length After Extension (m)	Max Seats
1	Rengat	26	1300	1400	50
2	Muara Bungo	31	815	1100	35
3	Muara Enim	36	900	1100	35
4	Bangka	38	1520	1800	70
5	Tanjung Karang	42	1520	1800	70
6	Semarang	55	1650	2400	150
7	Yogyakarta	60	1850	2400	150
8	Ampenan	68	1600	2000	100
9	Pontianak	89	1655	2000	100
10	Sanggau	90	600	1100	35
11	Muaratewe	94	600	800	20
12	Buntok	95	600	1100	35
13	Palangka Raya	97	1650	1800	70
14	Banjarmasin	103	1870	2400	150
15	Long Bawan	105	700	1100	35
16	Tarakan	106	1650	1800	70
17	Samarinda	109	900	1400	50
18	Balikpapan	110	1800	2400	150
19	Palu	118	1625	1800	70
20	Ujung Pandang	128	2500	2800	225
21	Kendari	131	1650	1800	70
22	Galela	139	750	800	20
23	Ambon	149	1850	2000	100
24	Bintuni	163	650	800	20
25	Fak-Fak	164	630	800	20
26	Enarotali	168	600	800	20
27	Serui	170	650	1100	35
28	Oksibil	173	600	800	20
29	Kepi	176	675	800	20

Table-5.12(2/2) Airport Repletion Schedule
(Year:2004 , Scenario-B)

Airport Construction

No.	City Name	Zone No.	Runway Length (m)	Max Seats
1	Kotabumi	41	1100	35

Hydroport Construction

No.	City Name	Zone No.	Max Seats
1	Sinabang	5	20
2	Padang Sidempuan	15	35
3	Gunung Sitoli	16	50
4	Sukabumi	49	35
5	Cirebon	52	50
6	Cilacap	56	50
7	Kediri	62	35
8	Sabu	78	20
9	Singkawang II	88	50
10	Sampit	98	20
11	Kotabaru	102	50
12	Tanjung Selor	104	35
13	Tanjung Redep	107	35
14	Tanah Grogot	111	50
15	Toli-Toli	117	35
16	Luwuk	121	20
17	Malili	123	35
18	Mamuju	124	35
19	Makale	125	50
20	Bau-Bau	134	35
21	Bandanaera	152	35

Figure-5.1 Distribution of Airports (1994) ···· Scenario-B

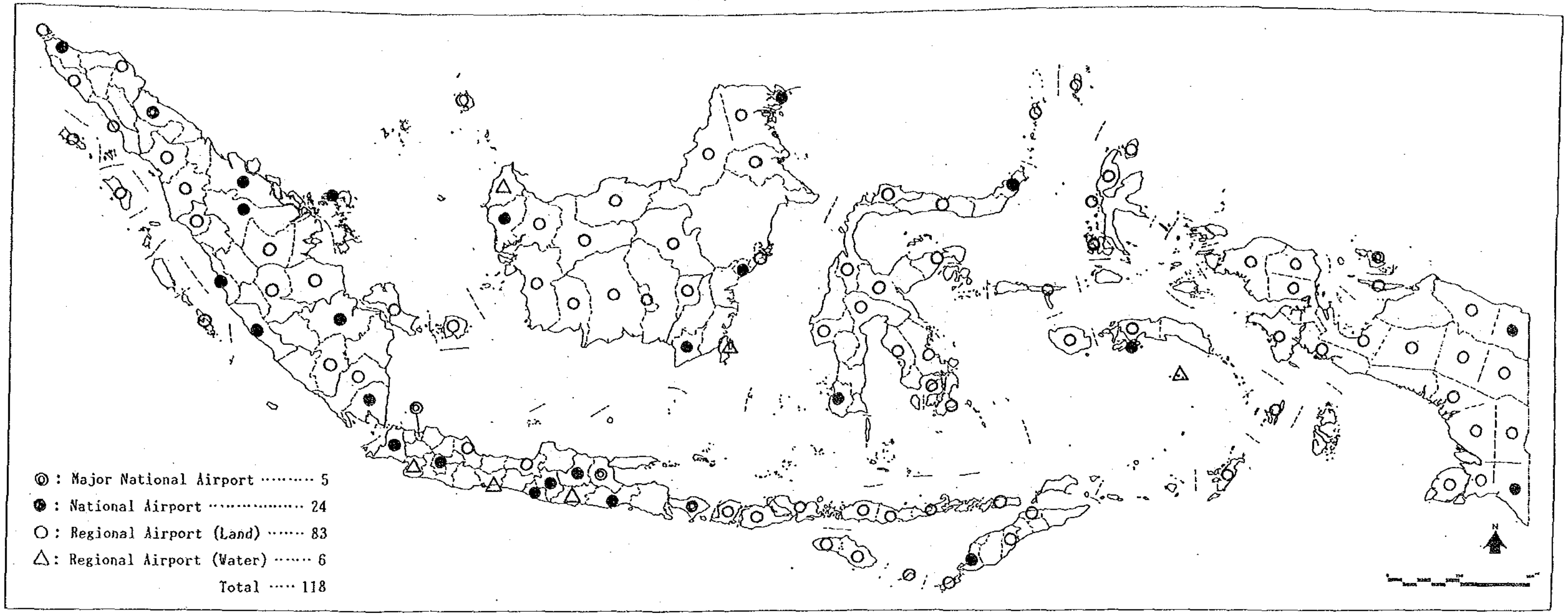


Figure-5.2 Distribution of Airports (2004) ···· Scenario-B

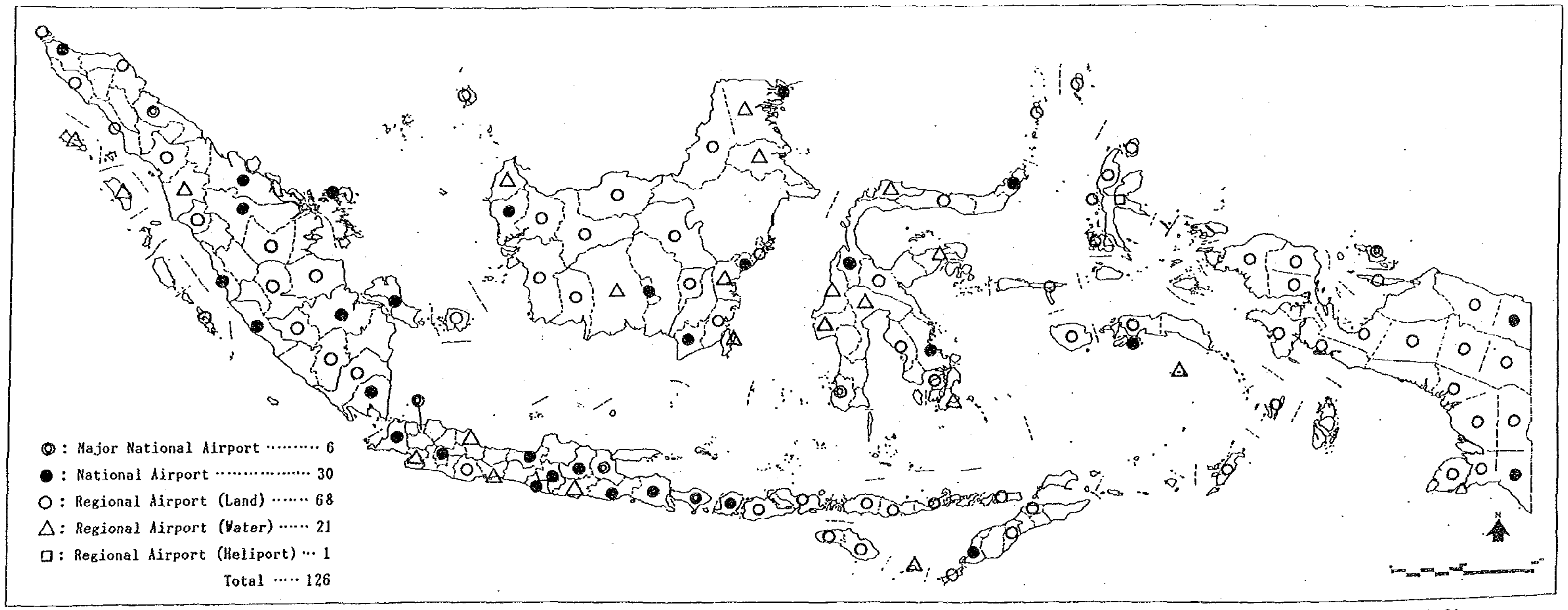


Table-5.13(1/2)　Fleet in 1994 (Scenario-B)

Aircraft Type : Conventional

Seat	No.of A/C	Flt/Week	Pax $(x10^3)$	Pax*Km $(x10^6)$	Route
10	66	1323	407	88.0	34
20	70	1232	757	221.2	47
35	34	772	818	256.6	30
50	69	1643	2525	1002.6	37
70	34	675	1452	1289.7	16
100	26	724	2223	1338.5	15
150	26	545	2509	2441.6	14
225	7	179	1239	1282.8	2
510	1	26	314	308.7	1
Total	333	7119	12244	8229.6	196

Aircraft Type : Amphibian

Seat	No.of A/C	Flt/Week	Pax $(x10^3)$	Pax*Km $(x10^6)$	Route
20	1	26	16	3.6	1
35	2	55	57	13.1	2
50	4	116	178	51.1	3
Total	7	197	252	67.8	6

Table-5.13(2/2) Fleet in 2004 (Scenario-B)

Aircraft Type : Conventional

Seat	No.of A/C	Flt/Week	Pax(x10³)	Pax*Km(x10⁶)	Route
10	30	652	200	27.3	21
20	58	1080	665	177.4	42
35	36	779	826	239.7	31
50	53	1370	2105	767.7	33
70	58	1294	2784	1911.3	31
100	42	1153	3536	2458.9	22
150	25	584	2691	2352.8	12
225	11	234	1604	2044.9	5
510	3	93	1132	880.9	2
Total	316	7239	15544	10860.9	199

Aircraft Type : Helicopter

Seat	No.of A/C	Flt/Week	Pax(x10³)	Pax*Km(x10⁶)	Route
10	2	60	18	1.6	1
Total	2	60	18	1.6	1

Aircraft Type : Amphibian

Seat	No.of A/C	Flt/Week	Pax(x10³)	Pax*Km(x10⁶)	Route
20	5	71	43	10.1	5
35	12	297	314	91.1	11
50	18	484	744	195.4	11
Total	35	852	1102	296.6	27

Table-5.14 Unaccomplished Air Routes

(Year:1994, Scenario-B)

No.	City Pair			Zone No.	Dist (Km)	Demand /Year	Reason
1	Lhok Seumawe	3	Meulaboh	4	112	126	*1
2	Padang	21	Dumai	24	299	508	*2
3	Atambua	83	Dili	85	112	22	*1
4	Tanah Merah	177	Merauke	178	280	756	*2
5	Medan	10	Prapat	12	322	3254	*2
6	Seram	148	Langgur	153	497	116	*1
7	kaimana	165	Timika	166	370	720	*2
8	Timika	166	Jayapura	172	457	720	*2
9	Enarotali	168	Jayawijaya	174	281	9128	*2
10	Manokwari	162	Fak-Fak	164	306	9924	*2
11	Mamuju	124	Ujung Pandang	128	282	13748	*2
12	Sorong	161	Fak-Fak	164	254	22918	*2
13	Muaratewe	94	Banjarmasin	103	326	11272	*2
14	Tanjung Selor	104	Samarinda	109	366	19488	*2
15	Tarakan	106	Tanjung Redep	107	610	10006	*2
16	Sinabang	5	Medan	10	298	34692	*2
17	Medan	10	Gunung Sitoli	16	279	51618	*2
Total						189016	

(Year:2004, Scenario-B)

No.	City Pair			Zone No.	Dist (Km)	Demand /Year	Reason
1	Lhok Seumawe	3	Meulaboh	4	112	158	*1
2	Padang	21	Dumai	24	299	678	*2
3	Atambua	83	Dili	85	112	26	*1
4	Tanah Merah	177	Merauke	178	280	944	*2
5	Medan	10	Prapat	12	322	2326	*2
6	Seram	148	Langgur	153	497	148	*1
7	kaimana	165	Timika	166	370	896	*2
8	Timika	166	Jayapura	172	457	896	*2
Total						6072	

*1 Passengers (Demand) are less than 175 persons/year

*2 Insufficiency of range for suitable aircraft

Table-5.15 Aircraft Distribution and Required Airports for Air Traffic Demand (Year : 1994 , Scenario - B)

Airport				Aircraft								Air Traffic Demand				
Runway Condition	No.of Airport	T/O L/D x 10^3/Y	Extension (m)	Light Plane	Small Plane I	Small Plane II	Medium Plane I	Medium Plane II	Large Plane I	Large Plane II	Total	No.of Route	Stage Length(km)	Flight /Day	Annual Pax.x10^3	Pax.Km x10^6
~600m (Inc. Heliport)	0	0	0	0							0	0	0	0	0	0
Grass≧ 600m	8	20	0	19							19	8	1329	53	119	39
Paved≧ 600m	9	33	0	30							30	9	1604	88	198	36
Grass≧ 800m	7	7	0	3	6						9	8	1665	17	74	15
Paved≧ 800m	20 (S3)	52	150	6	48 (S11)						54 (S11)	31 (S5)	8442	134	593	164
Paved≧1100m	22 (S2)	52	2950	18	31 (S4)	7					56 (S4)	53 (S2)	14757	125	830	244
Paved≧1500m	31 (S3)	226	775	29	62 (S6)	71	40				202 (S6)	126 (S3)	50731	571	5832	2912
Paved≧2100m	3 (S2)	51	1680	5	14 (S4)	6	15				40 (S4)	28 (S2)	11512	130	1843	912
Paved≧2500m	8	142	0	16	38	22	20	24	4		124	72	43094	360	5874	4694
Paved≧3000m	4 (S2)	162	0	6	12 (S5)	36	45	28	10	2	139 (S5)	63 (S2)	49642	421	9371	7507
Hydro port	6	9	-		3	4					7	6	1560	25	250	67
Sub Total	118 (S12)	754	5555	132	214 (S30)	146	120	52	14	2	680 (S30)	404 (S14)	184336	1924	24984	16590
at each class																
No. of Route				34	80	40	31	14	2	1						
Flight				189	298	251	200	78	26	4						
Annual Pax.				407	1648	2703	3675	2509	1239	314						
Pax. Km				88	495	1054	2628	2442	1283	309						
Total	118	754	5555	66	107	73	60	26	7	1	340	202	92168	962	12492	8295

( ) --- It's able to select STOL;(S) or Helicopter;(H) alternatively

Table-5.16 Aircraft Distribution and Required Airports for Air Traffic Demand (Year : 2004 , Scenario - B)

Airport				Aircraft								Air Traffic Demand				
Runway Condition	No.of Airport	T/O L/D x 10^3/Y	Extension (m)	Light Plane	Small Plane I	Small Plane II	Medium Plane I	Medium Plane II	Large Plane I	Large Plane II	Total	No.of Route	Stage Length(km)	Flight /Day	Annual Pax.x10^3	Pax.Km x10^6
~600m (inc. heliport)	1 (H1)	3	0	2 (H2)							2 (H2)	1 (H1)	89	8	18	1
Grass≧ 600m	2	1	0	2							2	2	298	3	9	1
Paved≧ 600m	2	15	0	12							12	3	367	42	93	12
Grass≧ 800m	9	11	0	3	9						12	11	2103	27	117	21
Paved≧ 800m	17 (S2)	43	1095	3	39 (S12)						42 (S12)	27 (S4)	6909	108	504	128
Paved≧1100m	26 (H1,S4)	67	4035	17 (H2)	38 (S8)	10					65 (H2,S8)	57 (H1,S4)	15537	162	1128	329
Paved≧1500m	32 (S4)	245	2080	14	71 (S11)	55	69				209 (S11)	135 (S4)	58404	616	7278	3884
Paved≧2100m	3 (S1)	61	2430	1	12 (S2)	7	24				44 (S2)	30 (S1)	12555	154	2571	1261
Paved≧2500m	9	171	300	10	24	32	35	25	11		137	92	58659	431	8462	6556
Paved≧3000m	4 (S2)	180	0	0	12 (S7)	20	72	25	11	6	146 (S7)	69 (S3)	58258	467	12042	9825
Hydro port	21	43	-		17	18					35	27	7621	112	1101	295
Sub Total	126 (H2,S13)	840	9940	64 (H4)	222 (S40)	142	200	50	22	6	706 (H4,S40)	454 (H2,S16)	220800	2130	33323	22313
at each class No. of Route				22	89	44	53	12	5	2						
Flight				102	318	265	350	83	33	13						
Annual Pax.				218	1848	2849	6320	2691	1604	1132						
Pax. Km				29	518	963	4370	2353	2045	881						
Total	126	840	9940	32	111	71	100	25	11	3	353	227	110400	1065	16661	11156

( ) --- It's able to select STOL;(S) or Helicopter;(H) alternatively

3) In the case of SCENARIO - C

(91) The same data as in Senario-A are also used in the study of Senario-C, but the airport data used in Scenario-C are those of existing airports (Table-5.1 in Section 5.04), as it is assumed that no investment is made on airports in future.

(92) The number of aircraft which required in meeting demand of each air route (airport to airport) for air traffic demand in the year 1994 and 2004 have been estimated, the size and number of aircraft are shown in Table-5.17 .
In the case of Scenario-C, however, it is assumed that no new investment is made for construction of new airports and/or extension of existing airports. This assumption may exclude the possibility of operating the paticular route due to insufficient range of the aircraft thereby chosen, which are too small in size for takeoff, landing on current airport runway length.

(93) Table-5.18 shows the routes which have been allocated no aircraft, because of their few demand or insufficient range on the suitable aircraft, and indicates the counts of 31 in 1994 and 35 in 2004.
The percentage satisfaction of routes and passengers are shown below.

	Demand	SCENARIO-A	Percentage Satisfaction
(Year : 1994)			
Routes	219	188	86 %
Passengers ($x10^6$)	12.76	11.72	92 %
(Year : 2004)			
Routes	235	200	84 %
Passengers ($x10^6$)	15.74	15.05	90 %

Table-5.17(1/2) Fleet in 1994 (Scenario-C)

Aircraft Type : Conventional

Seat	No.of A/C	Flt/Week	Pax $(x10^3)$	Pax*Km $(x10^6)$	Route
10	72	1481	455	94.3	36
20	69	1402	862	224.9	41
35	36	749	793	253.2	32
50	85	1963	3016	1357.1	39
70	45	965	2075	1439.3	19
100	15	431	1321	737.6	9
150	18	358	1646	1776.3	9
225	9	225	1553	1591.5	3
Total	349	7574	11723	7474.2	188

Table-5.17(2/2) Fleet in 2004 (Scenario-C)

Aircraft Type : Conventional

Seat	No.of A/C	Flt/Week	Pax $(x10^3)$	Pax*Km $(x10^6)$	Route
10	90	1952	601	128.5	37
20	77	1631	1003	262.3	39
35	32	704	746	220.9	29
50	111	2667	4096	1882.9	46
70	59	1305	2807	1918.0	24
100	22	642	1972	1128.4	12
150	22	437	2014	2379.5	10
225	11	263	1814	1831.6	3
Total	424	9601	15052	9752.0	200

Table-5.18(1/2) Unaccomplished Air Routes

(Year:1994, Scenario-C)

No.	City Pair				Dist	Demand	Reason
				Zone No.	(Km)	/Year	
1	Lhok Seumawe	3	Meulaboh	4	112	126	*1
2	Padang	21	Dumai	24	299	508	*2
3	Palembang	34	Kotabumi	41	209	4146	*3
4	Atambua	83	Dili	85	112	22	*1
5	Tanah Merah	177	Merauke	178	280	756	*2
6	Medan	10	Prapat	12	322	3254	*2
7	Seram	148	Langgur	153	497	116	*1
8	kaimana	165	Timika	166	370	720	*2
9	Timika	166	Jayapura	172	457	720	*2
10	Serui	170	Jayapura	172	482	2644	*2
11	Enarotali	168	Jayawijaya	174	281	9128	*2
12	Manokwari	162	Fak-Fak	164	306	9924	*2
13	Tanjung Karang	42	Sukabumi	49	270	21854	*3
14	Mamuju	124	Ujung Pandang	128	282	13748	*2
15	Sorong	161	Fak-Fak	164	254	22918	*2
16	Muaratewe	94	Banjarmasin	103	326	11272	*2
17	Tanjung Selor	104	Samarinda	109	366	19488	*2
18	Jakarta	43	Ketapang	93	601	23390	*2
19	Long Bawan	105	Samarinda	109	507	21472	*2
20	Tarakan	106	Tanjung Redep	107	610	10006	*2
21	Sinabang	5	Medan	10	298	34692	*2
22	Medan	10	Gunung Sitoli	16	279	51618	*2
23	Kotabumi	41	Jakarta	43	243	30340	*3
24	Semarang	55	Kediri	62	204	35468	*3
25	Jakarta	43	Cilacap	56	313	54930	*2
26	Luwuk	121	Ujung Pandang	128	574	32314	*2
27	Jakarta	43	Ampenan	68	1072	41372	*2
28	Jakarta	43	Tarakan	106	1605	55412	*2
29	Surabaya	63	Tarakan	106	1303	73982	*2
30	Jakarta	43	Ambon	149	2388	119894	*2
31	Banda Aceh	2	Jakarta	43	1797	124584	*2
Total						830818	

*1 Passengers (Demand) are less than 175 persons/year

*2 Insufficiency of range for suitable aircraft

*3 No Airport (Ciry name underlined)

Table-5.18(2/2) Unaccomplished Air Routes
(Year:2004, Scenario-C)

No.	City Pair				Dist	Demand	Reason
				Zone No.	(Km)	/Year	
1	Lhok Seumawe	3	Meulaboh	4	112	158	*1
2	Padang	21	Dumai	24	299	678	*2
3	Palembang	34	Kotabumi	41	209	4946	*3
4	Atambua	83	Dili	85	112	26	*1
5	Tanah Merah	177	Merauke	178	280	944	*2
6	Medan	10	Prapat	12	322	2326	*2
7	Seram	148	Langgur	153	497	148	*1
8	kaimana	165	Timika	166	370	896	*2
9	Timika	166	Jayapura	172	457	896	*2
10	Serui	170	Jayapura	172	482	3292	*2
11	Enarotali	168	Jayawijaya	174	281	11370	*2
12	Manokwari	162	Fak-Fak	164	306	12368	*2
13	Tanjung Karang	42	Sukabumi	49	270	29212	*3
14	Mamuju	124	Ujung Pandang	128	282	17334	*2
15	Sorong	161	Fak-Fak	164	254	6350	*2
16	Muaratewe	94	Banjarmasin	103	326	14266	*2
17	Tanjung Selor	104	Samarinda	109	366	29542	*2
18	Jakarta	43	Ketapang	93	601	28630	*2
19	Long Bawan	105	Samarinda	109	507	29790	*2
20	Tarakan	106	Tanjung Redep	107	610	14378	*2
21	Sinabang	5	Medan	10	298	47516	*2
22	Medan	10	Gunung Sitoli	16	279	71156	*2
23	Kotabumi	41	Jakarta	43	243	39436	*3
24	Semarang	55	Kediri	62	204	65498	*3
25	Jakarta	43	Cilacap	56	313	63120	*2
26	Luwuk	121	Ujung Pandang	128	574	40194	*2
27	Jakarta	43	Ampenan	68	1072	81910	*2
28	Jakarta	43	Tarakan	106	1605	77992	*2
29	Surabaya	63	Tarakan	106	1303	100616	*2
30	Jakarta	43	Ambon	149	2388	160614	*2
31	Banda Aceh	2	Jakarta	43	1797	156618	*2
32	Ternate	140	Buli Serani	141	89	18346	*3
33	Medan	10	Tanjung Karang	42	1216	32560	*2
34	Jakarta	43	Kendari	131	1762	58950	*2
35	Surabaya	63	Kendari	131	1129	64290	*2
Total						1286366	

Table-5.19 Aircraft Distribution and Required Airports for Air Traffic Demand (Year : 1994 , Scenario - C)

Airport				Aircraft								Air Traffic Demand				
Runway Condition	No.of Airport	T/O L/D x 10^3/Y	Extension (m)	Light Plane	Small Plane I	Small Plane II	Medium Plane I	Medium Plane II	Large Plane I	Large Plane II	Total	No.of Route	Stage Length(km)	Flight /Day	Annual Pax.x10^3	Pax.Km x10^6
~600m (Inc. Heliport)	0	0		0							0	0	0	0	0	0
Grass≧ 600m	10	24		23							23	10	1701	63	143	43
Paved≧ 600m	11	40		35							35	12	1980	104	236	39
Grass≧ 800m	6	6		2	6						8	7	1518	14	66	14
Paved≧ 800m	23	72		11	54						65	33	8101	188	795	193
Paved≧1100m	18	45		16	26	7					49	46	12942	109	733	220
Paved≧1500m	33	287		29	82	94	49				254	140	54837	732	7213	3442
Paved≧2100m	3	52		4	14	6	17				41	27	11303	131	1839	911
Paved≧2500m	5	87		16	21	13	11	16	4		81	46	28506	223	3568	3351
Paved≧3000m	4	171		8	7	50	43	20	14		142	55	40324	446	8847	6729
Sub Total	113	784		144	210	170	120	36	18		698	376	161212	2010	23440	14942
at each class No. of Route Flight Annual Pax. Pax. Km				36 212 455 94	73 307 1655 478	39 280 3016 1357	28 199 3396 2177	9 51 1646 1776	3 32 1553 1592							
Total	113	784		72	105	85	60	18	9		349	188	80606	1005	11720	7471

Table-5.20 Aircraft Distribution and Required Airports for Air Traffic Demand (Year : 2004 , Scenario - C)

Airport				Aircraft								Air Traffic Demand				
Runway Condition	No.of Airport	T/O L/D x 10^3/Y	Extension (m)	Light Plane	Small Plane I	Small Plane II	Medium Plane I	Medium Plane II	Large Plane I	Large Plane II	Total	No.of Route	Stage Length(km)	Flight /Day	Annual Pax.x10^3	Pax.Km x10^6
~600m (inc. Heliport)	0	0		0							0	0	0	0	0	0
Grass≧ 600m	10	28		26							26	10	1701	74	168	55
Paved≧ 600m	12	58		50							50	13	2219	156	347	62
Grass≧ 800m	6	8		2	6						8	7	1518	19	83	18
Paved≧ 800m	24	88		13	65						78	34	8275	227	963	240
Paved≧1100m	20	57		19	26	10					55	48	13434	140	971	289
Paved≧1500m	34	363		38	80	125	65				308	151	63457	937	9374	4633
Paved≧2100m	3	69		5	15	7	25				52	29	12346	175	2566	1260
Paved≧2500m	5	104		18	20	17	14	22	5		96	49	34292	268	4483	4351
Paved≧3000m	4	219		9	6	63	58	22	17		175	59	46050	584	11144	8593
Sub Total	118	994		180	218	222	162	44	22		848	400	183292	2580	30099	19501
at each class																
No. of Route				37	68	46	36	10	3							
Flight				279	334	381	278	62	38							
Annual Pax.				601	1749	4096	4779	2014	1814							
Pax. Km				129	483	1883	3046	2380	1832							
Total	118	994		90	109	111	81	22	11		424	200	91646	1290	15049	9750

Table-5.21 Operating Cost

Year : 1994

(/Year)

Classification of A/C	Light Airplane			Small Airplane			Medium Airplane			Large Airplane			Total		
Scenario	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Average DOC cent/seat-km	38.5	22.2	22.7	9.7	8.7	7.6	4.2	3.6	3.9	2.5	2.4	2.4	3.9	4.5	4.7
Average IOC cent/seat-km	2.3	1.6	1.6	1.3	1.2	1.0	0.9	0.6	0.6	0.6	0.6	0.6	0.8	0.7	0.7
Available Seat-km (Bil)	0.0	0.1	0.1	1.4	2.2	2.7	3.6	7.6	5.9	7.5	2.4	2.4	12.5	12.3	11.1
Total Operating Cost (M$)	10.4	31.2	34.2	149	219	236	183	318	265	233	70.1	71.1	576	638	606

Year : 2004

(/Year)

Classification of A/C	Light Airplane			Small Airplane			Medium Airplane			Large Airplane			Total		
Scenario	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Average DOC cent/seat-km	56.2	45.2	21.1	9.2	11.4	7.1	3.8	3.7	3.7	2.7	2.4	2.5	3.7	4.3	4.5
Average IOC cent/seat-km	2.6	2.6	1.6	1.3	1.5	1.0	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.7
Available Seat-km (Bil)	0.0	0.0	0.2	1.4	1.8	3.5	5.4	10.0	8.1	9.8	4.4	2.7	16.6	16.2	14.5
Total Operating Cost (M$)	14.8	19.5	43.6	149	228	284	245	439	352	333	129	84.3	742	816	764

It seems to be unrealistic to accomplish the air net works for the future air traffic demands, because of the lower satisfaction rates than that of Scenario-A or -B as shown table above.

(94) The estimation for Scenario-C and aircraft distribution and airport required are presented in Table-5.19 (year : 1994), Table-5.20 (year : 2004) as similar classification of Scenario-A or -B.

(95) Direct operating cost (DOC) and indirect operating cost (IOC) of aircraft are calculated and presented in Table-5.21 for Scenarios A, B and C.
It is obvious that total annual operating cost is the lowest in Scenario-A, in which aircraft having the minimum direct operating cost (DOC/seat-mile) are selected.
In Scenario-C, it is assumed that the selection of aircraft is constrained by the conditions of existing airports, therefore, if the percentage satisfaction of passenger or routes is increased compulsority from 90 % to 100 %, operating cost of Scenario-C grows the highest among these scenarios.

(96) The personnel expenses such as crew cost and maintenance cost prevailing in Indonesia in 1987 are used in oprating cost is also calculated based on figures stipulated in regulations which are applied to domestic airlines of Indonesia. The indirect operating cost is fairly large. Therefore, it would be necessary to formulate a future plan in such a manner that the burden of capital cost is not excessive.

(97) The cost for acquisition of aircraft, based on the assumption that all aircraft used in every route are to be purchased, plus the cost for extension (which are only summation of earth works cost for runway extension and overlay)

and construction of airports, are calculated and summarized in Table-5.22 and -5.23.
The cost for purchase of aircraft is lower in Scenario-C than Scenario-B, because the air traffic demands in future are not satisfied in Scenario-C, as showed in Figure-5.4.

(98) Evaluation of Scenarios-A, B and C indicate that extension of airport facilities ia essential in meeting the future air traffic demand. Construction and extension of local national airports and regional airports (including hydoport) would be particulary important.
The basic specifications of aircraft required in Scenario-A, and -B in which the most realistic way of airport extension is assumed, are presented in Table-5.24.
Especially, aircraft distribution and required airports in Scenario-B have been shown in Figure-5.5.

(99) The types of aircraft to be allocated to new air routes, which are determined in Section-4, as well as operations (flight/ week) are presented in Table-5.25 and Table-5.26. It can be seen by the tables that deployment of conventional, land based aircraft is effective in constituting major air network of future which is planned in this study.
Regional air network will be implemented amphibians to complement land plane.

Table-5.22 Aircraft Acquisition Cost and Airport Construction/Extension Cost (Up to Year ; 1994)

Aircraft

Aircraft Type	Light Airplane			Small Airplane			Medium Airplane			Large Airplane			Total (B$)		
Scenario	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Av.Unit Cost (M$)	1.4			6.7 ~ 7.0			20.8 ~ 22.5			38.1 ~ 45.2					
No.of Aircraft	23	66	72	125	180	190	48	86	78	25	8	9	221	340	349
Acquisition Cost (B$)	0.03	0.09	0.10	0.84	1.24	1.32	1.08	1.91	1.62	1.13	0.33	0.34	3.08	3.57	3.38

Airport

Airport Classification		Regional Airport			National Airport			Major National Airport			Total		
Scenario		A	B	C	A	B	C	A	B	C	A	B	C
Airport Construction	Unit Cost (B.RP)	15.0	6.9	-	-	-	-	-	-	-			
	No.of Airport	3	7	-	-	-	-	-	-	-	3	7	-
	Cost (B.RP)	45	48	-	-	-	-	-	-	-	45	48	-
Airport Extension	Unit Cost (B.RP)	2.5	3.0	-	8.4	7.8	-	12.4	-	-			
	No.of Airport	35	5	-	19	6	-	14	-	-	68	11	-
	Cost (B.RP)	88	15	-	160	47	-	174	-	-	422	62	-
Airport Cost (B.RP)		133	63	-	160	47	-	174	-	-	467	110	-

Airport extention costs are only summation of earth works cost for runway extension and overlay, therefore, they don't include the expences for expansion of airport building, navaids, service equipments, and etc.

Table-5.23 Aircraft Acquisition Cost and Airport Cocstruction/Extension Cost (Up to Year ; 2004)

Aircraft

Aircraft Type	Light Airplane			Small Airplane			Medium Airplane			Large Airplane			Total (B$)		
Scenario	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Av.Unit Cost (M$)	1.4 ~ 1.5			6.9 ~ 7.2			20.7 ~ 22.1			38.1 ~ 44.8					
No.of Aircraft	23	32	90	119	182	220	65	125	103	37	14	11	244	353	424
Acquisition Cost (B$)	0.03	0.05	0.13	0.83	1.31	1.56	1.44	2.64	2.14	1.66	0.62	0.42	3.96	4.62	4.25

Airport

Airport Classification		Regional Airport			National Airport			Major National Airport			Total		
Scenario		A	B	C	A	B	C	A	B	C	A	B	C
Airport Construction	Unit Cost (B.RP)	19.4	5.6	-	-	-	-	-	-	-			
	No.of Airport	3	22	-	-	-	-	-	-	-	3	22	-
	Cost (B.RP)	58	123	-	-	-	-	-	-	-	58	123	-
Airport Extension	Unit Cost (B.RP)	3.0	2.1	-	8.2	7.3	-	13.3	10.0	-			
	No.of Airport	34	15	-	23	13	-	17	1	-	74	29	-
	Cost (B.RP)	101	31	-	189	94	-	226	10	-	516	136	-
Airport Cost (B.RP)		159	154	-	189	94	-	226	10	-	574	258	-

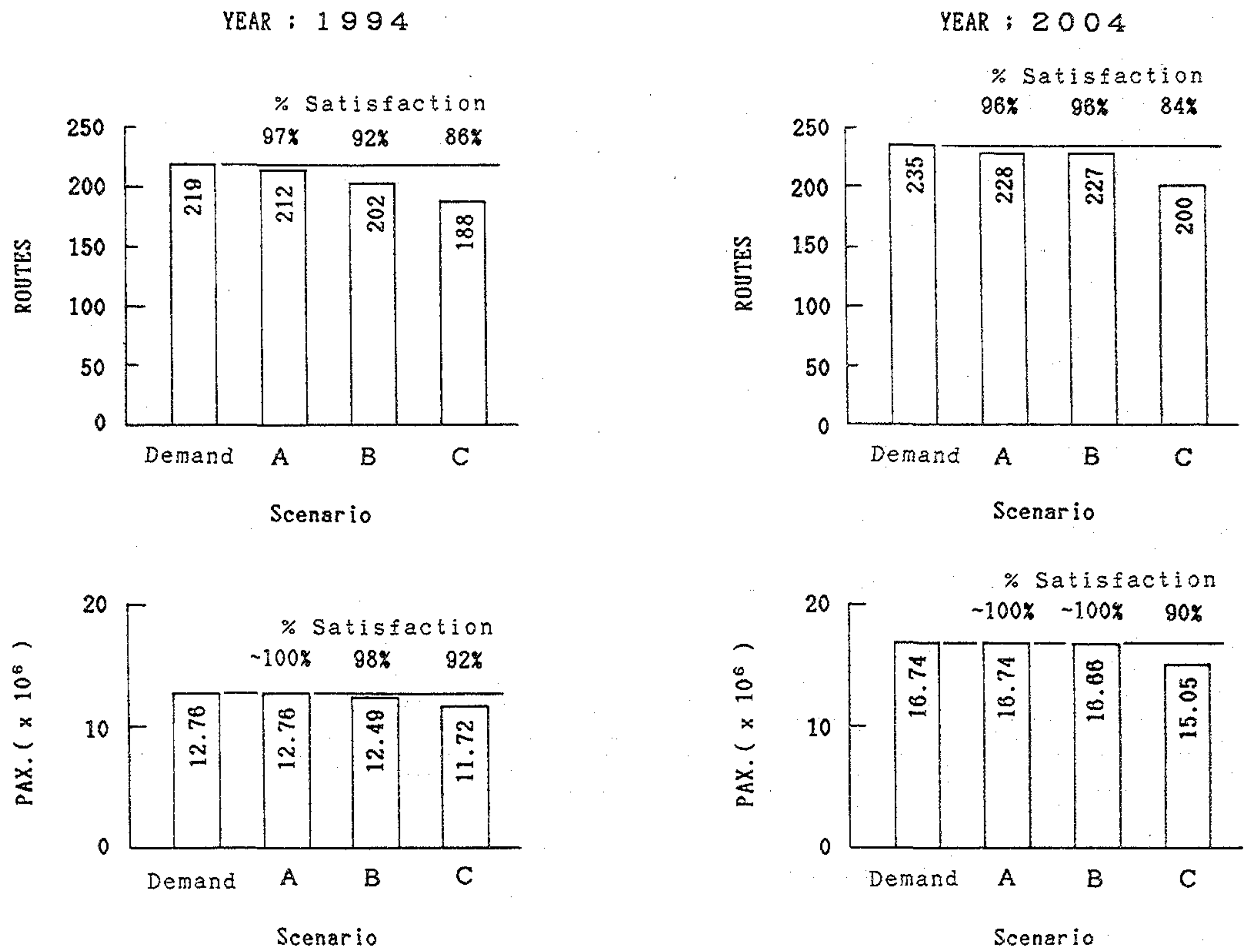
Airport extention costs are only summation of earth works cost for runway extension and overlay, therefore, they don't include the expences for expansion of airport building, navaids, service equipments, and etc.

Table-5.24 Required Basic Spesifications of Aircraft

Classification	Basic Requirments				Number of Aircraft				Current Aircraft	
	Seat	Range (Km)	Cruise Speed (Kt)	Runway Length (m)	Scenario-A		Scenario-B		Aircraft Name	Number of Aircraft
					1994	2004	1994	2004		
LIGHT PLANE	～ 10	500	~130	500	20	20	65	30	BN2	37
SMALL PLANE Class-I	～ 35	1400	165~220	1100	90	80	105	110~120*	CN212, CN235	58
SMALL PLANE Class-II	～ 50	2000	250~280	1400	30	40	70	70~ 90*	F27, HS748	42
MEDIUM PLANE Class-I	～100	3200	350~460	2000	35	50	60	100~130*	F28, DC9	57
MEDIUM PLANE Class-II	～150	4000	about 460	2400	15	20	25	25~ 40*	-	-
LARGE PLANE Class-I	～225	5500	about 460	2800	15	25	7	10~ 15*	A300, DC10	15
LARGE PLANE Class-II	～510	5500	about 460	3500	10	10	1	3~ 4*	B747	(6 Int'l)

* Based on the sensitivity check of modal spilit model
(Air traffic demand has increased by 34% in 2004)

Figure-5.3 Percentage Statisfaction in Each Scenario
(Route and Pax.)



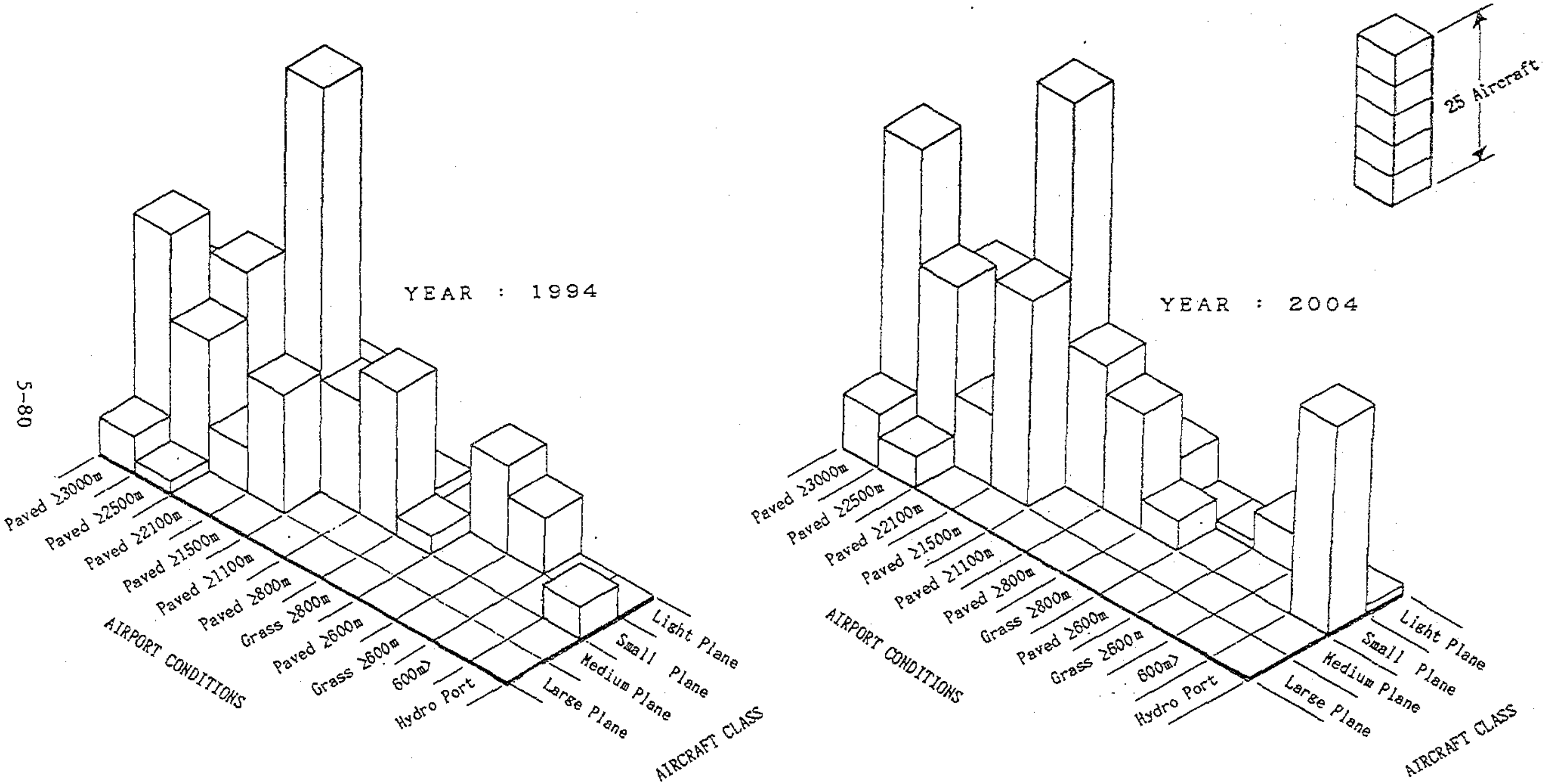


Figure-5.4 AIRCRAFT DISTRIBUTION AND RECQUIRED AIRPORTS

Table-5.25 New Air Routes (1994)

(Feeder Lines)

No.	City Pair		Dist (Km)	Demand /Year	Max Seats	No. A/C	Flight /Week
F 1	Pakanbaru	Sibolga	341	69068	50	2	45
F 2	Pontianak	Singkawang *	140	61990	50	1	40
F 3	Malang	Madiun	139	50856	50	1	33
F 4	Pontianak	Natuna	469	40234	50	1	26
F 5	Semarang	Kediri *	204	35468	35	1	34
F 6	Jakarta	Kotabumi	243	30340	35	1	29
F 7	Bandung	Pandeglang	161	29640	35	1	28
F 8	Bandar Lampung	Muara Enim	237	28072	20	2	46
F 9	Palembang	Muara Bungo	348	27686	20	2	45
F10	Pakanbaru	Padang Sidempuan	244	26458	10	4	86
F11	Pakanbaru	Lubuksikaping	161	23514	35	1	22
F12	Pontianak	Batang Tarang	128	23320	10	3	76
F13	Bandar Lampung	Sukabumi *	270	21854	35	1	21

* ; Hydroport

(Trunk Lines)

No.	City Pair		Dist (Km)	Demand /Year	Max Seats	No. A/C	Flight /Week
T 1	Banda Aceh	Jakarta	1797	124584	70	4	58
T 2	Jakarta	Ambon	2388	119894	70	5	56
T 3	Jakarta	Manado	2199	106160	150	2	23
T 4	Malang	Denpasar	284	90938	100	1	30
T 5	Pakanbaru	Yogyakarta	1353	90402	100	2	29
T 6	Surabaya	Tarakan	1303	73982	70	2	34
T 7	Malang	Banjarmasin	542	73106	100	1	24
T 8	Jakarta	Tarakan	1605	55412	70	2	26
T 9	Jakarta	Mataram	1072	41372	50	2	27
T10	Bandung	Denpasar	860	33488	70	1	16

Table-5.26 New Air Routes (2004)

(Feeder Lines)

No.	City Pair		Dist (Km)	Demand /Year	Max Seats	No. A/C	Flight /Week
F 1	Pakanbaru	Sibolga	341	94766	50	2	62
F 2	Pontianak	Singkawang *	140	83498	50	2	54
F 3	Malang	Madiun	139	87408	70	1	41
F 4	Pontianak	Natuna	469	54574	50	2	36
F 5	Semarang	Kediri *	204	65498	35	2	62
F 6	Jakarta	Kotabumi	243	39436	35	2	37
F 7	Bandung	Pandeglang	161	40268	35	1	38
F 8	Bandar Lampung	Muara Enim	237	40266	35	2	38
F 9	Palembang	Muara Bungo	348	33556	35	2	32
F10	Pakanbaru	Padang Sidempuan	244	33786	35	1	32
F11	Pakanbaru	Lubuksikaping	161	30892	35	1	29
F12	Pontianak	Batang Tarang	128	30866	35	1	29
F13	Bandar Lampung	Sukabumi *	270	29212	35	1	28
F14	Banjarmasin	Tanah Grogot	240	42292	50	1	28
F15	Jakarta	Tasikmalaya	230	32042	35	1	30
F16	Mataram	Banyuwangi	265	32014	35	1	30
F17	Palangkaraya	Rabuh Hampang	264	25538	35	1	24
F18	Ternate	Buliserani **	89	18346	10	2	60
F19	Palembang	Lubuk Linggau	174	17910	20	1	29

* ; Hydroport ** ; Heliport

(Trunk Lines)

No.	City Pair		Dist (Km)	Demand /Year	Max Seats	No. A/C	Flight /Week
T 1	Banda Aceh	Jakarta	1797	156618	70	5	73
T 2	Jakarta	Ambon	2388	160614	100	4	52
T 3	Jakarta	Manado	2199	142794	150	2	31
T 4	Malang	Denpasar	284	107122	100	1	35
T 5	Pakanbaru	Yogyakarta	1353	103510	100	2	34
T 6	Surabaya	Tarakan	1303	100616	70	3	47
T 7	Malang	Banjarmasin	542	76160	100	1	25
T 8	Jakarta	Tarakan	1605	77992	70	3	36
T 9	Jakarta	Mataram	1072	81910	100	1	27
T10	Bandung	Denpasar	860	40102	70	1	19
T11	Surabaya	Kupang	1237	74078	70	2	34
T12	Medan	Surabaya	1979	66356	150	1	14
T13	Surabaya	Kendari	1129	64290	70	2	30
T14	Jakarta	Kendari	1762	58950	70	2	27
T15	Yogyakarta	Balikpapan	1018	50528	70	1	23
T16	Malang	Balikpapan	870	46200	70	1	21
T17	Medan	Denpasar	2283	44724	100	1	15
T18	Semarang	Balikpapan	962	43340	70	1	20
T19	Medan	Bandar Lampung	1216	32560	70	1	15
T20	Medan	Bandung	1525	29646	70	1	14

SECTION 6

STUDY ON AIRPORT FACILITIES

SECTION 6

STUDY ON CIVIL AVIATION FACILITIES

6.01 GENERAL

(01) The "Civil Aviation Facilities (CAF)" herein defined include the airport facilities, the Navaids installed in an airport and en-route, and telecommunication systems and aeronautical meteorology. The present situations of these facilities are delineated in Section-2 of Part II of Main Report.

(02) The objectives of this study, Study on the Civil Aviation Facilities, are to foresee the probable physical deficiencies in air transport operation likely to occur in connection with the civil aviation facilities defined-above, due to introduction of a large-sized aircraft, increment of flight frequency and realization of the potential new air routes as listed in Tables-4.1 and 4.2, and as illustrated in Figures-4.2 and 4.3 of Section-4.

(03) To achieve the above objectives, the following works have been carried out.

- Data collection including field survey
- Evaluation of present airport facilities
- Future airport facility requirements
- Approximate cost estimate

The details of the above subjects are described hereunder.

6.02 AIRPORTS

6.02.1 Field Survey

(04) The field survey on the existing airports has been

conducted to supplement the data and information collected in Jakarta. The questionnaires concerning the current conditions of airport facilities were delivered to 64 major airports (1985/DGAC) as listed in Table-6.1 from DGAC Head Quarter and such 4 selected airports as Ujung Pandang, Kendari, Denpasar and Surabaya, where a branch office of DGAC exists. The regional distribution of the said 64 airports are as follows and the approximate location of these airports are shown in Figure-6.1

- Region-I	10 airports
- Region-II	10 airports
- Region-III	12 airports
- Region-IV	10 airports
- Region-V	10 airports
- Region-VI	12 airports
Total	64 airports

(05) The major survey items are summarized below.

- Overall conditions of airports and air traffic
- Maximum operation aircraft and airport facility
- Air flight services
- Natural conditions

The questionnaires used are shown in Table-A6.1 of Appendix.

Table-6.1 Major Airports of Civil Aviation Region

(I) Civil Aviation Region-I : 10 airports

1. Banda Aceh
2. Batam
3. Singkep
4. Rengat
5. Tanjung Pinang
6. Sibolga
7. Pekanbaru
8. Medan
9. Padang
10. Meulaboh

(II) Civil Aviation Region-II : 10 airports

1. Tanjung Karang
2. Curug
3. Tanjung Pandang
4. Bandung
5. Pontianak
6. Palembang
7. Bangka (Pankal Pinang)
8. Jambi
9. Bengkulu
10. Cenkareng (Soekarno Hatta/Jakarta)

(III) Civil Aviation Region-III : 12 airports

1. Yogyakarta
2. Solo
3. Semarang
4. Surabaya (Juanda)
5. Palangka Raya
6. Pangkalanbun
7. Surabaya (Perak)
8. Balikpapan
9. Banjarmasin
10. Tarakan
11. Samarinda
12. Kotabaru

(IV) Civil Aviation Region-IV : 10 airports

1. Seram (Amahai)
2. Ternate
3. Ujung Pandang
4. Gorontalo
5. Pitu (Morotai)
6. Palu
7. Ambon
8. Manado
9. Kendari
10. Poso

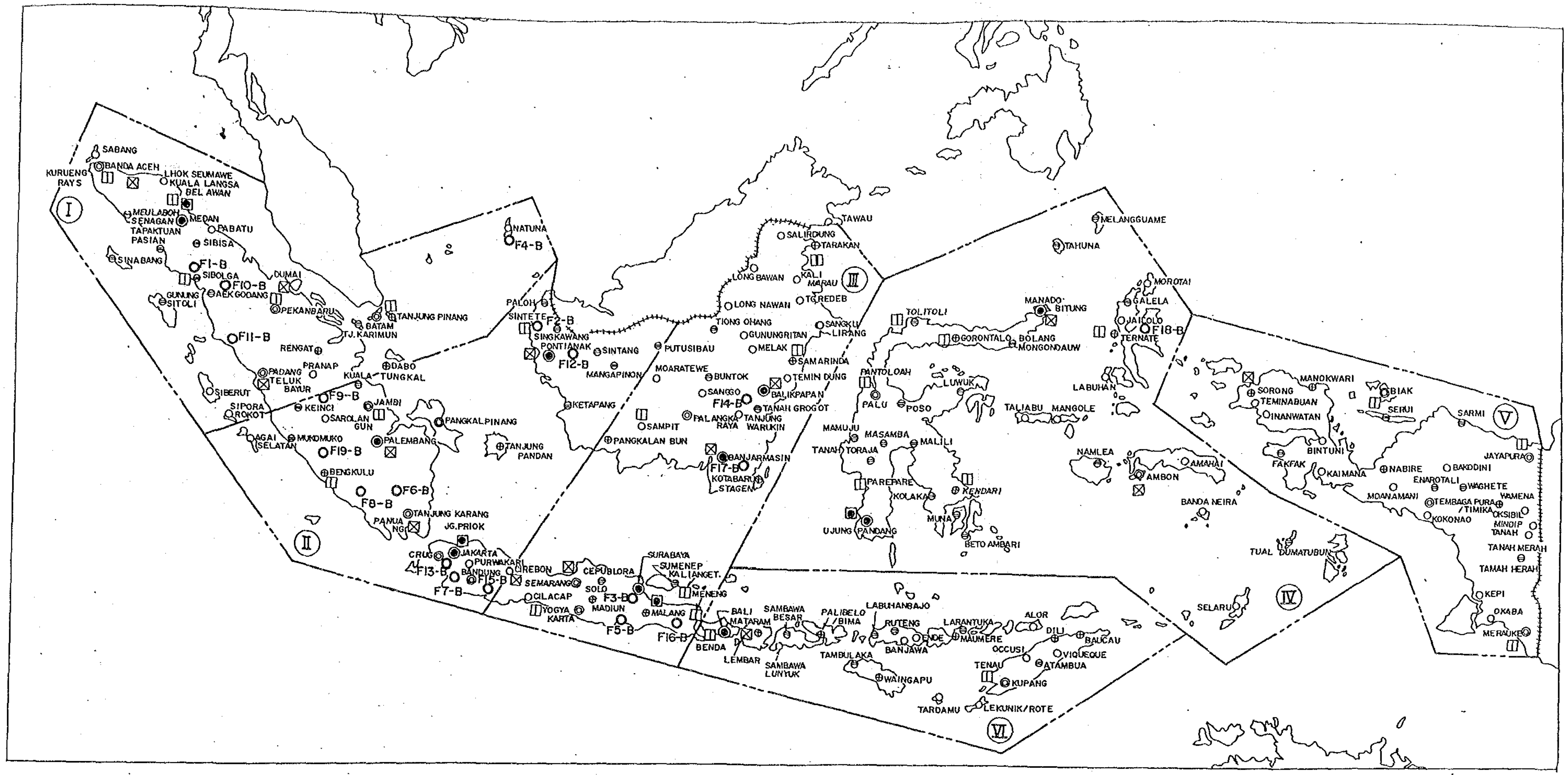
(V) Civil Aviation Region-V : 10 airports

1. Sorong
2. Kaimana
3. Manokwari
4. Merauke
5. Biak
6. Jayapura
7. Tembaga Pura (Timika)
8. Jayawijaya (Wamena)
9. Nabire
10. Fak-Fak

(VI) Civil Aviation Region-VI : 12 airports

1. Ngurah Rai (Denpasar/Bali)
2. Ampenan
3. Kupang
4. Komoro (Dili)
5. Waingapu
6. Maumere (Waioti)
7. Bima
8. Sumbawa Besar
9. Waikabubak
10. Baucau
11. Dili (Dili)
12. Ruteng

Source : AIRPORT TECHNICS DATA IN INDONESIA JAN 1985,
THE AIR TRAFFIC STATISTICS



LOCATION PLAN OF EXISTING AIRPORT (1986/1987), Not to Scale

LEGEND :

International/Regional, Major Airport (Category-I) ------ ◉
Regional, Border/Major Airport (Category-II) ------
Provincial, Feeder Airport (Category-III) ------
Municipal, Pioneer Airport (Category-IV) ------
Municipal, Pioneer Airport (Category-V) ------ o
Existing Domestic Air Route ------ See "Air Route Network of Scheduled Airlines, 1985-1986"
New Airport, Category-IV and V (Pioneer), ------ OF1-B
proposed by the Future Demand of the Inter-Island Traffic Project' 1987
Boundary Line and Number of Civil Aviation Region : (I)

Gateway Sea Port ------
Colleetor Sea Port ------ ⊠
Trunk Sea Port

Figure-6.1 Location of Existing Airports

(06) The filled questionnaires were returned from 64 airport offices through DGAC Head Quarter and its five(5) regional offices. The results are arranged in Table-6.2 and noteworthy findings are summarized below.

- The airports servicing over 20 years occupy about 90%.
- About 40% of the airports operate for 10 hours per day.
- A wide body jet can be accommodated by 7 airports.
- About a half number of airports have a runway length between 1,800 m and 800 m.
- About 84% of a passenger terminal building have a floor area less than 5,000 m^2.
- The airports which have been handling more than 300,000 pax. are about 17%.
- Aircraft movements of more than 100,000 movements correspond to 2% approximately.
- Most of airports are located in flat soft ground of silty clay with high ground water level.
- Load Classification Number(LNC) of runway of most airports falls within 12 to 22 for medium size aircraft.

(07) Through the field trips to more than 20 airports, the necessity of urgent rehabilitation has been seriously impressed. Most of facilities are old enough and look like decreasing its original capacity. By rehabilitating these existing facilities, the handling capacity of an existing airports could be improved and extended substantially with a minimum fund investment. Simultaneously, the safety of the air transport could be secured further.

6.02.2 Facility Requirements

(08) As listed in Tables-4.1 and 4.2, and illustrated in Figures-4.2 and 4.3 respectively in Section 4, the potential new air routes have been identified both in the

Table-6.2 Present Status of Airport

Air Flight Service

1. Number of operation air route	
- More than 12 routes	: approx. 5%
- Between 12 and 6 routes	: approx. 22%
- Between 6 and 3 routes	: approx. 38%
- Less than 3 routes	: approx. 30%
2. International & Domestic Passenger Demand	
- More than 300,000 pax.	: approx. 17%
- Between 300,000 and 100,000 pax.	: approx. 20%
- Between 100,000 and 20,000 pax.	: approx. 36%
- Less than 20,000 pax.	: approx. 20%
3. International & Domestic Cargo Demand	
- More than 50,000 t	: approx. 2%
- Between 50,000 and 10,000 t	: approx. 5%
- Between 10,000 and 1,000 t	: approx. 34%
- Less than 1,000 t	: approx. 53%
4. Number of aircraft movement	
- More than 100,000 movements	: approx. 2%
- Between 100,000 and 30,000 movements	: approx. 3%
- Between 30,000 and 3,000 movements	: approx. 52%
- Less than 3,000 movements	: approx. 38%

Natural Characteristics

1. Topography	
- Flat area	: approx. 52%
- Hilly area	: approx. 9%
- River bed	: n.a.
- Swamp, mountain, coast	: n.a.
2. Soil	
- Loamy or rocky	: approx. 2%
- Gravely, sandy	: n.a.
- Sandy, clayey	: approx. 6%
- Silty, clayey	: approx. 33%
3. Foundation Condition (natural)	
- Very hard	: approx. 2%
- Hard	: approx. 6%
- Soft	: approx. 27%
- Very soft	: n.a.
4. Ground water level	
- More than 10 m	: approx. 3%
- Between 10 m and 5 m	: approx. 6%
- Between 5 m and 1 m	: approx. 9%
- Less than 1 m	: approx. 22%

Note : n.a. means records are not available

Table-6.2 Present Status of Airport

General Condition of Airport and Air Traffic

1. Over 20 years of airport operation	: approx. 90%
2. Access to Airport 20 - 60 km	: approx. 69%
3. Land Size	: n.a.
4. Less than 6 m of elevation of airport reference point	: approx. 33%
5. Air service formation	
- Major air service	: approx. 55%
- Feeder air service	: approx. 27%
- Pioneer air service	: approx. 11%
6. Air service regularity	
- Major air service	: approx. 91%
- Feeder air service	: n.a.
- Pioneer air service	: approx. 2%
7. Flight operation hour	
- More than 10 hours	: approx. 39%
- Between 10 and 6 hours	: approx. 45%
- Less than 6 hours	: approx. 11%
8. Number of airport staff	
- More than 100 staffs	: approx. 41%
- Between 100 and 50 staffs	: approx. 36%
- Less than 50 staffs	: approx. 13%

Note : n.a. means records are not available

Maximum Operation Aircraft and Airport Facility

1. Maximum operation aircraft	
- Widebody jet	: approx. 11%
- Ordinary jet	: approx. 42%
- Ordinary plane	: approx. 42%
2. Runway length	
- More than 3,000m	: approx. 3%
- Between 3,000m and 1,800m	: approx. 33%
- Between 1,800m and 800m	: approx. 55%
- Less than 800m	: approx. 3%
3. Passenger terminal building	
- More than 20,000m2	: approx. 2%
- Between 20,000m2 and 5,000m2	: approx. 8%
- Less than 5,000m2	: approx. 84%
4. Cargo & other	
- More than 6,000m2	: approx. 2%
- Between 6,000m2 and 3,000m2	: approx. 8%
- Less than 3,000m2	: approx. 86%
5. Elect. & Mech. service utilities	
- Good & fair conditions	: approx. 44%
- Bad condition	: approx. 27%
- Worst condition	: n.a.
6. Airport navigation aids	
- IFR/High quality	: approx. 11%
- IFR/Ordinary quality	: approx. 27%
- VFR/High quality	: approx. 19%
- VFR/Ordinary quality	: approx. 14%

Note : n.a. means records are not available trunk lines and in the feeder lines by the year of 1994 and 2004. To realize such new air routes, the appropriate airports facilities should be provided in advance of commencement of services by any of the following measures;

- Construction of a new airport
- Expansion and overlay of the existing runway

if the existing airports could not afford to accommodate the aircraft and the air traffic load in the future.

(09) Out of these two alternatives, the work items and quantities for expansion and overlay of the existing runway certainly depend largely on the prevailing present conditions of these airports. To figure out these conditions, it inevitably requires the extensive evaluation survey on each specific airport. Some airport, for example, would need the overlay or the reconstruction of a part or all of a runway or addition of a terminal building. It could hardly be possible to investigate the present status of all study airports and assess the extent of works involved for upgrading the existing facilities good for the expected future aircraft load and passenger demand.

(10) As such, to estimate the approximate cost to be required for accommodating the expected future aircraft as specified in Table-5.24 of Section 5 , it is assumed that;

- The existing runway shall be overlaid and expanded, in case that the expected future load is heavier than that at present. The cost accruing from the probable expansion of an existing terminal building has been disregarded since its present capacity and status are quite uncertain.
- The new airports be constructed in the zones where the airport is presently nonexistent and opening of the new air route is expected within 20 years as

discussed in Section 5 and listed in Tables-5.6(3/3), 5.7(3/3), 5.11 and 5.12(2/2) of Section-5.

(11) The work quantities and cost incurred for expansion and overlay naturally vary depending on the size/type of an aircraft to be assigned. To simplify and generalize, the runway has been classified to 6 groups by available numbers of seats of an aircraft as presented in Table-A6.2 and Table-A6.3 and listed in Tables-5.6(3/3), 5.7(3/3), 5.11 and 5.12(2/2).

Table-6.3 Numbers of Seats versus Runway Length

NO	Nos.of Seats	Runway(L*W)	Equiv.Aircraft
1	340 ≤ S < 510	2,900*45*1	B-747-300
2	150 ≤ S < 340	2,900*45*1	
		2,800*45	
3	50 ≤ S < 150	2,400*45	DC-9
		2,000*45	
		1,800*45	
4	20 ≤ S < 50	1,400*30	F-27
		1,100*30	CN-235
5	10 ≤ S < 20	800*23	DHC-6
6	S < 10	500*18	BN-2A

*1: Thickness of pavement is different.
S: Number of seats

Each runway belonging to the same group specified in the above table has a similar pavement structure. Thus, the cost required for extension and overlay of a runway in the specific group is mutually identical.

(12) As broken down in Tables-5.6, 5.7, 5.11 and 5.12 of Section-5, the accumulated extension and overlay length of a runway has been assessed in consideration to the existing runway length and the future aircraft to be put on services, and is summarized by Scenario which is defined in Section 5, in the following Table-6.4.

Table-6.4 Runway Extension and Overlay Length

NO	Nos.of Seats	SCENARIO-A Exten. (m)	SCENARIO-A O.L (m)	SCENARIO-B Exten. (m)	SCENARIO-B O.L (m)
	1994				
1	340 ≤ S < 510	2,345	6,355	-	-
2	150 ≤ S < 340	8,960	22,240	-	-
3	50 ≤ S < 150	11,325	28,075	2,455	10,345
4	20 ≤ S < 50	9,995	22,405	1,950	2,850
5	10 ≤ S < 20	1,090	5,310	150	650
6	S < 10	-	-	-	-
	Total	33,715	84,385	4,555	13,845
	2004				
1	340 ≤ S < 510	4,150	7,450	-	-
2	150 ≤ S < 340	13,165	23,535	300	2,500
3	50 ≤ S < 150	13,290	33,510	4,510	21,890
4	20 ≤ S < 50	12,850	22,150	2,935	6,465
5	10 ≤ S < 20	820	3,980	1,095	4,505
6	S < 10	-	-	-	-
	Total	44,275	90,625	8,840	35,360

Note: Exten.; Extension
O.L ; Overlay
S ; Number of seats

In the above table, the length denoted in the column of 2004 means the length required, unless expansion and overlay will have been made at all by 2004. For example, in case of Scenario-A, the group of a runway which shall serve in 2004 for an aircraft having number of seats from 150 to 340, or 2,800m*45m and 2,900m*45m at the longest in the group, shall be extended by 13,165m and overlaid by 23,535m in the very group total, if no extension and overlay on the runway in the group would have been made at all by that year.

(13) While, the facility requirements of the probable new airports to serve the potential new air routes is figured in accordance with the airport classification criteria to select the suitable development scale. The criteria currently effective in Indonesia are the credit points given to the components concerning;

- Air traffic volume
- Status of the airport
- Type of aircraft
- Availability of air safety operation
- Availability of telecommunications, air navigations, electricities and visual aids facilities
- Other additional components

The credit points given to the respective component is tabulated in Table-6.5.

Table-6.5 Credit Points Assign for the each Component

Components	Point
1. Air traffic demand:	
a. Annual aircraft movement for every 1,000 movements (take off and landing)	100
b. Number of passenger For every 10,000 pax (depart & arrive)	100
c. Number of cargo For every 100,000 kg (loading & unloading)	100
2. Status of airport:	
a. Internatinal airport	100
b. Border airport	50
c. Domestic airport	30
d. Pioneer airport	10
3. Type of aircraft:	
a. B-767, B-747, DC-10, Air Bus A-300, A-310, etc.	100
b. DC-9, F-28, B-757, A-320, etc.	75
c. F-27, DC-3, CN-235, etc.	50
d. Aircraft type smaller than DC-3, CN-235	25
4. Service facilities of air safety operation:	
a. Unattended	10
b. AFIS (Aerodrome Flight Information Service)	75
c. ADC (Aerodrome Control Tower)	100
d. APP (Approach Control Office)	100
e. ACC (Area Control Centre)	100
f. FSS (Flight Service Station)	75
g. FIC (Flight Information Centre)	
- Flight Information Region (FIR)	100
- Upper Information Region (UIR)	100
h. AIS (Aeronautical Information Services)	50
i. Fire fighting facilities	100
j. Refuelling Facilities	100

Table-6.5 Credit Points Assign for the each Component

Components	Point
5. Telecommunications, Air Navigations, Electricities, and Visual Aids Facilities:	
a. Telecommunication Facilities;	
1) AMS (Aeronautical Mobile Service);	
a) VHF (Very High Frequency)	100
b) UHF (Ultra High Frequency)	75
c) HF (High Frequency)	50
2) AFS (Aeronautical Fixed Service);	
a) AFTN/RTT (Aeronautical Fixed Telecommunication Network/Radio Teletype & Radio Telephony)	100
b) DSC (Direct Speech Circuit)	100
b. Air Navigation Facilities;	
1) NDB (Non Directional Radio Beacon)	25
2) VOR (Very High Frequency Omni Range)	50
3) DME (Distance Measuring Equipment)	50
4) RADAR (Radio Detecting And Ranging)	100
5) ILS (Instrument Landing System)	100
c. Electricity Facilities;	
1) Power: (kVA = Kilovolt Ampere)	
a) More than 850 kVA	100
b) More than 500 kVA and less than 849 kVA	75
c) 250 kVA - 499 kVA	50
d) 100 kVA - 249 kVA	25
e) Less than 99 kVA	10
d. Visual Aids Facilities;	
a) VASI (Visual Approach Slope Indicator)	50
b) Runway Light	100
c) Approach Light	100
d) REIL (Runway End Indication Light)	75

Table-6.5 Credit Points Assign for the each Component

Componenets	Point
6. <u>Other Additional Components</u>:	
a. Servicing Government Activity (Catchment Area/Hinter land);	
1) Province	1,000
2) Municipality	250
b. Airport Operation Hour;	
1) 19 - 24 hours	100
2) 13 - 18 hours	75
3) 9 - 12 hours	50
4) Less than 9 hours	25
c. Educational Centre	1,000
d. Industrial Development Centre	1,750

<u>The airport categorization and credit point</u>:

- The airport classification is devided into 5 catagories.

1. Airport Catagory/Class I
2. Airport Catagory/Class II
3. Airport Catagory/Class III
4. Airport Catagory/Class IV
5. Airport Catagory/Class V

- The airport classification is based on credit point which can reac to every airport.

1. Airport Category/Class I ; total point: more than 10,000
2. Airport Category/Class II ; total point: 4,000 - 9,999
3. Airport Category/Class III; total point: 1,000 - 3,999
4. Airport Category/Class IV ; total point: 600 - 999
5. Airport Category/Class V ; total point: less than 600

<u>Source</u>: Letter of Minister of Transportations and Communications No. 117/AU104/PH6-82, Jakarta, 3 April 1982.

(14) To assess the minimum credit point of the respective Category of an airport, the model airport representing each Category has been selected preliminarily based on the total capacity of the present operation among the existing airports as follows.

- Category-I Manado Airport
- Category-II Jayapura Airport
- Category-III Dili Airport
- Category-IV Sarmi Airport
- Category-V Moanamani Airport

Then, the credit points of each model airport is calculated based on the given point as presented in the aforesaid Table-6.5. The results are shown in Table-6.6, which is revised to meet the concept design for the recent airport facility requirements.

(15) As per Table-6.6, the total minimum credit point of each Category of airports in 2004 will be defined as follows.

- Category-I more than 15,000 points
- Category-II 7,500 to 14,999 points
- Category-III 5,000 to 7,499 points
- Category-IV 2,500 to 4,499 points
- Category-V 1,500 to 2,499 points

Whereas, the points of probable new land airports, which are named in Tables 5.6(3/3) and 5.7(3/3), given by the

Table-6.6 Minimum Credit Point of Airport

* Appl ... Application

Notes: 1) Following credit point will be formed as for minimized airport, 2004.
2) Minimum credit point of Cat-I, II, III, IV and V will be modified due to present requirement of civil aviation to Airport Classification Criteria.

References: a) Airport Classification Criteria b) STATISTIK ANGKUTAN UDARA 1984/1985
c) Air Transportation Demand, 1986

Notice: Above reference will be used for the study of min. aircraft movement and number of cargo. Necessary model airport will designate; Manado/Cat-I, Jayapura/Cat-II, Dili/Cat-III, Sarmi/Cat-IV and Moanamani/Cat-V.

	Airport Category / Class	Category-I		Category-II		Category-III		Category-IV		Category-V	
	Basic Components	Appl.	Credit Point	Appl.	Credit Point	Appl.	Credit Point	Appl.	Credit Point	Appl.	Credit Point
1.	Air Traffic Demand:										
a.	Aircraft Movement (Annual)	o	1,150	o	800	o	400	o	200	o	100
b.	Number of Passenger (Annual)	o	3,900	o	1,750	o	1,225	o	125	o	50
c.	Number of Cargo (Annual)	o	4,000	o	1,950	o	1,370	o	790	o	530
2.	Status of Airport:										
a.	International airport/major airport (International and regional air services)	o	100	-	-	-	-	-	-	-	-
b.	Border airport/major airport (Regional air services)	-	-	o	50	-	-	-	-	-	-
c.	Domestic airport/feeder airport (Provincial air services)	-	-	-	-	o	30	-	-	-	-
d.	Pioneer airport/pioneer airport (Municipal air services)	-	-	-	-	-	-	o	10	o	10
3.	Type of Aircraft:										
a.	B-767, B-747, DC-10, A-300, etc.	B-747	100	DC-10-30	100	-	-	-	-	-	-
b.	DC-9, F-28, B-757, A-320, etc.	-	-	-	-	F-28	75	-	-	-	-
c.	F-27, DC-3, CN-235, etc.	-	-	-	-	-	-	F-27	50	-	-
d.	Aircraft type smaller than DC-3, CN-235	-	-	-	-	-	-	-	-	DHC-6	25
4.	Service Facilities of Air Safety Operation:										
a.	Unattended	-	-	-	-	-	-	-	-	o	10
b.	AFIS	o	75	o	75	o	75	-	-	-	-
c.	ADC	o	100	o	100	o	100	o	100	o	100
d.	APP	o	100	o	100	-	-	-	-	-	-
e.	ACC	o	100	-	-	-	-	-	-	-	-
f.	FSS	-	-	-	-	-	-	o	75	-	-
g.	FIR	o	100	o	100	o	100	o	100	o	100
	UIR	-	-	-	-	-	-	-	-	-	-
h.	AIS	o	50	o	50	-	-	-	-	-	-
i.	Fire fighting facilities	o	100	o	100	o	100	o	100	o	100
j.	Refuelling facilities	o	100	o	100	o	100	o	100	o	100

Table-6.6 Minimum Credit Point of Airport

Airport Category / Class Basic Components	Category-I Appl.	Category-I Credit Point	Category-II Appl.	Category-II Credit Point	Category-III Appl.	Category-III Credit Point	Category-IV Appl.	Category-IV Credit Point	Category-V Appl.	Category-V Credit Point
5. Tele-Comm., Air Navigations, Electricities and Visual Aids Facilities:										
a. Tele-Communication Facilities;										
1) AMS										
a) VHF	o	100	o	100	o	100	-	-	-	-
b) UHF	o	75	o	75	o	75	-	-	-	-
c) HF	o	50	o	50	o	50	o	50	o	50
2) AFS										
a) AFTN/RTT	o	100	o	100	o	100	-	-	-	-
b) DSC	o	100	o	100	o	100	-	-	-	-
b. Air Navigation Facilities;										
1) NDB	o	25	o	25	o	25	o	25	o	25
2) VOR	o	50	o	50	o	50	o	50	-	-
3) DME	o	50	o	50	o	50	o	50	-	-
4) RADAR	o	100	o	100	o	100	-	-	-	-
5) ILS	o	100	o	100	o	100	-	-	-	-
c. Electricity Facilities;										
1) Power (kVA - Kilovolt Ampere)										
a) More than 850 kVA	o	100	-	-	-	-	-	-	-	-
b) 500 kVA - 849 kVA	-	-	o	75	-	-	-	-	-	-
c) 250 kVA - 499 kVA	-	-	-	-	o	50	o	50	-	-
d) 100 kVA - 249 kVA	-	-	-	-	-	-	-	-	o	25
e) Less than 99 kVA	-	-	-	-	-	-	-	-	-	-
d. Visual Aids Facilities;										
a) VASI	o	50	o	50	o	50	o	50	-	-
b) Runway Light	o	100	o	100	o	100	o	100	-	-
c) Approach Light	o	100	o	100	o	100	o	100	-	-
d) REIL	o	75	o	75	o	75	o	75	-	-
6. Other Additional Components:										
a. Servicing Government Activity (Catchment Area/Hinter Land);										
1) Province	o	1,000	o	1,000	-	-	-	-	-	-
2) Municipality	-	-	-	-	o	250	o	250	o	250
b. Airport Operation Hour;										
1) 19 - 24 hours	o	100	-	-	-	-	-	-	-	-
2) 13 - 18 hours	-	-	o	75	-	-	-	-	-	-
3) 9 - 12 hours	-	-	-	-	o	50	o	50	-	-
4) Less than 9 hours	-	-	-	-	-	-	-	-	o	25

Table-6.6 Minimum Credit Point of Airport

(TARGET YEAR OF 2,004)

Airport Category / Class Basic Components	Category-I		Category-II		Category-III		Category-IV		Category-V	
	Appl.	Credit Point	Appl.	Credit Point	Appl.	Credit Point	Appl.	Credit Point	Appl.	Credit Point
c. Educational Centre	o	1,000	-	-	-	-	-	-	-	-
d. Industrial Development Centre (IPZ)	o	1,750	-	-	-	-	-	-	-	-
Total min. credit point for airport category/class	15,000 (Revised)		7,500 (Revised)		5,000 (Revised)		2,500 (Revised)		1,500 (Revised)	

passenger demand forecast as per Tables-6.7 and 6.8 are:

- F5-B, Kediri 1773.4 (1994) 3274.9 (2004)
- F6-B, Kota Bumi 1517.0 (1994) 1971.8 (2004)
- F13-B, Suka Bumi 1092.7 (1994) 1460.6 (2004)

As is clear in the above, the probable 3 new land airports all correspond to Categories-IV and V in the aspect of passenger demand. In addition, all of the probable new hydro ports fall within Category-V.

(16) While, as defined in the line 3.c and 3.d of Table-6.6, the maximum operation aircraft type corresponds to F-27 class aircraft for Category-IV and DHC-6 class aircraft for Category-V. Thereby, the airport index of a probable new land airport are to be defined as follows.

* Airport Category: Category-IV
    - Number of Passenger: 12,500 - 122,500
    - Maximum Operation Aircraft: F-27
    - Runway, L x W: 1,600m x 45m
      (covers HS-748-2B & C-160/non-scheduled as specified in Repelita-IV)

* Airport Category: Category-V
    - Number of Passenger: 5,000 - 12,500
    - Maximum Operation Aircraft: DHC-6
    - Runway, L x W: 800m x 23m
      (covers CN-235 & C-212/non scheduled as specified in Repelita-IV)

(17) In addition, since the number of passenger varies from 122,500 to 5.000 in wide range within Category-IV and V, the standard scale of the new airports is subdivided to three types as defined below.

- Type-A/CAT-IV, 25,000 to 50,000 passengers

Table-6.7 Air Passenger Demand Forecast of New Feeder Air Route

No. of Air Route	Dist. (km)	No. of Airport	Name of Assigned Airport and/or Location	Passenger Demand Forecast, 1994	Passenger Demand Forecast, 2004	No. of Air Route	Dist. (km)	No. of Airport	Name of Assigned Airport and/or Location	Passenger Demand Forecast, 1994	Passenger Demand Forecast, 2004
F-1	295	F1-A	SIMPANG TIGA (PKU)	34,534	47,383	F-11	168	F11-A	SIMPANG TIGA (PKU)	11,757	15,446
		F1-B	SIBOLGA	"	"			F11-B	LUBUK SIKAPING	"	"
F-2	123	F2-A	SUPADIO (PNK)	30,995	41,749	F-12	240	F12-A	SUPADIO (PNK)	11,660	15,433
		F2-B	SINGKAWANG	"	"			F12-B	BATANG TARANG	"	"
F-3	151	F3-A	MALANG (MLG)	25,428	43,704	F-13	252	F13-A	BRANTI (TGK)	10,927	14,606
		F3-B	MADIUN	"	"			F13-B	SUKA BUMI	"	"
F-4	458	F4-A	SUPADIO (PNK)	20,117	27,287	F-14	220	F14-A	SAMSUDIN NOOR (BDJ)	–	21,146
		F4-B	NATUNA	"	"			F14-B	TANAH GROGOT	–	"
F-5	212	F5-A	A. YANI (SRG)	17,734	32,749	F-15	232	F15-A	SOEKARNO HATTA (JKT)	–	16,021
		F5-B	KEDIRI	"	"			F15-B	TASIK MALAYA	–	"
F-6	269	F6-A	SOEKARNO HATTA (JKT)	15,170	19,718	F-16	233	F16-A	SELAPARANG (AMI)	–	16,007
		F6-B	KOTA BUMI	"	"			F16-B	BANYUWANGI	–	"
F-7	155	F7-A	H. SASTRA NEGARA (BDO)	14,820	20,134	F-17	256	F17-A	PANARUNG (PKY)	–	12,769
		F7-B	PANDEGLANG	"	"			F17-B	RABUH HAMPANG	–	"
F-8	236	F8-A	BRANTI (TGK)	14,036	20,133	F-18	88	F18-A	BABULLAH (PTE)	–	9,173
		F8-B	MUARA ENIM	"	"			F18-B	BULISERANI	–	"
F-9	271	F9-A	TALANG BETUTU (PLM)	13,843	16,778	F-19	176	F19-A	TALANGBETUTU (PLM)	–	8,955
		F9-B	MUARA BUNGO	"	"			F19-B	LUBUK LINGGAU	–	"
F-10	244	F10-A	SIMPANG TIGA (PKU)	13,229	16,893						
		F10-B	PADANG SIDEMPUAN	"	"						

Table-6.8 Air Passenger Demand Forecast of New Trunk Air Route

(Sheet No.2 of 2)

No. of Air Route	Dist. (km)	No. of Airport	Name of Assigned Airport	Passenger Demand Forecast, 1994	Passenger Demand Forecast, 2004	No. of Air Route	Dist. (km)	No. of Airport	Name of Assigned Airport	Passenger Demand Forecast, 1994	Passenger Demand Forecast, 2004
T-1	1,803	T1-A	BLANG BINTANG (BTJ)	62,292	78,309	T-11	1,297	T11-A	JUANDA (SUB)	-	37,039
		T1-B	SOEKARNO HATTA (JKT)	"	"			T11-B	EL. TARI (KOE)	-	"
T-2	2,414	T2-A	SOEKARNO HATTA (JKT)	59,947	80,307	T-12	1,954	T12-A	POLONIA (MES)	-	33,178
		T2-B	PATIMURA (AMQ)	"	"			T12-B	JUANDA (SUB)	-	"
T-3	2,208	T3-A	SOEKARNO HATTA (JKT)	53,080	71,397	T-13	1,185	T13-A	JUANDA (SUB)	-	32,145
		T3-B	SAM RATULANGI (MDC)	"	"			T13-B	W. MONGINSIDI (KDI)	-	"
T-4	295	T4-A	MALANG (MLG)	45,469	53,561	T-14	1,792	T14-A	SOEKARNO HATTA (JKT)	-	29,475
		T4-B	NGURAH RAI (DPS)	"	"			T14-B	W. MONGINSIDI (KDI)	-	"
T-5	1,372	T5-A	SIMPANG TIGA (PKU)	45,201	51,755	T-15	1,023	T15-A	ADI SUCIPTO (JOG)	-	25,264
		T5-B	ADI SUCIPTO (JOG)	"	"			T15-B	SEPINGGAN (BPN)	-	"
T-6	1,279	T6-A	JUANDA (SUB)	36,991	50,308	T-16	890	T16-A	MALANG (MLG)	-	23,100
		T6-B	TARAKAN (TRK)	"	"			T16-B	SEPINGGAN (BPN)	-	"
T-7	571	T7-A	MALANG (MLG)	36,553	38,080	T-17	2,284	T17-A	POLONIA (MES)	-	22,362
		T7-B	SAMSUDIN NOOR (BDJ)	"	"			T17-B	NGURAH RAI (DPS)	-	"
T-8	1,594	T8-A	SOEKARNO HATTA (JKT)	27,706	38,996	T-18	1,229	T18-A	POLONIA (MES)	-	16,280
		T8-B	TARAKAN (TRK)	"	"			T18-B	BRANTI (TGK)	-	"
T-9	1,075	T9-A	SOEKARNO HATTA (JKT)	20,686	40,955	T-19	1,511	T19-A	POLONIA (MES)	-	14,823
		T9-B	SELAPARANG (AMI)	"	"			T19-B	H. SASTARA NEGARA (BDO)	-	"
T-10	880	T10-A	H. SASTARA NEGARA (BDO)	16,744	20,051	T-20	952	T20-A	A. YANI (SRG)	-	11,670
		T10-B	NGURAH RAI (DPS)	"	"			T20-B	SEPINGGAN (BPN)	-	"

Note: Air passenger demand forecast of existing airport as shown above, it is average of the demand forecast of new air route for the aircraft planning. This will be added to individual demand forecast for the air development of each existing airport.

- Type-B/CAT-IV, 12,500 to 25,000 passengers
- Type-C/CAT-V, 5,000 to 12,500 passengers

With this classification, the development scale of the probable new airports is summarized in Tables-6.9.

Table-6.9 Standard Scale of New Airport Facility, 2004

(AIRPORT CATEGORY/CLASS: IV and V, PIONEER AIRPORT)

Note: For air navaids equipments in the airport facility requirements, will be referred to the final report on the navaids and tele-comm. covers radio & radar equipments and visual aids at air route and airport.

	Description / Type of Facility	Cat/Class-IV, Type-A	Cat/Class-IV, Type-B	Cat/Class-V, Type-C	Remarks
General Condition of New Airport	Air Service Regularity	Dom/Scheduled	Dom/Scheduled	Dom/Scheduled	. chartered flight available
	Air Service Formation	Tertiary & Access	Tertiary & Access	Access	. Radial and loop air routes.
	Air Operation Area	Provincial & Municipal	Provincial & Municipal	Municipal	. by the civil aviation services.
	Operation Aircraft	F-27/STOL VTOL	F-27/STOL VTOL	DHC-6/STOL VTOL	. F-27, CN-235: 52 and 38 seats. . DHC-6: 18 seats. . STOL, VTOL: less than 18 seats.
	Land Size of Airport (ha)	100	100	50	. includes future expansion.
	Elevation of Airport Reference Point (m)	X > 6	X > 6	X > 6	
	Topography	Flatly	Flatly	Flatly	. elev. difference < 3 m
	Foundation of Natural Ground	Hardy/Soft	Hardy/Soft	Hardy/Soft	. field CBR > 6.0 (Ave.), silty clay.
	Ground Water Level (m)	X≤-3	X≤-3	X≤-3	
	Distance between Airport to City/town (km)	20 - 60	20 - 60	20 - 60	
Airport Demand Forecast	Air Passenger (Annual) (man)	50,000	25,000	12,500	. assumed by the air passenger demand forecast of new air route. (max.)
	Air Cargo (Annual) (t)	1,080	935	660	. assumed by the minimum credit point of airport.
	Air Craft Movement (Annual) (no.)	2,500	1,700	1,400	. assumed by the minimum credit point of airport (take-off & landing)
	Peak Hour Air Passenger (man)	76	38	19	. passenger time fluctuation ÷ . aircraft time fluctuation
	Peak Hour Aircraft Movement (no.)	1.9	1.3	1.1	. number of aircraft in peak hour
	Airport Operation Hour (hr.)	6	6	6	. min. operation hour
	Max. Operation Aircraft	F - 27	F - 27	DHC - 6	. (HS-748-2B, C-160/Non-Scheduled)/Cat-IV . (CN-235, C-212/Non-Scheduled)/Cat-V
Airport Facility Requirements	Land Acquisition (ha)	100	100	50	. includes future expansion.
	Runway, Length x Width (m)	1,600 x 45	1,600 x 45	800 x 23	. covers take-off & landing of HS-748-2B & C-160/Cat-IV and CN-235 & C-212/Cat-V
	Runway Strip, Length x Width (m)	1,720 x 300	1,720 x 300	920 x 300	. includes future instrument runway
	Taxiway, Length x Width (m)	150 x 23	150 x 23	150 x 23	"
	Aircraft Parking Apron including reserve spot (m²)	1: C-160 1: F-27 1: CN-235 1: DHC-6 (165x90)	1: C-160 1: F-27 1: CN-235 (135x90)	1: CN-235 2: DHC-6 (110x75)	. occupation time of apron: 1. first flight .... 1.5 hr 2. scheduled flight .... 1.0 hr . covers HS-748-2B and C-160/Cat-IV and CN-235 & C-212/Cat-V.
	Passenger Complex Builidng (m²)	1,400	700	350	. departure & arrival units, and boading and handling equipments
	Cargo Terminal Building (m²)	250	200	150	. cargo, luggage, air mail units, and loading and lifting equipments.
	Supporting Ancillary Building (m²)	280	160	140	. control tower, utility station and etc.
	Car Parking Area (lot/m²)	40/1,400	20/700	10/350	. for passenger, airport staff, employee and visitor.
	Land-Side Service Road (m/lane)	1,000/1	1,000/1	500/1	. terminal area for passenger & cargo traffic.
	Rescue & Fire Station (Car/m²)	1/80	1/80	1/80	. air navigation aids required for aircraft operation.
	Aviation Fuel Supply (kl/m²)	-	-	-	. will be provided by fuel enterprise and airlines.
	Elect. Power Supply (kVA)	500	500	250	. for building, navaids and telephony (includes generator)
	Water Supply (ton/month)	1.08	0.54	0.27	. water supply line and treatment plant.
	Sanitary Waste (ton/month)	4.66	2.33	1.17	. sanitary sewer line and treatment plant.

(18) The probable new airports, listed in Tables-5.6(3/3), 5.7(3/3), 5.11 and 5.12(2/2) could be classified based on a magnitude of passenger demand as follows.

Table-6.10 Numbers of New Airports Required by Scenario

Type of Airport	Numbers of Airport			
	SCENARIO-A		SCENARIO-B	
	1994	2004	1994	2004
1.Land Airport				
Type-A/Cat-IV	-	1	-	-
Type-B/Cat-V	2	2	1	1
Type-C/Cat-V	1	-	-	-
2.Hyro Airport				
Type-C	-	-	6	21

(19) In respect to the conceptual engineering design of the airport facilities, the following materials are referred to.

- Standard of Airfield Facility Recommended by ICAO, shown in Table-6.10.
- Standard of Sea-Air Station Facility by SJAC shown in Table-6.11.
- Site Requirement of Air Operation-Obstacle Limitation Surface (Land Air Station) shown in Figure-6.2.
- Site Requirement of Air Operation (Sea Air Station) shown in Figure-6.3.

6.02.3 Approximate Cost

(20) The approximate cost required for extension and overlay of the existing airports, and construction of a new airport in order to accommodate the future traffic demand is estimated for each Scenario as presented in Tables A6.4 to A6.5 and summarized below.

Table-6.11(1) Summary of Approximate Cost

Description	SCENARIO-A		SCENARIO-B	
	1994	2004	1994	2004
Runway Extension	217	289	28	53
Runway Overlay	205	227	34	83
Const. of New Land Airport	45	58	19	19
Const. of New Hydroport	-	-	30	104
Grand Total	467	574	111	259

Unit: Millions Rp.= 588.2 US.$

Whereas, if the land acquisition cost which is likely to be covered by the budget of a local government concerned is disregarded, the cost will be reduced as follows.

Table-6.11(2) Summary of Approximate Cost

Description	SCENARIO-A		SCENARIO-B	
	1994	2004	1994	2004
Runway Extension	204	272	26	49
Runway Overlay	205	227	34	83
Const. of New Land Airport	43	55	18	18
Const. of New Hydroport	-	-	26	91
Grand Total	452	554	104	241

Unit: Millions Rp.= 588.2 US.$

(21) The unit cost applied to the above cost estimate has been assessed based on the following procedures.

A. Unit Cost of Extension and Overlay

1) Pavement structure has been assumed in relation with the subject load represented in numbers of seats of aircraft(see Table-A6.2).

2) Based on the dimension of the pavement thus assumed,

the unit work quantity per meter of extension and overlay of a runway has been estimated for each class of the runway. In this process, the width of landing area has been considered 300 meters for instrument landing and 150 meters for non-instrument landing.

3) The unit price of respective work, such as earth work, drainage work, pavement, etc., has been quoted by referring the price of similar work under construction. The unit cost has been given by quantity times unit price of the respective work as tabulated in Table-A6.3 and summarized below.

Table-6.12 Unit Cost of Extension & Overlay

NO	Nos.of Seats	Extension	Overlay
1	340 ≤ S < 510	7,497	3,332
2	150 ≤ S < 340	7,290	3,135
3	50 ≤ S < 150	6,980	2,876
4	20 ≤ S < 50	5,161	1,263
5	10 ≤ S < 20	3,475	893
6	S < 10	3,084	728

Unit; Tousands Rp./meter

B. Unit Construction Cost of New Airport

1) Based on the facility requirements as discussed in 6.02.2, the work quantities of each type of airport have been calculated and, by applying the same unit price as that adopted in Item A above, the unit construction cost has been assessed as shown in Table-A6.8 for a land airport and Table-A6.9 for a hydro airport.

(22) Since the actual field investigation has not been made in this particular, several assumptions have been employed in cost estimate as follows.

- The natural conditions are assumed to be normal in general sense.
- Data and maps collected are used as much as possible for evaluation of site conditions.
- Recent data of airport and other engineering construction between 1981 and 1987 in the South-East Asia, are applied for the unit price estimate.
- Composition of construction work items for airport, are referred to FAA construction specification.
- Extension cost of terminal buildings related to upgrading of the existing runway is not included.
- Exchange rates on December 1987 are fixed at U.S.$ 1.00 equivalent to Rp. 1,700 and Yen 132.00

(23) Hence, the grand total cost to be required for expansion and overlay of the existing runways, and construction of the new probable airports to satisfy the demand of each SCENARIO as presented in Table-6.11 in Para.(20) will amount to 467.0 billions Rp. in 1994 and 573.7 billions Rp.in 2004 for SCENARIO-A and, 110.0 billions Rp.in 1994 and 258.4 billions for SCENARIO-B.

The cost above just shows an approximate cost level and shall not be applied to any specific project without modifications necessary.

6.03 NAVAIDS AND COMMUNICATIONS

6.03.1 Evaluation of Present Status

(24) The following is the evaluation of present status and some improvement measures conceivable, which have been worked based on the present situations treated in Part II. In general, most of VOR seems functioning well. The following problems, however,have been reported from the officials concerned.

- Difficult access to a navigational station for maintenance.
- Shortage of spare parts, technicians and fuel supply.
- Limited electricity supply.
- Limited airport operation hour.
- Uncertain schedule of flight test
- Station be on air on request.

(25) The existing NDBs be desirably replaced by precise VOR, DVOR (Doppler VOR) instead of conventional VOR. In the area where there are many military aircraft flying, TACAN (Tactical Air Navigation System) should be collocated with VOR, instead of DME(VOR/DME). TACAN can be also usable for civil aircraft. because its nature is the same as that of DME. However, NDB need to remain located at some locations, because there will be a small number of military aircraft like a reconnaissance flight with the narrow cockpit which has no enough space to provide VOR airborne equipment besides tactical instruments.
The question that, which NDB can be replaced by VOR and which NDB should be left as it is, should be discussed among the authorities concerned.

(26) For small pioneer aircraft, it is desirable to provide VOR airborne equipment, since the VOR system accuracy is superior to that of NDB. Thus, it will make

their operationability higher when homing to destination airport.

(27) Conventional NDB of low range be better replaced by the new type of medium or higher range. It is, however, not necessary to replace all of them, because the provision of higher power NDB makes radio fixes in conjunction with the existing NDB of lower power so that a pilot can use the fixes as a reference point to adjust his navigational deviation. Some of the example cases are delineated in Appendix to Section 6.

(28) It is desirable to install DVOR for the airways traversing wide bodies of water. They are better located on landfalls than on islands in between navigation aids which constitute the airway. It is impractical to install them on islands from viewpoint of accessibility for maintenance, availability of technicians and security problems. The effect of provision of DVOR is discussed in relation with Radio Line-of-Sight in Appendix to Section 6.

(29) ICAO, Annex 10 specifies that there is a need to indicate a system accuracy figure for the guidance of state planning VOR systems. VOR system use error is given by the following formula.

$$\text{VOR System Use Error (Es)} = \sqrt{Eg^2 + Ea^2 + Ep^2}$$

where,

- VOR radial signal error (Eg):
  This element consists of the radial displacement error and the radial variability error. It is determined by considering such factors as fixed radial displacement, monitoring, polarization effects, terrain effects and environment changes.

- VOR airborne equipment error (Ea):
  This element embraces all factors in airborne VOR system which induces errors(errors resulting from the use of compass information in some VOR displays are not included).

- VOR pilotage element (Ep):
  The value taken for this element is that used in PANS-OPS(Doc 8168) for pilot tolerance.

This is to specify the protected airspace of an airway to protect an aircraft flying on the airway. Extensive flight check should be conducted to derive uniform accuracy to apply basically on whole Indonesia, There could,however, be some exception depending on the airspace circumstances. It is said that VOR System Use Error (Es) is 10 degree and NDB System Use Error is 15 degree in Indonesia. Some examples are shown in Appendix to Section 6.

(30) Such terminal navaids as LLZ, G/S. VOR, OM and MM have to have precise functionability, since an airport tends to be exposed to meteorologically low atmospheric condition and geographic condition. A pilot on final landing leg under IFR condition has to rely upon these facilities. OM and MM have to be in conformity with requirements specified in ICAO, Annex 10. VOR should be collocated with DME to give a pilot precise distance guidance during his critical maneuvering on final. In the area where there are movements in mixture of civil and military aircraft, TACAN should be introduced instead of DME, because a military aircraft can not use DME.

(31) VASIS better be replaced by PAPI(Precision Approach Path Indicator) when the existing VASIS come to need replacement. PAPI gives more precise guidance to a pilot than conventional VASIS. This system is specified by ICAO,

Annex 14 that the beam of light produced by the light units shall show through an angle of at least 1 degree 30 minutes above and below the mean of the transition sector both by day and by night and in azimuth through at least 10 degree by day and at least 15 degree by night. The effective visual range in clear weather shall be at least 7.4 KM within these angles.

(32) In case of the water based airport, the runway elevation is affected by a high-tide and low-tide limits as well as a wave-height. Even an airport on a lake, being more free from the conditions of the sea airport,will have a different runway elevation according to seasons rainy and dry. Minimum Obstacle Surface Limits will be established based on the Mean Sea Level (MSL), which is subject to change according to the above mentioned water conditions when a pilot tries to land. Installations of LLZ, G/S and MM are not available, but VOR may be providable if a suitable land terrain is found at a appropriate distance on the extension line of runway centerline.
DME is better to be collocated with VOR, because Decision Height (DH) will be often subject to change according to the above mentioned water phenomena. VFR flight is recommendable for this type of airport at beginning of operation. Figure-6.2 depicts a desirable site that a VOR is to be installed.

(33) Aeronautical Fixed Service (AFS)of FTN, RTT and ATS Direct Speech Circuits are leased from and operated through PERUMTEL satellite and micro-wave channels. Some of RRT and ATS Direct Speech Circuits are still operated on HF, but it is said that DGAC has a plan to operate them via PERUMTEL leased channel in future. Performance reliability should be clarified to upgrade the system in due consideration to;

- The HF circuits performance is low because of

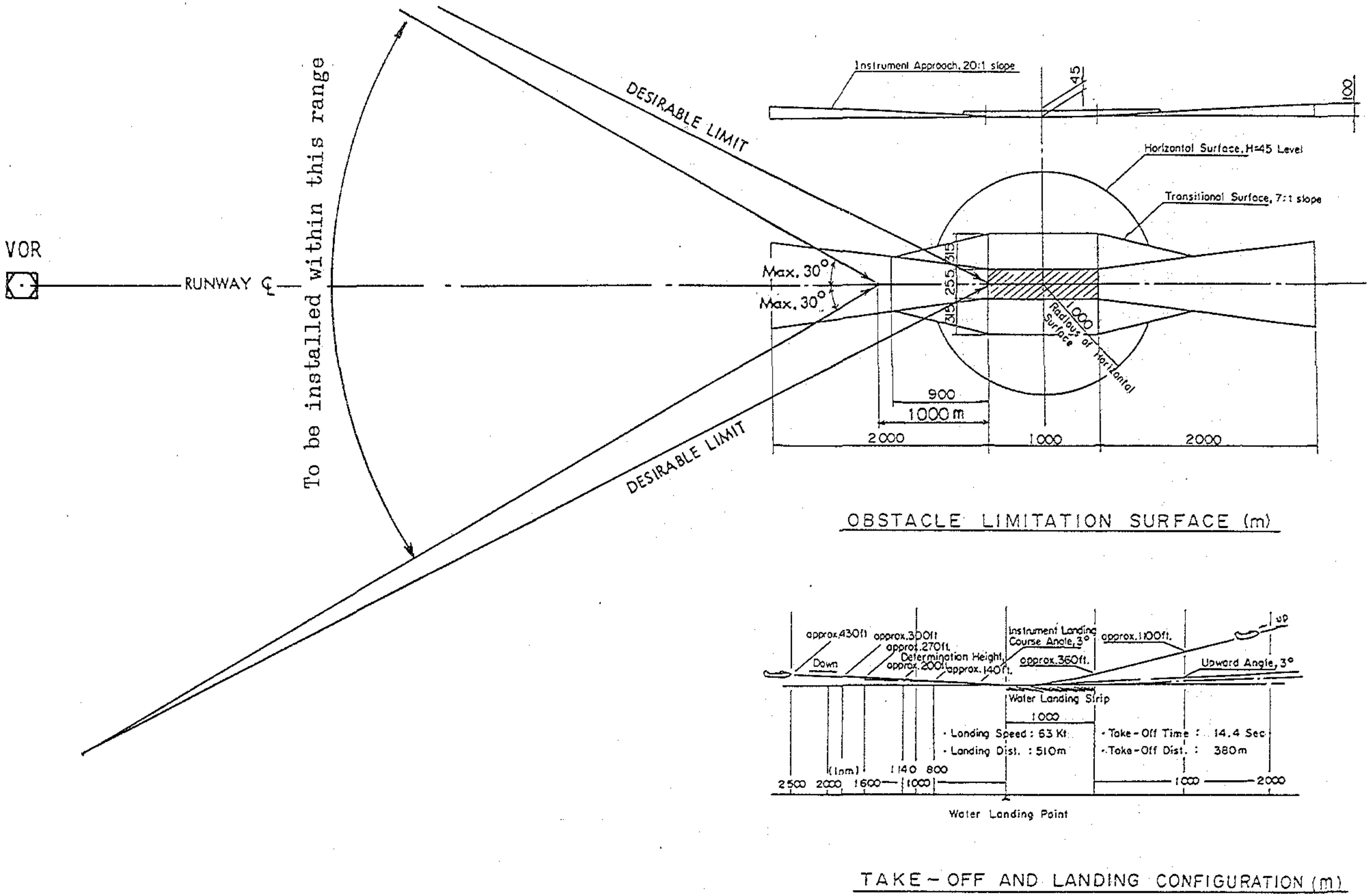


Figure-6.2 Desirable Site of VOR to be Installed atmospheric static and other problems, which is common by nature of HF operation.

- The link cables between the airport and the Perumtel exchange in town sometimes causes trouble, as being seldom maintained, which lowers down AFS circuits performance.

(34) HF en-route communications to provide flight information service for international and domestic flight, and Terminal VHF communications for Approach and Aerodrome Control services have been conducted. Most of airports provided with AMS, however, have communication problems as follows.

- Existence of high terrain and, old and inadequate power of transmitter cause the VHF coverage blind area. Low flying aircraft can not establish communication with the VHF stations.
- The breakage of the underground or overhead communication cables because of rain, wind and road construction. The terminal side panels are not negligible because they are old, rusty and loose and break circuit connections.

(35) ATC sometimes can not establish direct communications with en-route aircraft, then ATC instructions have to be given via HF air-ground channels. To cope with this problem, DGAC is planning to promote construction of VHF Extended Range (ER) stations at several locations to cover fully whole FIRs by VHF. It is desirable to materialize this plan as quickly as possible to make ATC VHF communication with en-route aircraft flying in any FIR available. Most of airports provided with AMS, they have communication problems as following :

- VHF coverage blind area existing many. The reason why low flying aircraft can not establish the communication with the VHF stations is due to the existence of high terrain and inadequate power of the transmitter.

- The breakage of the underground or overhead communication cables because of rain, wind and road construction.

- The terminal side panels are not neligible because they are old, rusty and loose and break circuit connections.

(36) It is desirable to install ER VHF stations at a higher terrain to ensure better coverage of LOS (line of sight). There is usually no access to such a higher area from the airports and the cities. The budget hampers construction of ER VHF stations at a higher terrain because of the higher cost burden.

(37) A plan should be made to solve the above mentioned problems station by station and year by year in order of importance of stations. In addition, at least two generator sets per a station desirably be provided with adequate power output and fuel supply all the year round.

(38) The domestic satellite system PALAPA, the most reliable transmission network, has existed. By using the satellite to interconnect the ground sites, the range of the existing air-ground communications system could be extended. The air-ground communications can be initiated from and ACC through a satellite to a remote ground station, where re-transmit to an aircraft using conventional VHF repeater equipment.

(39) The through-satellite transmission would be one of the best solution to cope with the currently prevailing problems from viewpoints of;

- Low error rates
- An easy installation in the premises of the existing ground stations or near the communication centers, being relatively from land acquisition problem.
- Low cost of transmission for long distance and of direct connection with all nodes of network, being from wires and microwave stations.
- A great number of benefits on air traffic control system, such as;
    * provision of a continuous and reliable coverage for a safer and more efficient means of control.
    * provision of a quick means to accommodate the air traffic demand increase.
    * extension of coverage all over the air space and elimination of blind areas.
    * realization of a harmonized air traffic control on all major air routes from a single ACC.

(40) Though satellite transmission might be the best, it may be still earlier to introduce it for air-ground communications. Another solution so far is to use micro circuits which enable most of data transmit by linking with RCAG remote Center air-ground system at a reasonable price.

(41) As mentioned beforehand, routine preventive maintenance seems to have seldom been conducted. Importance of maintenance could not be overemphasized. Maintenance personnel be increased and trained so as to have the up-to-date technologies being use for aviation field. Storage of spare-parts should be provided at appropriate sites to be able to feed spare-parts with maintenance personnel. Good inventory system should be built so that a preventive supply

demand can be made in well advance. Also, preventive security guard system is to be provided around the spare-parts storage building.

(42) Several problems have been reported of the meteorological field as the followings.

- Equipment provided at meteorological stations are of minimum need with low accuracy hampering smooth operations.
- Meteorological information transmitted through AFTN is slow and sometimes does not reach the receiver.
- Meteorological stations are generally located far from the flight operation service section at airports, which makes communication unstable between flight service stations.

(43) Meteorological accuracy level is reportedly to be still low. With provision of some more new equipment, such as weather radar, radiosonde, rawin, computer, teletypewriter, etc., accuracy level will be upgraded.

6.03.2 Facility Requirements

(44) The potential new routes selected in SECTION- 5 and tabulated in Table-4.1 and Table-4.2, are composed of 20 trunk routes and 19 feeder routes by the year of 2004. To open these routes, the Navaids and the communication systems are necessarily required to ensure the safe and economic flight operation on the new routes.

(45) The direct routes connecting straight the origin/destination airports could not be a real airway. Otherwise, a lot of Navaids (VOR and/or NDB), AMS (Aeronautical Mobile System) and AFS(Aeronautical Fixed System) and aeronautical personnel who take care of those system, are additionally needed for each new airway and,

thus, the tremendous budget shall be consumed for provision of such additional facilities. And, airliners that are going to operate the flights on promising air routes might not be compensated for non-payable services.

(46) It might be wise and practical to fly by making full use of the existing Navaids and telecommunication systems as far as the additional cost accruing from the obliged detouring flight be offset by saving of cost which otherwise be spent for construction and maintenance of the new facilities. Taking into account above conditions, the structure of the future air routes and the flight operation are tentatively assumed from the practical viewpoint as follows.

- The existing Navaids be utilized to constitute an air route as much as possible for a cost saving.
- For an air route needed to traverse over a wide body of water, power of NDB be increased, since the LOS(line of sight) of VOR is limited by the earth curvature.
- A direct fight, which flies on the shortest route between O-D airports, may be made if such flight is navigationally possible and makes up for operational cost. Whereas, if the direct flight is navigationally impossible, the detouring flight may be made by utilizing the existing without landing any airports. Landings at some airports, with passengers not changing their boarding aircraft, shall be considered as a kind of the direct flight. Thus, an airline can pick up more passengers at the landed airports to make the operational cost compensationable.
- ATC(Air Traffic Controller) shall issue a direct route clearance to a pilot, if the traffic permits and aircraft is capable to conform under its own

navigation (Inertia Navigation System-INS equipped) to such ATC clearance.

(47) To identify the most likely air route based on the current Airway Chart, the cross reference has been made between each O/D pair airports in 1994 and 2004 respectively, which are summarized in Table-6.13 for trunk route and Table-6.14 for feeder route.

Tables show;

- Name of O/D pair airport with city name
- Straight distance between pair airport
- Pax. demand (forecast by 1994 & 2004)
- Existing runway, length & width (m)
- Availability of Navaids including ILS, Radar, VOR, DME & NDB with operation hour
- Availability of AMS(Aeronautical Movable Service)
- Availability of AFS(Aeronautical Fixed Service)
- Availability of meteo-information service
- Availability of lighting aids
- Fire Project Category

With these informations, the necessity of the additional Navaids and communication facility and/or of replacement or reinforcement of existing facilities for the respective potential new route has been examined.

(48) Tables-6.15 and 6.16, prepared based on Tables-6.13 and 6.14, show the proposed realistic air route by using the existing Navaids along the airways derived from the current Airway Charts, as shown in Figure-6.3.

Tables comprise;

- Name of O/D city pair
- Necessity of new route
- Route distance, direct & realistic flight
- Necessity of Navaids

(49) The first line of Table-6.15, for example, can be

REMARKS: NC: NEED CHANGE; IAP: INDONESIAN AIR FORCE; ID: NAVAIDS IDENTIFICATION; W: POWER (WATTS); X: EXISTS; ?: UNKNOWN; dx: DUPLEX

Table-6.13 (1) Prospective Air-Routes with Related Airports and Aeronautical Operation Status (Trunk Route)

1994 TRUNK	NEW ROUTE: NAME OF AIRPORT / NAME OF CITY (OP.HR)	CLASS	ZONE NO.	DISTANCE Straight NM (KM)	DEMAND PAX 1994 / 2004	RUNWAY (m)	NAVIGATION AIDS (OPERATION HOUR - GMT): ILS LLZ	ILS GP	ILS MM	ILS OM	RADAR	VOR ID/W	DME CH/W	NDB ID/W	N.C	CONTROLS/COMMUNICATIONS: ACC	TMA	APP	TWR	APIS	PIS	FSS	ATIS	AERONAUTICAL FIXED SERVICES (AFS): CHANNEL LTT	RTT	RTP	AFTN	METEOROLOGICAL SERVICES: OBSERVATIONS H	b	S	REPORTS METAR	SPECI	LANDING FORECAST TREND	EQUIPMENT VX RADAR	SATELITE	OPERATION HOUR	LIGHTING AIDS: APP	THR	RWY	REIL	VASIS	OBST	FLOOD	ABN	FIRE PROTECT CATEGORY
T1	BLANG BINTANG BANDA ACEH (BTJ)	II	2	976 (1803)	124,584 / 156,618	1850x45						BAC/100W	81/1KW	NZ/500W (00.00-11.00)	X				VHFx1 (00.00-11.00)					X		HFx2	1	X		X	X	X					X	X	X	X	X	X			VI
	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43			3660x60 3050x60	15W 15W (24W)	15W 15W	2W 2W	2W 2W	PSR/3.5MW SSR/2.5KW	CKG/100W DKT/100W (24H)	83/1KW 72/1KW	GR/CL/ALL GL/CR/25W (24H)		VHFx6	VHFx2	VHFx3	VHFx5	VHFx1	VHFx2 (24H)		VHFx1 (24H)	dx	HFx14 dx HFx53	HFx2	11	X	X	X	X	X	X	X	X	24H	HIALS CAT I	X	X	X	T VASI 3°	X	X	X	IX
T2	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43	1304 (2404)	119,894 / 160,614	″ ″	″ ″ (″)	″ ″	″ ″	″ ″	″ ″	″ ″ (″)	″ ″	″ ″ (″)		″	″	″	″	″	″		″ (″)	dx	HFx14 dx HFx53	HFx2	11	X	X	X	X	X	X	X	X	24H	HIALS CAT I	X	X	X	T VASI 3°	X	X	X	IX
	PATIMURA (Intn'l Entry) AMBON (AMQ) (12H)	II	149			1850x45	15W (24H)	15W	1W	DME 1KW		AMN/100W (24H)	102x1KW	OH/2.5KW (24H)	X			VHFx1 (22.00-09.00)	VHFx1 (22.00-09.00)			HFx5 (22.00-09.00)		dx	HFx6	HFx7	2	X		X	X	X					X	X	X	X	X	X			VI
T3	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43	1192 (2208)	106,160 / 142,794	3660x60 3050x60	15W 15W	15W 15W	2W 2W	2W 2W	PSR/3.5MW SSR/2.5KW	CKG/100W DKT/100W (24H)	83/1KW 72/1KW	GR/CL/ALL GL/CR/25W (24H)		VHFx6	VHFx2	VHFx3	VHFx5	VHFx1	HFx12 (24H)		VHFx1 (24H)	dx	HFx14 dx HFx53	HFx2	11	X	X	X	X	X	X	X	X	24H	HIALS CAT I	X	X	X	T VASI 3°	X	X	X	IX
	SAM RATULANGI (Intn'l Entry) MANADO (MDC) (11H)	I	114			2500x45	15W (23.00-10.00)	15W	1W	1W		MNO/100W TDO/100W (23.00-10.00)	89/1KW 94/1KW	MD/2.5KW SR/80W (23.00-10.00)	X X		VHFx1 (23.00-10.00)		VHFx1 (23.00-10.00)			HFx5	VHFx1 (23.00-10.00)		dx HFx6	HFx4	3	X		X	X	X						X	X	X	3.25°	X		X	VII
T4	MALANG MALANG (MLG)	(IAP) II	65	159 (295)	90,938 / 107,122	2250x40								AR/?																															
	NGURAH RAI (Intn'l) DENPASAR (DPS) (24H)	I	67			2700x45	10W (24H)	10W (23.00-17.00)	1W	DME 1KW	PSR/650KW SSR/2.5KW	DPS/100W (24H)	102/1KW	DR/2.5KW (24H)		VHFx3 (24H)		VHFx1 (24H)	VHFx2 (23.00-17.00)		HFx8 (24H)		VHFx1 (22.00-11.00)	dx	HFx8	HFx3	4	X		X	X	X	X	X	X	24H									IX
T5	SIMPANG TIGA (Intn'l Entry) PEKANBARU (PKU) (11H)	II	25	741 (1372)	90,402 / 103,510	2150x30					SSR/2.5KW	PKU/100W (00.00-11.00)	58/1KW	NW/500W (00.00-11.00)	X		VHFx1 (00.00-11.00)		VHFx1 (00.00-11.00)					X			2	X		X	X	X													VI
	ADI SUCIPTO YOGYAKARTA (JOG)	(IAP) II	60			1850x40						JOG/100W (24H)	75/1KW	OP/500W (23.00-12.00&OR)	X				VHFx2 (23.00-11.00)						dx HFx4		11	X		X	X	X													VII
T6	JUANDA (Intn'l Entry) SURABAYA (SUB) (18H)	I	63	700 (1297)	73,982 / 100,000	3000x45	15W	15W	1W	1W		SBY/100W (24H)	78/1KW	SB/500W VR/500W (24H)	X X		VHFx1 (23.00-17.00)		VHFx1 (23.00-17.00)						dx HFx6 HFx2 dx HFx12		3	X		X	X	X													VIII
	TARAKAN (Intn'l Entry) TARAKAN (TRK) (10H)	III	106			1520x30						TRK/100W (23.00-09.00)	113/1KW	OT/500W	X					VHFx1 (23.00-09.00)						HFx3	1	X		X	X	X													V
T7	MALANG MALANG (MLG)	(IAP) II	65	308 (571)	73,106 / 76,160	2250x40								AR/?																															
	SAMSUDIN NOOR BANJARMASIN (BDJ)	I	103			1870x45	15W	15W	1W	1W		BDM/100W (23.00-12.00)	58/1KW	OU/500W (23.00-12.00)	X		VHFx1 (23.00-11.00)		VHFx1 (23.00-11.00)			HFx5 (23.00-11.00)		X	dx HFx6	HFx3	2	X		X	X	X					X	X	X	X	X	X			VII
T8	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43	861 (1594)	55,412 / 77,992	3660x60 3050x60	15W 15W (24H)	15W 15W	2W 2W	2W 2W	PSR/3.5MW SSR/2.5KW (24H)	CKG/100W DKJ/100W (24H)	83/1KW 72/1KW	GR/CL/ALL GL/CR/25W (24H)		VHFx6	VHFx2	VHFx3	VHFx5	VHFx1	HFx12 (24H)		VHFx1 (24H)	dx	HFx6 dx HFx53	HFx2	11	X	X	X	X	X													IX
	TARAKAN (Intn'l Entry) TARAKAN (TRK) (10H)	III	106			1520x30						TRK/100W (23.00-09.00)	102/1KW	OT/500W	X					VHFx1 (23.00-09.00)						HFx3	1	X		X	X	X													V
T9	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43	581 (1075)	41,372 / 81,910	3660x60 3050x60	15W 15W (24H)	15W 15W	2V 2V	2W 2W	PSR/3.5MW SSR/2.5KW	CKG/100W DKT/100W (24H)	83/1KW 72/1KW	GR/CL/ALL GL/CR/25W (24H)		VHFx6	VHFx2	VHFx3	VHFx5	VHFx1	HFx12 (24H)		VHFx1 (24H)	dx	HFx6 dx HFx53	HFx2	1	X	X	X	X	X	X	X	X	24H									IX
	AMPENAN MATARAM (AMI)	III	68			1600x30								GA/500W (23.00-11.00)	X			VHFx1 (23.00-11.00)	VHFx1 (23.00-11.00)									X		X	X	X													V
T10	H.SASTARANE GARA BUNDUNG (BDO)	(IAP) II	51	475 (880)	33,488 / 40,102	1987x30						BND/100W (OH & OR)	117/1KW	OY/500W YY/100W (OH & OR)	X X			VHFx1 (23.00-11.00)	VHFx1 (23.00-11.00)							UHFx2	1	X		X	X	X					X	X	X	X	X	X	X	X	VI
	NGURAH RAI (Intn'l) DENPASAR (DPS) (24H)	I	67			2700x45	10W (24H)	10W (23.00-17.00)	1W	DME 1KW	PSR/650W SSR/2.5KW	DPS/100W (24H)	102/1KW	OR/2.5KW		VHFx3 (24H)		VHFx1 (24H)	VHFx2 (23.00-17.00)		HFx8 (21H)		VHFx1 (22.00-11.00)	dx	HFx8	HFx3	4	X		X	X	X	X	X	X	24H	HIALS CAT I	X	X	X	3 BAR 3°	X	X	X	IX

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Table-6.13 (2) Prospective Air-Routes with Related Airports and Aeronautical Operation Status (Trunk Route)

2004 TRUNK	NEW ROUTE: NAME OF AIRPORT / NAME OF CITY (OP.HR)	CLASS	ZONE NO.	DISTANCE Straight NM (KM)	DEMAND PAX. 2004	RUNWAY (m)	NAVIGATION AIDS (OPERATION HOUR - GMT): ILS LLZ	ILS GP	ILS MM	ILS OM	RADAR	VOR ID/W	DME CH/W	NDB ID/W	N.C	CONTROLS/COMMUNICATIONS: ACC	TMA	APP	TWR	APIS	PIS	FSS	ATIS	AERONAUTICAL FIXED SERVICES (AFS): CHANNEL LTT	RTT	RTP	AFTN	METEOROLOGICAL SERVICES: OBSERVATIONS H	b	S	REPORTS METAR	SPECI	LANDING FORECAST TREND	EQUIPMENT VX RADAR	SATELITE	OPERATION HOUR	LIGHTING AIDS: APP	THR	RWY	REIL	VASIS	OBST	FLOOD	ABN	FIRE PROTECT CATEGORY
T11	JUANDA (Intn'l Entry) SURABAYA (SUB) (18H)	I	63	700 (1297)	74,078	1650x30	15W	15W	1W	1W		SBY/100W (24H)	78/1KW	GR/CL/ALL GL/CR/25W (24H)			VHFx1 (23.00-17.00)		VHFx1 (23.00-17.00)						dx HFx6 dx HFx14	HFx2	3	X		X	X	X													VIII
	PENFUI (Intn'l Entry) KUPANG (KOE) (12H)	II	81			1350x60 1850x30						KPG/100W (22.00-10.00)	59/1KW	OK/300W (22.00-10.00)				VHFx1 (22.00-10.00)	VHFx1 (22.00-10.00)			HFx5 (22.00-11.00)		X		HFx3	3	X		X	X	X						X	X	X	X	X	X	X	VI
T12	POLONIA (Intn'l Entry) MEDAN (MES) (17H)	I	10	1055 (1954)	66,356	2900x45	15W	15W	1W	1W	PSR/2MW SSR/2.5KW	MDN/100W WMM/100W (24H)	86/1KW 77/1KW	ON/300W (24H)		VHFx1	VHFx1 (23.00-16.00)		VHFx1 (23.00-16.00)			HFx2	VHFx1 (23.00-16.00)	dx	dx HFx6 HFx4 dx HFx16		5	X		X	X	X	X	X		24H	X	X	X	X	3 BAR 3.19°,3°	X	X	X	VIII
	JUANDA (Intn'l Entry) SURABAYA (SUB) (18H)	I	63			1650x30	15W	15W	1W	1W		SBY/100W	78/1KW	SB/500W VR/500W	X X		VHFx1		VHFx1						dx HFx6 dx HFx14	HFx2	3	X		X	X	X													VIII
T13	JUANDA (Intn'l Entry) SURABAYA (SUB) (18H)	I	63	640 (1185)	64,290	3000x45	15W	15W	1W	1W		SBY/100W (24H)	78/1KW	SB/500W VR/500W (24H)	X X		VHFx1 (23.00-17.00)		VHFx1 (23.00-17.00)						dx HFx6 dx HFx14	HFx2	3	X		X	X	X	X	X		24H	X	X	X		3 BAR			X	VIII
	W.MONGINSIDI KENDARI (KDI)	(IAP) III	131			1650x30						KDI/100W (23.00-08.00)	97/1KW	NI/500W (23.00-08.00)	X					VHFx1 (23.00-08.00)						HFx2	1	X		X	X	X							X						V
T14	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43	968 (1792)	58,950	3660x60 3050x60	15W 15W (24H)	15W 15W	2W 2W	2V 2V	PSR/3.5MW SSR/2.5KW (24H)	CKG/100W KDT/100W (24H)	83/1KW 72/1KW	GR/CL/ALL GL/CR/25W (24H)		VHFx6	VHFx2	VHFx3	VHFx5	VHFx1	HFx12 (24H)		VHF-1 (24H)	dx	HFx6 dx HFx53	HFx2	11	X	X	X	X	X	X	X	X	24H									IX
	W.MONGINSIDI KENDARI (KDI)	(IAP) III	131			1650x30						KDI/100W (23.00-08.00)	97/1KW	NI/500W	X						VHFx1					HFx2	1	X		X	X	X													V
T15	ADI SUCIPTO YOGYAKARTA (JOG)	(IAP) II	60	552 (1032)	50,528	1850x40						JOG/100W (24H)	75/1KW	OP/500W (23.00-12.00&OR)					VHFx2 (23.00-11.00)						dx HFx4		1	X		X	X	X						X	X					X	VII
	SEPINGGAN BALIKPAPAN (BFN)	I	110			1800x30						BPN/100W	119/1KW	OL/500W LL/25W	X ?		VHFx1		VHFx1					X		HFx2	2	X		X	X	X					X	X	X	X	X	X	X		VII
T16	MALANG MALANG (MLG)	(IAP) II	65	481 (890)	46,200	2250x40								AR/?																															
	SEPINGGAN BALIKPAPAN (BPN)	I	110			1800x30						BPN/100W (23.00-11.00)	119/1KW	OL/500W LL/25W (23.00-11.00)	X ?		VHFx1 (23.00-11.00)		VHFx1 (23.00-11.00)				VHFx1 (23.00-11.00)	X		HFx2	2	X		X	X	X					X	X	X	X	X	X	X		VII
T17	POLONIA (Intn'l Entry) MEDAN (MES) (17H)	I	10	1233 (2284)	44,724	2900x45	15W	15W	1W	1W	PSR/2MW SSR/2.5KW	MDN/100W WMM/100W (24H)	86/1KV 77/1KW	ON/300W (24H)		VHFx1	VHFx1 (23.00-16.00)		VHFx1 (23.00-16.00)			HFx2	VHFx1 (23.00-16.00)	dx	dx HFx6 HFx4 dx HFx16		5	X		X	X	X	X	X		24H	X	X	X	X	3 BAR 3.19°,3°	X	X	X	VIII
	NGURAH RAI (Intn'l) DENPASAR (DPS) (24H)	I	67			2700x45	10W (24H)	10W (23.00-17.00)	1W	DME 1KW	PSR/650KW SSR/2.5KW	DPS/100W (24H)	102/1KW	OR/2.5W (24H)		VHFx3 (24H)		VHFx1 (24H)	VHFx2 (23.00-17.00)		HFx8 (24H)		VHFx1 (22.00-11.00)	dx	HFx8	HFx3	4	X		X	X	X													IX
T18	POLONIA (Intn'l Entry) MEDAN (MES) (17H)	I	10	664 (1229)	32,560	2900x45	15W	15W	1W	1W	PSR/2MW SSR/2.5KW	MDN/100W WMM/100W (24H)	86/1KW 77/1KW	ON/300W (23.00-12.00&OR)		VHFx1	VHFx1 (23.00-16.00)		VHFx1 (23.00-11.00)			HFx2	VHFx1 (23.00-16.00)	dx	dx HFx6 HFx4 dx HFx16		5	X		X	X	X	X	X		24H	X	X	X	X	3 BAR 3.19°,3°	X	X	X	VIII
	BRANTI BANDAR LAMPANG (TGK)	II	42			1520x30						TKG/100W (24H)	97/1KW	TP/500W (24H)	X			VHFx1 (23.00-11.00)	VHFx1 (23.00-11.00)						dx HFx2		1	X		X	X	X					X	X	X	X	X	X			VI
T19	POLONIA (Intn'l Entry) MEDAN (MES) (17H)	I	10	816 (1511)	29,646	2900x45	15W	15W	1W	1W	PSR/2MW SSR/2.5KW	MDN/100W WMM/100W (24H)	86/1KW 77/1KW	ON/300W (24H)		VHFx1	VHFx1		VHFx1 (23.00-11.00)			HFx2	VHFx1 (23.00-16.00)	dx	dx HFx6 HFx4 dx HFx16		5	X		X	X	X	X	X		24H									VI
	H.SASTARANE GARA BANDUNG (BDO)	(IAP) II	51			1987x30						BND/100W (OH & OR)	117/1KW	OY/500W YY/100W (OH & OR)	X X			VHFx1 (23.00-11.00)	VHFx1 (23.00-11.00)							UHFx2	1	X		X	X	X													VI
T20	ACHMAD YANI SEMARANG (SRG)	(ARMY) II	55	514 (952)	23,340	1650x45 1150x45					SSR/2.5KW	SMG/100W (24H)	84/1KW	BA/500W OC/500W PC/? BA00.00-14.00 OC23.00-12.00 PC00.00-12.00	X X ?		VHFx1 (23.00-12.00)		VHFx1 (23.00-12.00)						dx HFx1		1	X		X	X	X													VI
	SEPINGGAN BALIKPAPAN (BPN)	I	110			1800x30						BPN/100W (23.00-11.00)	119/1KW	OL/500W LL/25W (23.00-11.00)	X ?		VHFx1 (23.00-11.00)		VHFx1 (23.00-11.00)				VHFx1 (23.00-11.00)	X		HFx2	2	X		X	X	X					X	X	X	X	X	X	X		VII

Table-6.14 (1) Prospective Air-Routes with Related Airports and Aeronautical Operation Status (Feeder Route)

REMARKS: NC: NEED CHANGE; IAF: INDONESIAN AIR FORCE; ID: NAVAIDS IDENTIFICATION; W: POWER (WATTS); X: EXISTS; ?: UNKNOWN; dx: DUPLEX

1994 FEEDER	NEW ROUTE: NAME OF AIRPORT / NAME OF CITY (OP.HR)	CLASS	ZONE NO.	DISTANCE Straight NM (KM)	DEMAND PAX. 1994 / 2004	RUNWAY (m)	ILS LLZ	ILS GP	ILS MM	ILS OM	RADAR	VOR ID/W	DME CH/W	NDB ID/W	N.C	ACC	TMA	APP	TWR	APIS	FIS	FSS	ATIS	AFS CHANNEL LTT	RTT	RTF	AFTN	OBSERVATIONS H	h	S	REPORTS METAR	SPECI	LANDING FORECAST TREND	EQUIPMENT WX PADAR	SATELITE	OPERATION HOUR	LIGHTING APP	THR	RWY	REIL	VASIS	OBST	FLOOD	ABN	FIRE PROTECT CATEGORY
F1	SIBOLGA	IV	14	159 (295)	69,068 / 94,766	1400x30								SK/500W (00.00-07.00)	X										HFx1		1	X		X	X	X													
	SIMPANG TIGA(Intn'l Entry) PEKANBARU (PKU) (11H)	II	25			2150x30					SSR/2.5KW	PKU/100W (00.00-11.00)	58/1KW	NW/500W (00.00-11.00)	X		VHFx1 (00.00-11.00)		VHFx1 (00.00-11.00)					X			2	X		X	X	X													V
F2	SINGKAWANG	IV	88	66 (123)	61,990 / 83,498	970x30																																							
	SUPADIO(Intn'l Entry) PONTIANAK (PNK) (11H)	I	89			2150x30						PNK/100W (23.00-10.00)	79/1KW	AT/500W (23.00-10.00)	X		VHFx1 (23.00-10.00)		VHFx1 (23.00-10.00)			HFx6 (23.00-10.00)	VHFx1 (00.00-04.00)	X		HFx4	2	X		X	X	X					X	X	X	X	X	X			VI
F3	MADIUN	(IAF) -	61	82 (151)	50,856 / 87,408	1800x30																																							
	MALANG MALANG (MLG)	(IAF) II	65			2250x40								AR/?																															
F4	RANAI NATUNA	(IAF) III	29	247 (458)	40,234 / 53,574	1500x30								RN/?											HFx1			X		X	X	X													VI
	SUPADIO(Intn'l Entry) PONTIANAK (PNK) (11H)	I	89			1655x30						PNK/100W (23.00-10.00)	79/1KW	AT/500W (23.00-10.00)	X		VHFx1 (23.00-10.00)		VHFx1 (23.00-10.00)			HFx6 (23.00-10.00)	VHFx1 (00.00-04.00)	X		HFx4	2	X		X	X	X					X	X	X	X	X	X			VI
F5	ACHMAD YANI SEMARANG (SRG)	(ARMY) II	55	115 (212)	35,468 / 65,498	1650x45 1150x45					SSR/2.5KW	SMG/100W (24H)	84/1KW	BA/500W OC/500W PC/? BA00.00-14.00 OC23.00-12.00 PC00.00-12.00	X X ?		VHFx1 (23.00-12.00)		VHFx1 (23.00-12.00)						dx HFx1		1	X		X	X	X					X	X	X	X	X	X	X		VI
	KEDIRI	-	62			—																																							
F6	SUKARNO HATTA (Intn'l) JAKARTA (JKT) (24H)	I	43	145 (269)	30,340 / 39,436	3660x60 3050x60	15W 15W (24H)	15W 15W (24H)	2W 2W (24H)	2W 2W	PSR/3.5MW SSR/2.5KW	CKG/100W DKT/100W (24H)	83/1KW 72/1KW	GR/CL/ALL GL/CR/25W		VHFx6	VHFx2	VHFx3 (24H)	VHFx5 (24H)	VHFx1	HFx12		VHFx1 (24H)	dx	HFx14 dx FHx53	HFx4	11	X	X	X	X	X	X	X	X	24H									IX
	KOTA BUMI	-	41			—																																							
F7	PANDEGLANG	II	44	84 (155)	29,640 / 40,268	1800x30																																							
	H.SASTRA NEGARA BANDUNG (BDO)	(IAF) II	51			1987x30						BND/100W (OH & OR)	117/1KW	OY/500W YY/100W (OH & OR)	X X				VHFx1 (23.00-11.00)							UFHx2	1	X		X	X	X													VI
F8	MUARA ENIM	IV	36	127 (236)	28,072 / 40,266	900x30																																							
	BRANTI BANDAR LAMPUNG (TGK)	II	42			1520x30						TKG/100W (24H)	97/1KW	TP/500W (24H)	X			VHFx1 (23.00-11.00)	VHFx1 (23.00-11.00)						dx HFx2		1	X		X	X	X													VI
F9	MUARA BUNGO	IV	31	146 (271)	27,686 / 33,556	850x30																				HFx1																			
	TALANG BETUTU(Intn'l Entry) PALEMBANG (PLM) (15H)	I	34			2200x45	110.5 15W	329.6 15W	1W	1W	PSR/650KW SSR/2.5KW	PLB/100W (24H)	120/1KW	OW/500W WW/25W (23.00-14.00)				VHFx2 (23.00-14.00)	VHFx1 (23.00-14.00)			HFx6 (23.00-14.00)	VHFx1 (23.00-14.00)	X	dx HFx16	HFx5	1	X		X	X		X	X	X	24H	HIALS		X	X	3 BAR 2.96°,2.99°	X		X	VII
F10	PADANG SIDENPUAN	IV	15	132 (244)	26,458 / 33,786	750x30																																							
	SIMPANG TIGA(Int.Entry) PEKANBARU (PKU) (11H)	II	25			2150x30					SSR/2.5KW	PKU/100W (00.00-11.00)	58/1KW	NW/500W (00.00-11.00)	X		VHFx1 (00.00-11.00)		VHFx1 (00.00-11.00)					X			2	X		X	X	X						X	X	X	X				VI

Table-6.14 (2) Prospective Air-Routes with Related Airports and Aeronautical Operation Status (Feeder Route)

REMARKS: NC: NEED CHANGE; IAF: INDONESIAN AIR FORCE; ID: NAVAIDS IDENTIFICATION; W: POWER (WATTS); X: EXISTS; ?: UNKNOWN; dx: DUPLEX

1994 FEEDER	NEW ROUTE: NAME OF AIRPORT / NAME OF CITY (OP.HR)	CLASS	ZONE NO.	DISTANCE Straight NM (KM)	DEMAND PAX. 1994 / 2004	RUNWAY	ILS LLZ	ILS GP	ILS MM	ILS OM	RADAR	VOR ID/W	DME CH/W	NDB ID/W	N.C	ACC	TMA	APP	TWR	APIS	FIS	FSS	ATIS	AFS CHANNEL LTT	RTT	RTF	AFTN	OBSERVATIONS H	h	S	REPORTS METAR	SPECI	LANDING FORECAST TREND	EQUIPMENT WX PADAR	SATELITE	OPERATION HOUR	LIGHTING APP	THR	RWY	REIL	VASIS	OBST	FLOOD	ABN	FIRE PROTECT CATEGORY
F11	LUBUK SIKAPING	III	18	91 (168)	23,514 / 30,892	1300x30																																							
	SINPANG TIGA(Intn'l Entry) PEKANBARU (PKU) (11H)	II	25			2150x30					SSR/2.5KW	PKU/100W (00.00-11.00)	58/1KW	NW/500W (00.00-11.00)	X		VHFx1 (00.00-11.00)		VHFx1 (00.00-11.00)					X			2	X		X	X	X													VI
F12	SUPADIO PONTIANAK (PNK)	I	89	130 (240)	23,320 / 30,866	1655x45						PNK/100W (23.00-10.00)	79/1KW	AT/500W (23.00-10.00)	X		VHFx1 (23.00-10.00)		VHFx1 (23.00-10.00)			HFx6 23.00-10.00	VHFx1 (00.00-04.00)	X		HFx4	2	X		X	X	X					X	X	X	X	X	X			VI
	BATANG TARANG (SANGGAU)	-	90			900x30																																							
F13	BRANTI BANDAR LAMPUNG (TGK)	II	42	136 (252)	21,854 / 29,212	1520x30						TKG/100W (24H)	97/1KW	TP/500W (24H)	X			VHFx1 (23.00-11.00)	VHFx1 (23.00-11.00)						dx HFx1		1	X		X	X	X													VI
	SUKA BUMI	-	49			—																																							

2004 FEEDER	NEW ROUTE: NAME OF AIRPORT / NAME OF CITY	CLASS	ZONE NO.	DISTANCE Straight NM (KM)	DEMAND PAX. 2004	RUNWAY	ILS LLZ	ILS GP	ILS MM	ILS OM	RADAR	VOR ID/W	DME CH/W	NDB ID/W	N.C	ACC	TMA	APP	TWR	APIS	FIS	FSS	ATIS	AFS CHANNEL LTT	RTT	RTF	AFTN	OBSERVATIONS H	h	S	REPORTS METAR	SPECI	LANDING FORECAST TREND	EQUIPMENT WX PADAR	SATELITE	OPERATION HOUR	LIGHTING APP	THR	RWY	REIL	VASIS	OBST	FLOOD	ABN	FIRE PROTECT CATEGORY
F14	SAMSUDIN NOOR BANJARMASIN (BDJ)	I	103	119 (220)	42,292	1870x45	15W	15W	1W	1W		BDM/100W (23.00-12.00)	117/1KW	OU/500W			VHFx1 (23.00-11.00)		VHFx1 (23.00-11.00)			HFx5 (23.00-11.00)		X	dx HFx6	HFx3	2	X		X	X	X													VII
	TANAH GROGOT	IV	111			640x30																																							
F15	SUKARNO HATTA(Intn'l) JAKARTA (JKT) (24H)	I	43	125 (232)	32,042	3600x60 3050x60	15W 15W (24H)	15W 15W (24H)	2W 2W (24H)	2W 2W	PSR/3.5MW SSR/2.5KW	CKG/100W DKT/100W (24H)	38/1KW 72/1KW	GR/CL/ALL GL/CR/25W (24H)		VHFx6 (24H)	VHFx2 (24H)	VHFx3 (24H)	VHFx5 (24H)	VHFx1 (24H)	HFx12 (24H)		VHFx1			HFx2	1	X		X	X	X													V
	TASIK MALAYA	III	53			1200x30																																							
F16	BANYU WANGI	II	66	126 (233)	32,014	2000x30																																							
	AMPENAN MATARAM (AMI)	III	68			1600x30								GA/500W (23.00-11.00)	X				VHFx1 (23.00-11.00)									X		X	X	X					X	X			X				V
F17	RANARUNG PALANG KARAYA (PKY)	II	97	138 (256)	25,538	1540x30								PK/3KW (23.00-11.00)						VHFx1 (23.00-09.00)						HFx2	2	X		X	X	X													V
	RAMBUH HAMPANG	-	101			1300x30																																							
F18	BABULLAH TERNATE (TTE)	III	140	55 (88)	18,346	1423x30								TR/80W (22.00-08.00)	X					VHFx1 (22.00-08.00)						HFx4	1	X		X	X	X				24H									V
	BULI SERANI	-	141			—																																							
F19	LUBUK LINGGAN	IV	33	110 (176)	17,910	1000x30																																							
	TALANG BETUTU(Intn'l Entry) PALEMBANG (PLM) (15H)	I	34			2200x45	110.5 15W	329.6 15W	1W	1W	PSR/650KW SSR/2.5KW	PLB/100W (24H)	120/1KW	OW/500W WW/25W (23.00-14.00)				VHFx2 (23.00-14.00)	VHFx1 (23.00-14.00)			HFx6 (23.00-14.00)	VHFx1 (23.00-14.00)	X	dx HFx16	HFx5	1	X		X	X		X	X		24H	HIALS		X	X	3 BAR 2.96°,2.99°	X		X	VII

LEGEND:

X(INS): Aircraft recommended to equip with INS (Inertial Navigation System)

Table-6.15 Requirements for Proposed Air Routes (Trunk Route)

	TRUNK	ORIGIN - DESTINATION	NEW ROUTE NEEDED OR NOT		PROPOSED ROUTE (NAVAIDS & AIRWAYS)	ROUTE DISTANCE (NM)		NAVAIDS NEEDED TO BE REPLACED BY NEW ONE
			NEED	NO NEED		DIRECT	FLIGHT	
By 1994	T1	BANDA ACEH - JAKARTA		X	BAC W19 PDG W11 JKG W11 CKG	976	980	NZ/500W, OQ/500W, TF/500W
				X	(or, BAC W12 MDN W12 PLB W12 CKG)		(992)	NZ/500W, NW/500W
	T2	JAKARTA - AMBON		X	CKG W45 OC W52 MKS W53 AMN	1304	1326	OC/500W, OH/2KW or more
	T3	JAKARTA - MANADO		X	CKG W15 FK W15 BPN W15 MNO	1192	1206	OL/500W→2KW or more, MD/2KW or more
	T4	MALANG- DENPASAR	X		LW -Ð- (thru WR(R)-1) BLI	159	153	
				X	(or, LW (ML) -Ð- SBY W33 BLI)		(283)	BA/500W, SB/500W
	T5	PEKANBARU - YOGJAKARTA		X	PKU W12 PLB W12 CKG W45 OC PURMO SO JOG	741	826	OC/500W, SO/500W
			X		(or, " " " CKG -Ð- JOG thru WI(R)-8)		(767)	OF/500W.
	T6	SURABAYA - TARAKAN		X	SBY W31 BDM W18 BPN W18 TRK	700	792	OL/500W→2KW or more, OU/2KW or more, OT/500W
			X		SBY W31 BDM (or, -Ð- TRK) 445NM		(706)	OT/500W
	T7	MALANG - BANJARMASIN		X	LW -Ð- SBY W31 BDM	308	295	
	T8	JAKARTA - TARAKAN	X		CKG W15 FK -Ð- TRK 510NM 410NM	861	915	OT/500W
				X	(or, CKG W15 FK W18 BPN W18 TRK)		(980)	OL/500W→2KW or more, OU/2KW or more, OT/500W
	T9	JAKARTA - MATARAM		X	CKG W45 CA SMG SBY W33 BLI W42 GA	581	608	CA/500W, OC/500W, BA/500W, SB/500W, GA/500W
	T10	BANDUNG - DENPASAR		X	BND -Ð- CA W45 SMG SBY W33 BLI	475	483	CA/500W, OC/500W, BA/500W, SB/500W
2004——1995	T11	SURABAYA - KUPANG		X	SBY W43 AGUNG W43 NQ NR W33 KPG	700	659	SB/500W, NR/500W→2KW or more
	T12	MEDAN - SURABAYA		X	MDN W11 PDG W11 TKG PW W45 SBY			NQ/500W→2KW or more, NR/500W→2KW or more
				X	MDN W12 PLB W12 CKG HLM W45 SBY	1055	1143	NW/500W, CA/500W, OC/500W, BA/500W, SB/500W
			X (INS)		(or, MDN W12 PLB -Ð- SBY) 560NM		(1088)	NW/500W, SB/500W
	T13	SURABAYA - KENDARI		X	SBY W32 MKS W41 NI	640	609	NI/500W→2KW or more
	T14	JAKARTA - KENDARI		X	CKG W45 OC W52 MKS W41 NI	968	1094	CA/500W, OC/500W, NI/500W→2KW or more
			X (INS)		(or, CKG -Ð- MKS W41 NI) 780NM		(961)	NI/500W→2KW or more
	T15	YOGYAKARTA - BALIKPAPAN	X		JOG SO SMG -Ð- BDM W18 BPN 1314NM	552	585	OF/500W, SO/500W, OL/500W→2KW or more
	T16	MALANG - BALIKPAPAN		X	-Ð- SBY W31 BDM W18 BPN	481	479	SB/500W, OL/500W→2KW or more, OU/2KW or more
	T17	MEDAN - DENPASAR		X	MDN W12 PLB W12 CKG HLM W45 SBY W33 BLI	1233	1309	NW/500W, CA/500W, OC/500W, BA/500W, SB/500W
	T18	MEDAN - BANDAR LAMPUNG		X	MDN W11 PDG W11 TKG	644	673	NQ/500W, TF/500W
	T19	MEDAN - BANDUNG		X	MDN W12 PLB W12 CKG -Ð- BND	816	830	NW/500W, OY/60W (LOC)
					(or, MDN W11 PDG W11 TKG CKG -Ð- BND)		(828)	
	T20	SEMARANG - BALIKPAPAN	X		SMG -Ð- BDM W18 BPN 312NM	514	519	OC/500W, OU/2KW or more, OL/500W→2KW or more

Table-6.16 Requirements for Proposed Air Routes
(Feeder Route)

	FEEDER	ORIGIN - DESTINATION	NEW ROUTE NEEDED OR NOT		PROPOSED ROUTE (NAVAIDS & AIRWAYS)	ROUTE DISTANCE (NM)		NAVAIDS NEEDED TO BE REPLACED	NAVAIDS NEEDED FOR LIKELY NEW AIRPORT
			NEED	NO NEED		DIRECT	FLIGHT		
By 1994	F1	PEKANBARU - SIBOLGA	X		PKU Ð SK	159	159	SK/500W	SIBOLGA has already
	F2	PONTIANAK - SINGKAWANG	X		PNK Ð A/P	66	66	AT/500W	No need at beginning
	F3	MALANG - MADIUN	X		ML (or LW) Ð A/P	82	82		"
	F4	PONTIANAK - NATUNA	X		PNK Ð RN	247	247	AT/500W	NATUNA has already at RANAI
	F5	SEMARANG - KEDIRI *	X		SMG Ð A/P	115	115	OC/500W	No need at beginning
	F6	JAKARTA - KOTA BUMI *	X		CKG Ð A/P	145	145		"
	F7	BANDUNG - PANDEGLANG	X		BND Ð A/P	84	84	OY/500W YY/100W (LOC)	"
	F8	BANDAR LAMPUNG - NUARA ENIM	X		TKG Ð A/P	127	127	TF/500W	"
	F9	PALEMBANG - MUARA BUNGO	X		PLB W25 A/P	146	146		"
	F10	PEKANBARU - PANDANG SIDENPUAN	X		PKU Ð A/P	132	132	NW/500W	"
	F11	PEKANBARU - LUBUK SIKAPANG	X		PKU D A/P	91	91	NW/500W	"
	F12	PONTIANAK - BATANG TARANG	X		PNK Ð A/P	130	130	AT/500W	"
	F13	BANDAR LAMPUNG - SUKA BUMI *	X		TKG Ð A/P	136	136	TF/500W	"
	F14	BANJARMASIN - TANAH GROGOT	X		BDM W18 A/P	119	119	OU/2.5KW	"
1995	F15	JAKARTA - TASIK MALAYA	X		CKG Ð A/P	125	125		"
	F16	MATARAM - BANYU WANGI	X		GA W42 BL1 W33 Ð A/P (or, GA W42 BL1 Ð)	126	146	GA/500W	"
	F17	PARANGKARAYA - RAMBUH HAMPANG	X		FK Ð A/P	138	138		"
2004	F18	TERNATE - BULI SERANI *	X		TR Ð A/P	55	55	TR/80W	"
	F19	PALEMBANG - LUBUK LINGGAN	X		PLM Ð A/P	110	110		"

Note: Airports with mark * have not existed, totaling 4 airports