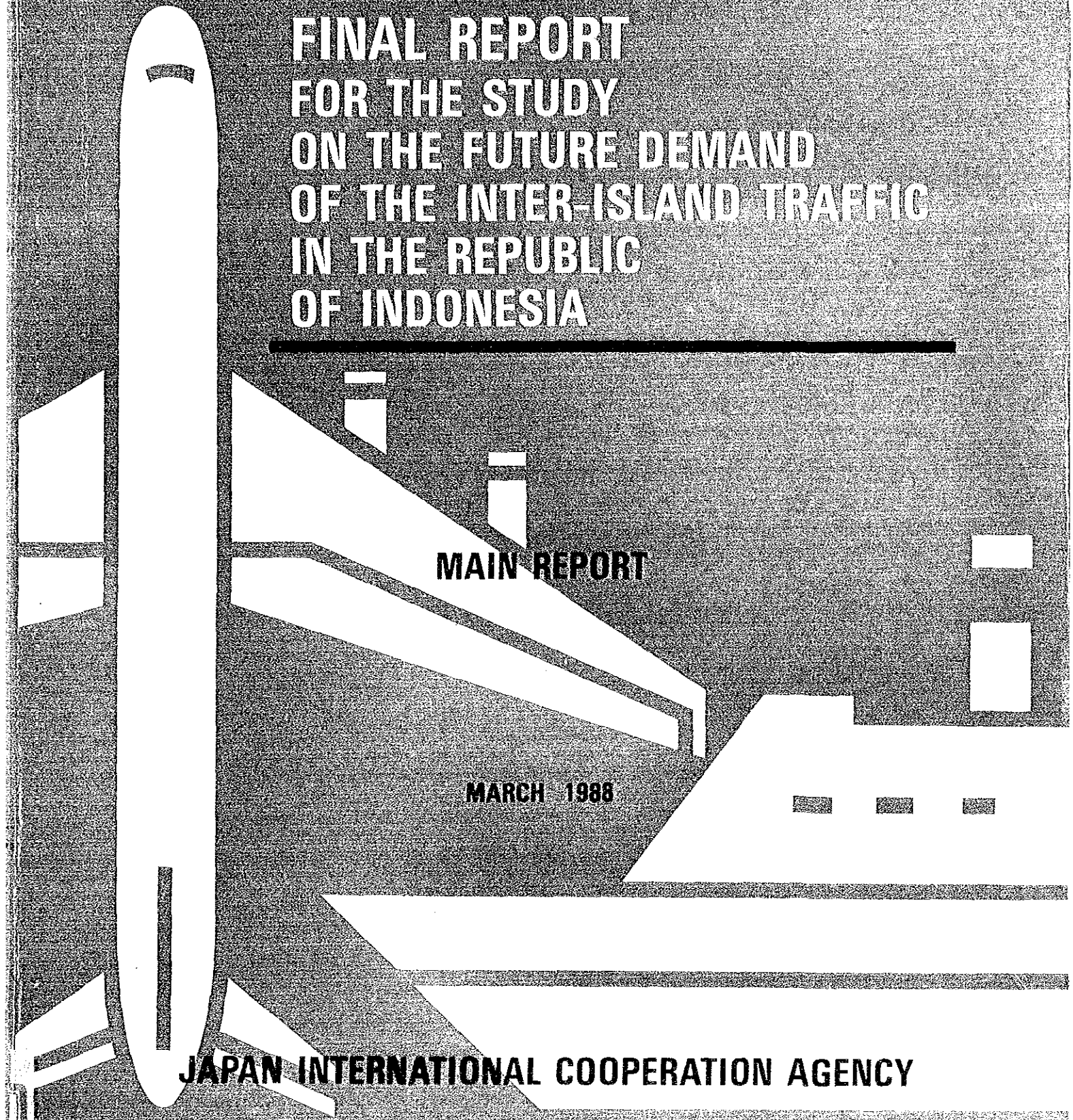
社会開発協力部報告書

No. 7

FINAL REPORT FOR THE STUDY ON THE FUTURE DEMAND OF THE INTER-ISLAND TRAFFIC IN THE REPUBLIC OF INDONESIA



MAIN REPORT

MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

FINAL REPORT
FOR THE STUDY ON THE FUTURE DEMAND OF THE INTER-ISLAND TRAFFIC IN THE REPUBLIC OF INDONESIA

MAIN REPORT

MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Republic of Indonesia, the Japanese Government has decided to conduct a study on the Future Demand of the Inter-island Traffic and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Indonesia a study team headed by Mr. Kunio Kishida, Nippon Koei Co., Ltd. comprising experts from Nippon Koei Co., Ltd., Central Consultant INC. and The Society of Japan Aerospace Companies INC., from January, 1987 to January, 1988.

The team had discussions on the Project with the officials concerned of the Government of Indonesia and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared. I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relationship between our two countries.

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

March, 1988

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CONCLUSION

CONCLUSION

The conclusions brought through the Study are summarized below. The detailed methodologies and various assumptions employed to reach the conclusions are delineated in the respective Section of the Main Report and the Study Report.

1. AIR AND SEA PASSENGER DEMAND FORECAST

1.1 The future air and sea passenger demands are forecast as tabulated below.

Table-1 Future Air and Sea Passenger Demand

Year	Air Passenger	Sea Passenger	Total
1984	6,869 (27.0%)	18,566 (73.0%)	25,435 (100.0%)
1994	9,036 (27.6%)	23,703 (72.4%)	32,739 (100.0%)
2004	12,026 (28.0%)	30,873 (72.0%)	42,899 (100.0%)

Note: Unit ; 1,000 trips
Assumed GDP Growth Rate ; 5%

In case that the passengers traveling by a ferry between Surabaja and Madura where the distance is too short and not competitive against the mode of air transport, are deleted, the share of air passenger will come up to about 35% in 2004 as tabulated below.

Year	Air Passenger	Sea Passenger	Total
1984	6,869 (33.3%)	13,729 (66.7%)	20,598 (100.0%)
1994	9,036 (34.1%)	17,443 (65.9%)	26,479 (100.0%)
2004	12,026 (34.6%)	22,764 (65.4%)	34,790 (100.0%)

1.2 Referring to Table-1, an annual growth rate of the air and the sea passengers averaged for 20 years (1984 to 2004) corresponds to 2.84% and 2.57% respectively. Whereas, a share of the air transport will grow by 1% from 27% to 28% in the above 20 years, including the sea passengers between Surabaja and Madura.

1.3 The share of the air transport , 28% by 2004 as shown in Table-1, is assessed on the conditions that the current fare and time value remain constant as of 1987. While, the share will grow up to 35%, provided that the time value grows in proportion to the increment of GDP per head.

1.4 The sensitivity of a forecast traffic demand against GDP growth rate shows that ± 1% difference of GDP affects -3.8% and + 4.4% fluctuation of air traffic demand volume in 20 years, as presented in Table-2

Table-2 Sensitivity of Traffic Demand Against GDP

Year	GDP		
	4%	5%	6%
1994	8,915 (-1.3)	9,036	9,164 (+2.1%)
2004	11,567 (-3.8)	12,026	12,558 (+4.4%)

1.5 The future desire line of the air and the sea passengers between a pair of 27 provinces are illustrated in Figure-1 and Figure-2. From a region-wise aspect, the future air passenger demand may be characterized as follows.

- Sumatera :

  Majority of demand in Sumatera are inter-region traffic with Jawa. In the case of intra-region traffic demand, most of them are limited traffic demands, except Medan-Pekanbaru pair.

- Jawa/Bali :

  There are very strong desire line between Sumatera as inter-region traffic demand. While, Jakarta-Surabaya, Jakarta-Yogjakarta, Jakarta-Semalang and Jakarta-Bali pairs contain high traffic demand in the case of intra-region traffic demand.

- Nusa Tenggara :

  Majority of demand in Nusa Tenggara are concentrated into inter-region traffic with Jawa/Bali, while inter-region traffic demand are limited.

- Kalimantan :

  Balikpapan-Tarakan, Balikpapan-Banjarmasin, Balikpapan-Samarinda and Banjarmasin-Kotabaru pairs contain high traffic demand in the case of intra-region traffic demand, however majority passengers' trips are related to Jawa.

- Sulawesi :

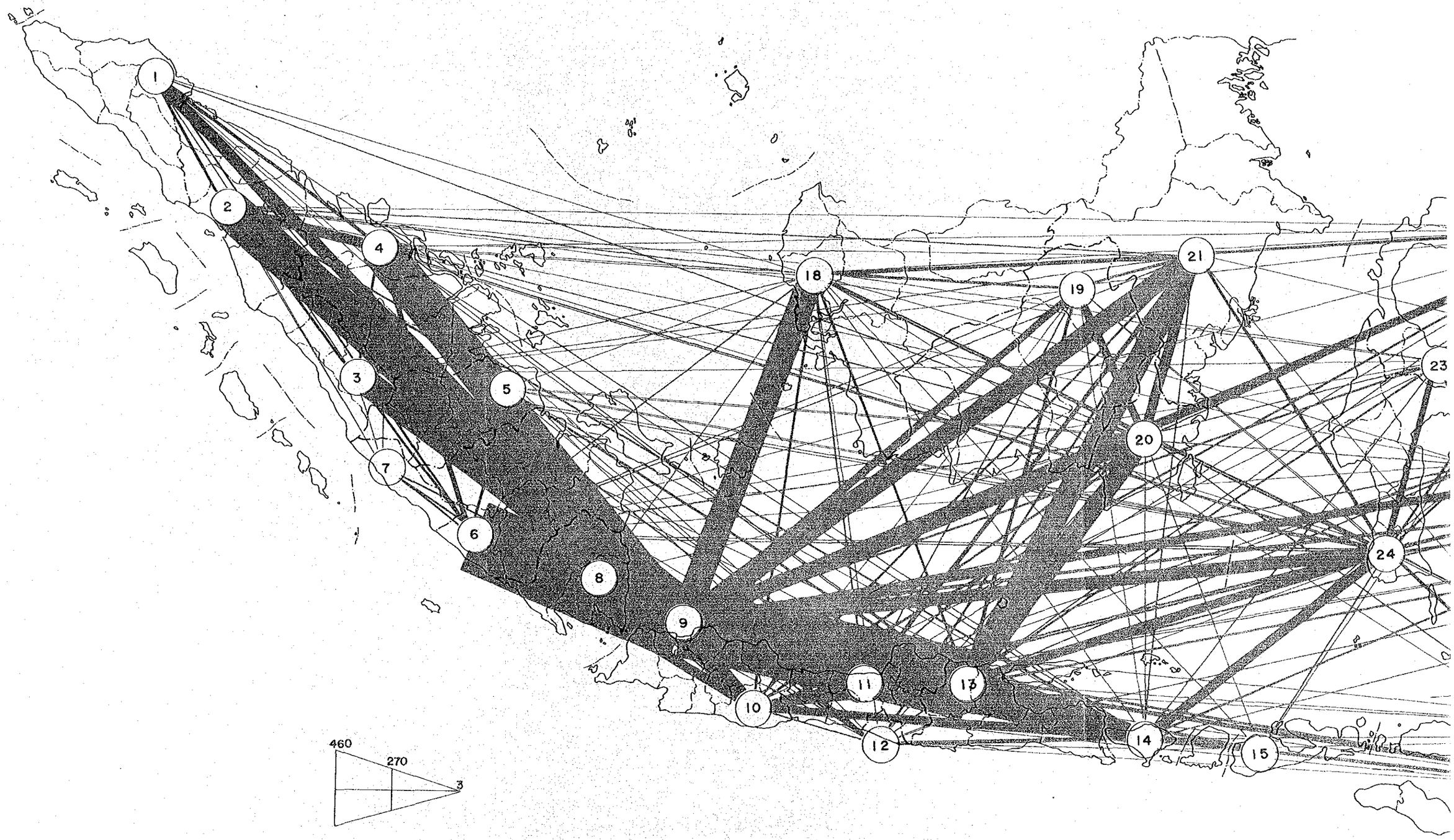
  Strong desire lines can be observed on Ujung Pandang-Jawa/Bali, followed by Madado-Jawa/Bali, Ujung Pandang-Kalimantan, Kendari-Jawa/Bali, Ujung Pandang-Sumatera.

- Maluku :

  Ambon-Ternate and Ambon-Mangole pairs are higher demand OD pairs in this region. However, majority of passenger trips are related to Jawa/Bali.

- Irian Jaya :

  In the case of intra-region traffic demand,



460
270
3

Unit : 1,000 Trips

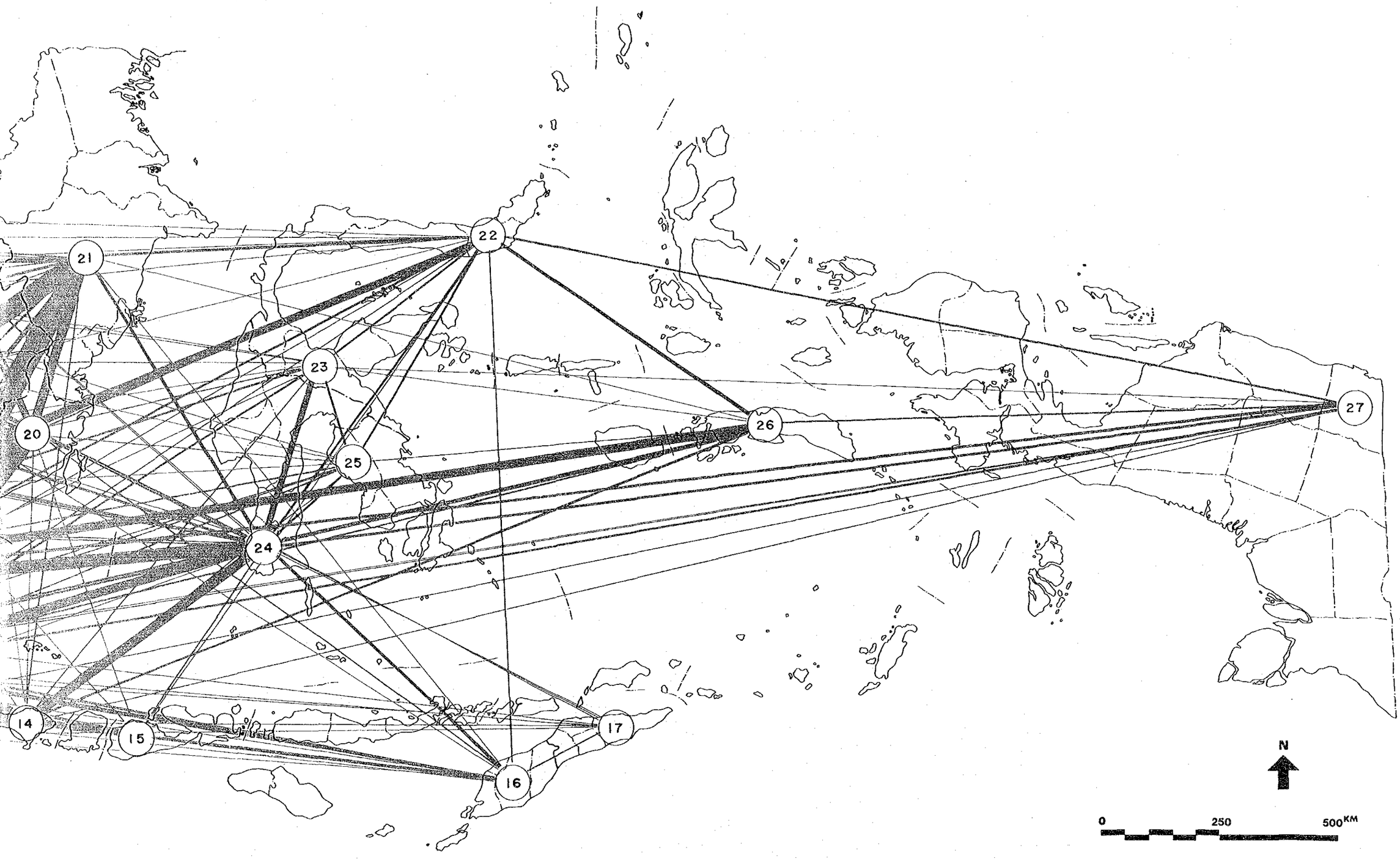
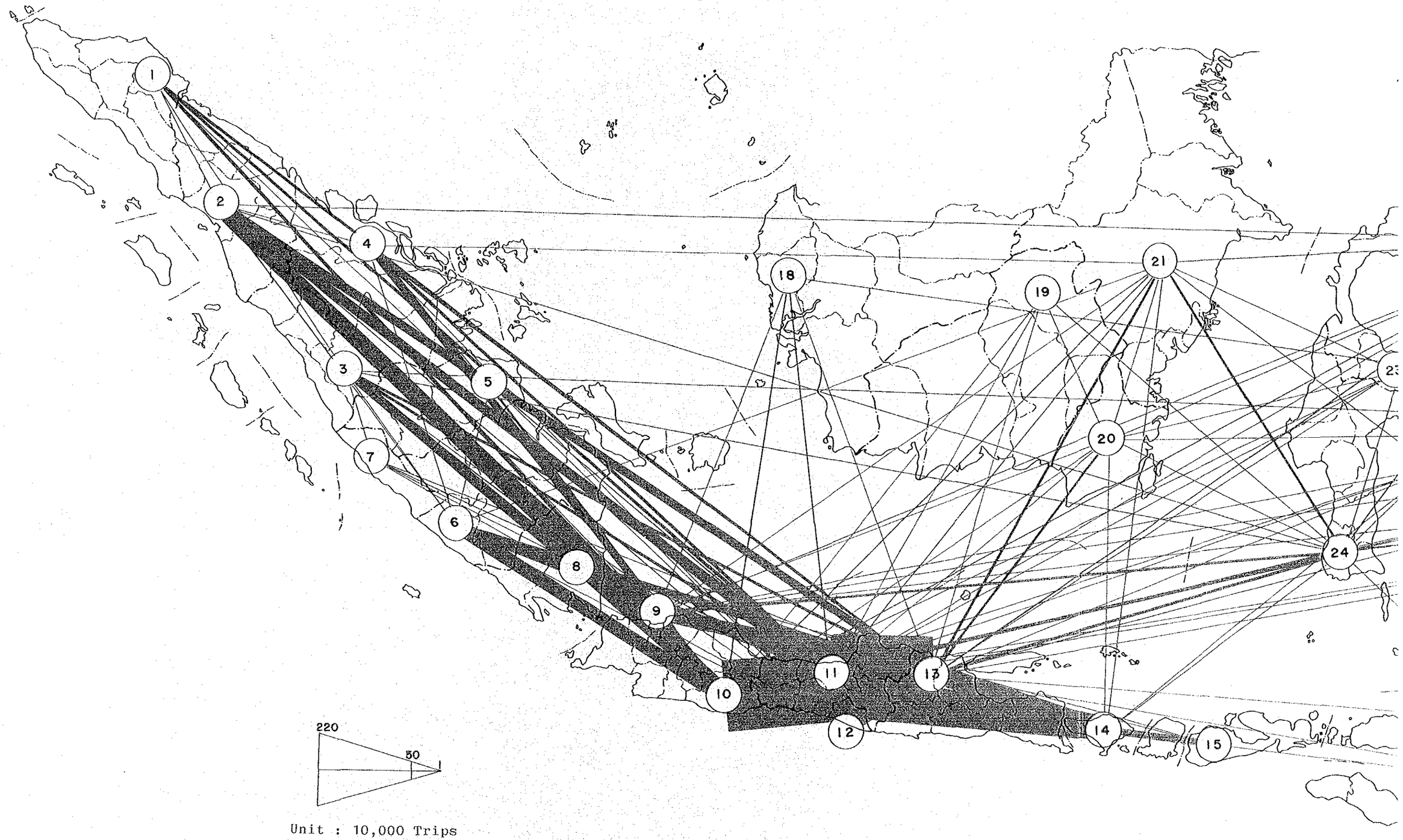


Figure-1 Future Desire Line of Air Passenger
Demand Between Provinces - 2004



Unit : 10,000 Trips

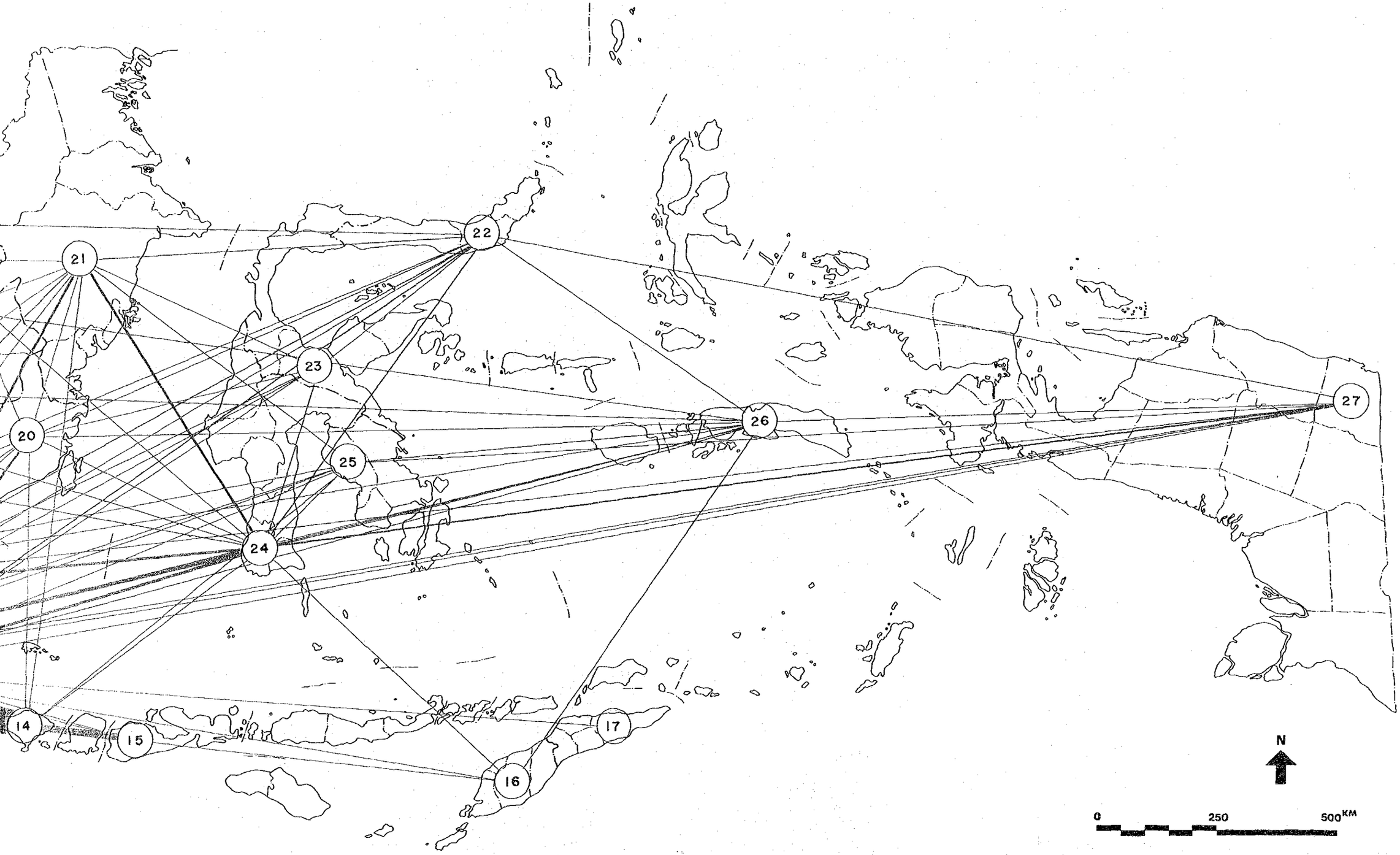


Figure-2 Future Desire Line of Sea Passenger
Demand Between Provinces - 2004

there are strong desire lines can be found on Jayapura-Wamena and Jayapura-Biak pairs, followed by Biak-Timika, Jayapura-Merauke, Biak-Sorong and Biak-Nabire pairs.

2. POTENTIAL NEW AIR ROUTES

2.1 The potential new air routes, which are likely to have a future traffic demand significant enough to justify the opening of regular air services on the new route concerned, are picked out among all the conceivable new air routes from a viewpoint of the magnitude of probable traffic demand. The definitions and/or the terminology employed in this study concerning the new air routes are delineated below.

- Major Airports : Airports being currently served by the daily flight of HS 748 (44 seats) and F-27 aircraft class or larger, corresponding to about 20,000 passengers per year or more.
- Minor Airports : Airports other than the Major Airports and an imaginary airport which is currently non-existent.
- Trunk Routes : Air Route connecting Major Airports including new and existing routes.
- Feeder Routes : Air Route connecting Major Airport-Minor Airport pair and Minor Airport-Minor Airport pair including new and existing routes.

2.2 The potential new air routes are recognized in both the feeder route and the trunk route under the following screening criteria.

In case of the feeder route, the new air route which is likely to have the annual passenger demand of more than about 20,000 passengers or justifiable for daily flight services of F-27 class aircraft, are selected as a potential new air route, out of all the conceivable feeder routes.

While, in case of the trunk route, the new air route of which future passenger traffic demand will fall within the largest 10 passenger demand amongst all the conceivable new trunk routes, is considered as a potential new trunk route.

2.3 Under the criteria defined above, the potential new air routes are identified as summarized below.

- Potential new feeder air routes
  - * By 1994 13 routes
  - * By 2004 19 routes
- Potential new trunk air routes
  - * By 1994 10 routes
  - * By 2004 10 routes

The list of the respective potential route specified by the city pair or the airport pair is shown in Table-3 and Table-4 and their approximate location of the airports concerned to the new routes is given in Figure-3 and Figure-4.

Table-3 Potential New Air Route (Feeder Route)

Year	New Feeder Routes				Distance	Passenger Demand **
	No. *	City Name (Airport Name)	Zone No.	City Name	Zone No.	(Km)	(Trips)
1994	1	Pekanbaru (Simpang Tiga)	25	Sibolga	14	295	69,068 94,766
	2	Pontianak (Supadio)	89	Singkawang	88	123	61,990 83,498
	3	Malang (Malang)	65	Madiun	61	151	50,856 87,408
	4	Pontianak (Supadio)	89	Natuna	29	458	40,234 54,574
	5	Semarang (A. Yani)	55	Kediri	62	212	35,468 65,498
	6	Jakarta (Soekarno Hatta)	43	Kotabumi	41	269	30,340 39,436
	7	Bandung (H. Sastranegara)	51	Pandeglang	44	155	29,640 40,268
	8	Bandar Lampung (Branti)	42	Muara Enim	36	236	28,072 40,266
	9	Palembang (Talangbetutu)	34	Muara Bungo	31	271	27,686 33,556
	10	Pekanbaru (Simpang Tiga)	25	Padang Sidempuan	15	244	26,458 33,786
	11	Pekanbaru (Simpang Tiga)	25	Lubuk Sikaping	18	168	23,514 30,892
	12	Pontianak (Supadio)	89	Batang Tarang	90	240	23,320 30,866
	13	Bandar Lampung (Branti)	42	Sukabumi	49	252	21,854 29,212
2004	14	Banjarmasin (Samsudin Noor)	103	Tanah Grogot	111	220	42,292
	15	Jakarta (Soekarno Hatta)	43	Tasik Malaya	53	232	32,042
	16	Mataram (Selaparang)	68	Banyuwangi	66	233	32,014
	17	Palangkaraya (Panarung)	97	Rabuh Hampang	101	256	25,538
	18	Ternate (Babullah)	140	Buliserani	141	88	18,346
	19	Palembang (Talangbetutu)	34	Lubuk Linggan	33	176	17,910

Note * : Each new air route number can be referred on Figures-4.2 & 4.3
** : Passenger demand shown in the upper and lower rows represent demand in 1994 and 2004, respectively.

Table-4 Potential New Air Route (Trunk Route)

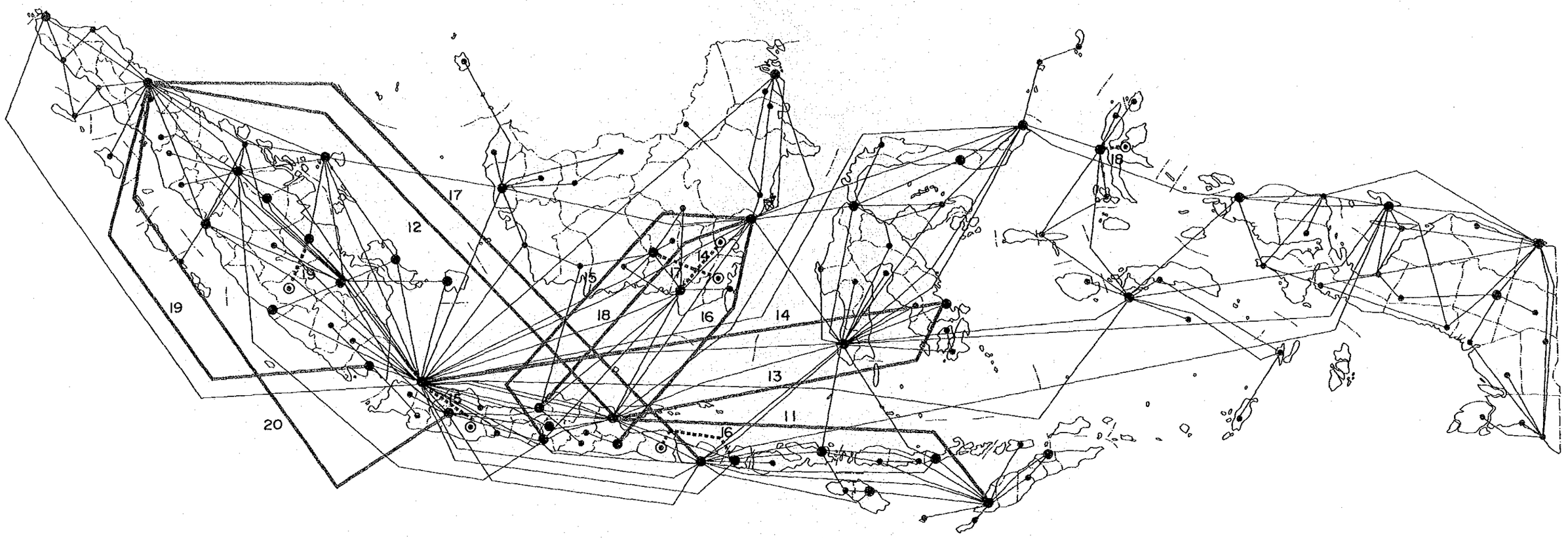
Year	New Trunk Air Routes				Distance	Passenger Demand **
	No. *	City Name (Airport Name)	Zone No.	City Name (Airport Name)	Zone No.	(Km)	(Trips)
1994	1	Banda Aceh (Blang Bintang)	2	Jakarta (Soekarno Hatta)	43	1,803	124,584 156,618
	2	Jakarta (Soekarno Hatta)	43	Ambon (Patimura)	149	2,414	119,894 160,614
	3	Jakarta (Soekarno Hatta)	43	Manado (Sam Ratulangi)	114	2,208	106,160 142,794
	4	Malang (Malang)	65	Denpasar (Ngurah Rai)	67	295	90,938 107,122
	5	Pekanbaru (Simpang Tiga)	25	Yogyakarta (Adi Sucipto)	60	1,372	90,402 103,510
	6	Surabaya (Juanda)	63	Tarakan (Tarakan)	106	1,279	73,982 100,616
	7	Malang (Malang)	65	Banjarmasin (Samsudin Noor)	103	571	73,106 76,160
	8	Jakarta (Soekarno Hatta)	43	Tarakan (Tarakan)	106	1,594	55,412 77,992
	9	Jakarta (Soekarno Hatta)	43	Mataram (Selaparang)	68	1,075	41,372 81,910
	10	Bandung (H.Sastaranegara)	51	Denpasar (Ngurah Rai)	67	880	33,488 40,102
2004	11	Surabaya (Juanda)	63	Kupang (El Tari)	81	1,297	74,078
	12	Medan (Polonia)	10	Surabaya (Juanda)	63	1,954	66,356
	13	Surabaya (Juanda)	63	Kendari (W.Monginsidi)	131	1,185	64,290
	14	Jakarta (Soekarno Hatta)	43	Kendari (W.Monginsidi)	131	1,792	58,950
	15	Yogyakarta (Adi Sucipto)	60	Balikpapan (Sepinggan)	110	1,023	50,528
	16	Malang (Malang)	65	Balikpapan (Sepinggan)	110	890	46,200
	17	Medan (Polonia)	10	Denpasar (Ngurah Rai)	67	2,284	44,724
	18	Semarang (A. Yani)	55	Balikpapan (Sepinggan)	110	952	43,340
	19	Medan (Polonia)	10	Bandar Lampung (Branti)	42	1,229	32,560
	20	Medan (Polonia)	10	Bandung (H.Sastaranegara)	51	1,511	29,646

Note * : Each new air route number can be referred on Figures-4.2 & 4.3
** : Passenger demand shown in the upper and lower rows represent demand in 1994 and 2004, respectively.

LEGEND

	New Trunk Air Routes
	New Feeder Air Routes
	Existing Air Routes
	Major Airports
	Existing Airport with Scheduled Flight
	Zone without Scheduled Flight Airport

Figure-3 New Air Route for 1994



LEGEND

	New Trunk Air Routes
	New Feeder Air Routes
	Existing Air Routes
	Major Airports
	Existing Airport with Scheduled Flight
	Zone without Scheduled Flight Airport

Figure-4 New Air Route for 2004

3. AIRCRAFT

3.1 Basic requirements for the aircraft that can accommodate the future air passenger demand was studied under the following three scenarios ;

- Scenario-A : The existing airports can be substantially upgraded and several new land airports can be constructed so as to make the aircraft operable under minimum direct operating cost.

- Scenario-B : This is a compromised scenario between the Scenario-A and Scenario-C. Some existing airports can be upgraded, and some new hydroports as well as land airports can be constructed to save total infrastructure investment cost.

- Scenario-C : The existing airports can be utilized as much as possible without any additional investment for new construction and/or upgrading. Some burden will result from increases of aircraft operating cost.

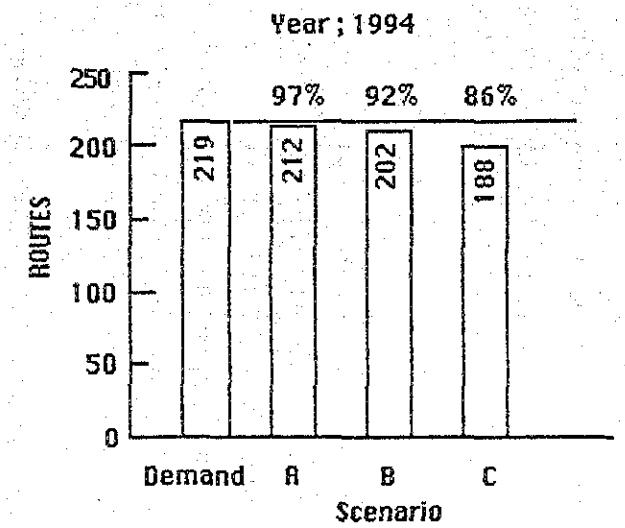
3.2 The basic requirements and number of aircraft likely to satisfy the probable demand under Scenarios -A and -B, are summarized as shown in Table-5. In case of Scenario-C, some unsatisfaction for accommodation of the given air traffic demand (approximately 10% loss in passengers) and economical inefficiency of flight operation (approximatery 20% higher than optimal DOC) will arise due to physical constraints of the airport facilities.

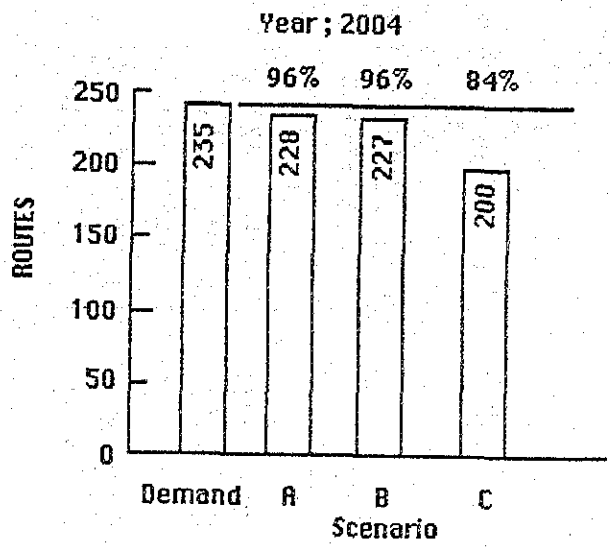
Table-5 Percentage Satisfaction in Each Scenario
(Routes and Pax.)

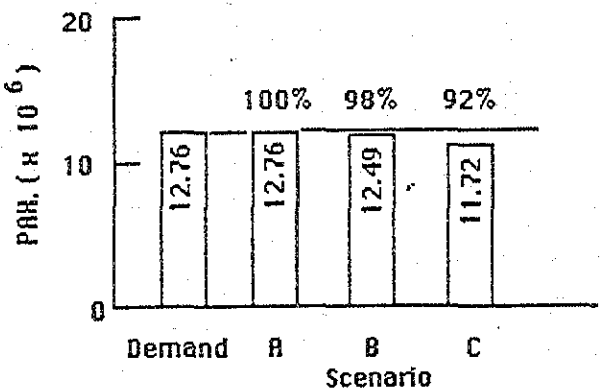
SCENARIOS	RATE (%)	
	1994	2004
- Passenger		
Scenario-A	100	100
Scenario-B	98	100
Scenario-C	92	90
- Routs		
Scenario-A	97	96
Scenario-B	92	96
Scenario-C	86	84

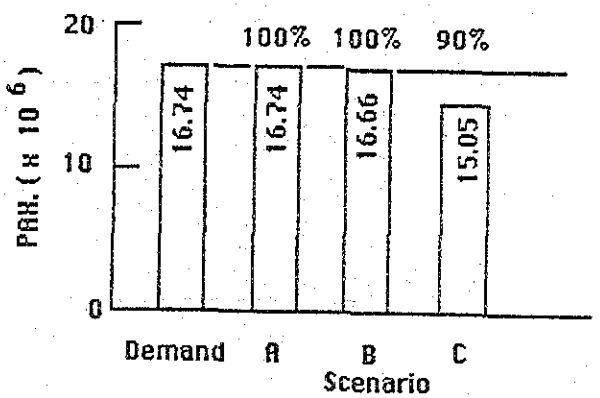
In case of Scenario-C, in which no additional investment would have been allotted to upgrading and improvement of the airport facilities by the year specified, only 92% (1994) and 90% (2004) of the air passenger could be accommodated due to the likely physical constrains of the airport facilities. Thus, this Scenario is considered unrealistic. Table-5 is illustrated in Figure-5.

Figure-5 Percentage Satisfaction in Each Scenario









3.3 Total acquisition cost of the aircraft fleet as shown in Table-7, is approximately estimated and summarized as shown in Table-6.

Table-6 Aircraft Acquisition Cost (Up to Year 2004)

Unit : Billion US$

AIRCRAFT	SCENARIO-A	SCENARIO-B
Light Airplane	0.03 (23)	0.05 (32)
Small Airplane	0.83 (119)	1.31 (182)
Medium Airplane	1.44 (65)	2.64 (125)
Large Airplane	1.66 (37)	0.62 (14)
T O T A L	3.96 (244)	4.62 (353)

( ) : Number of Aircarft

3.4 Study results is likely to be concluded as below ;

(a) In effectively coping with the increased future demand for air traffics, it is desirable to upgrade airport facilities. In particular, the improvement by expansion of selective national airports and rehabilitation and/or construction at regional airport system (including hydroport) will be needed.

(b) It will be essential to increase transportation capacity by modernizing and introducing aircraft. However, because a large proportion of operating cost is taken up by equipment cost (depreciation) and capital cost, this will have to be carried out while giving careful consideration to prevent the burden of equipment cost growing too large.

(c) In the construction of network like that assumed in this study, the provision of regular landbased aircraft on

Table-7 Required Number of Aircraft

Classification	Basic Requirement				Number of Aircraft				Current Aircraft	
					Scenario-A		Scenario-B			
	Seat	Range (km)	Cruise Speed (Kt)	Runway Length	1994	2004	1994	2004	Aircraft Name	Number of Aircraft
LIGHT PLANE	~10	500	~130	500	20	20	65	30	BN2	-
SMALL PLANE Class-I	~35	1400	165~220	1100	90	80	105	110~120	CN212,CN235	38
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	58
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)

the national routes can be considered effective. For regional air transport network, it is preferable to improve networks with small landbased aircraft, in addition, with amphibious aircraft complementarily.

(d) With the rising value of time that accompanies increases of GDP, passengers will be more inclined to use air transport and air traffic demand will increase steadily for future. As a result, further investment in medium and large sized aircraft is likely to be increased.

4. AIRPORTS

4.1 To cope with the future heavier aircraft load and generation of the new passenger demand, it would become necessary to extend and overlay the existing runway and/or to construct the new airports depending on Scenarios stated-above.

4.2 In assessing the work quantities required for extension and overlay of the existing runway, it is assumed that all of the existing runway should be extended and overlaid to the extent that the runway could sustain the new aircraft load after upgrading and extension. On this assumption, the length of necessary extension and overlay is calculated and given in Table-8.

Table-8 Total Length of Extension and Overlay

Works	SCENARIO-A		SCENARIO-B	
	1994	2004	1994	2004
Extension (m)	33,715	44,275	4,455	8,840
Overlay (m)	84,385	90,625	13,845	35,360
Total (m)	128,000	134,900	18,400	44,200

In the above Table, the total length of 128,000 meters in 1994 for Scenario-A means that the accumulated runway length corresponds to 128,000 meters to accommodate the optimal aircraft properly under operation of Scenario-A.

4.3 In addition to the above extension and overlay, several new airports should be constructed to follow the conditions of each Scenario. Such airports all belong to Category-IV and Category-V by reference to the future traffic demand volume. The required number of the new airports is presented in Table-9.

Table-9 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. Hydroport				
Type-C	-	-	6	21
Total	3	3	7	22

The facility requirements of each type of the airports are shown in Table-10.

Table-10 Provisional Scale of New Airport Facility

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	1: C-160 1: F-27 1: CN-235 1: DHC-6	1: C-160 1: F-27 1: CN-235	1: CN-235 2: DHC-6	. occupation time of apron: 1. first flight ..... 1.5 hr 2. scheduled flight .... 1.0 hr
	(m²)	(165x90)	(135x90)	(110x75)	. covers HS-748-2B and C-160/Cat-IV and CN-235 & C-212/Cat-V.
	Passenger Complex Building (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.

4.4 The approximate cost accruing from the said extension, overlay and construction is estimated based on the current price level of the respective work as depicted in Table-11 below.

Table-11 Summary of Approximate Cost

Description	SCENARIO-A		SCENARIO-B	
	1994	2004	1994	2004
Runway Extension	217	289	28	53
	(204)	(272)	(26)	(49)
Runway Overlay	205	227	34	83
Const. of New Land Airport	45	58	19	19
	(43)	(55)	(18)	(18)
Const. of New Hydroport	-	-	30	104
			(26)	(91)
Grand Total	467	574	111	259
	(452)	(554)	(104)	(241)

Unit: Millions Rp.= 588.2 US.$

( ): Land acquisition cost excluded

Improvement cost of the terminal buildings of the airports where runway be extended and overlaid is not included in the above Table.

In case that the land to be required for extension and construction of the new airports would be provided by the Government by free of charge, the figures in bracket may be applicable, equivalent to about 3 to 6% deduction in total.

The cost figured in the column of 2004 in the Table-11 corresponds to the amount, should no upgrading works have been done by that year.

In any cases, however, the approximate cost estimated here should not be referred to any specific project without proper modification, since that cost stands on many and various assumptions.

4.5 Through the field trips to nearly 20 airports concerned to the Study, the necessity of urgent rehabilitation of the existing airports has been seriously impressed. Many facilities are aged and look like having lost their original capacity.

5. NAVAIDS AND COMMUNICATIONS

5.1 It would technically be possible for an aircraft to serve the new airports by flying on a costly detouring route so as to avail the aid of the existing Navaids and communication system. Nevertheless, it might be not practical.

5.2 From the viewpoint of flight safety, expeditiousness and operation economy, additional installation , rehabilitation and replacement of Navaids and communication system would be necessary. The practical replacement schedule of Navaids is presented in Table-12.
In addition, the communication system should desirably be established by providing, inter alia, the following facilities by 1994.

- Banda Aceh	TWR, 1 VHF (30W)
	TMA, 1 VHF (50W)
- Tarakan	TMA, 1 VHF (50W), 1 dx RTT(500W)
- Kendari	TMA, 1 VHF (50W), 1 dx RTT(500W)
- Mataram	TWR, 1 VHF (30W), 1 dx RTT(500W)
- Bandung	TWR, 1 VHF (30W), 1 dx RTT(500W)
- Bandar Lampung	TWR, 1 VHF (30W)
- Pontianak after 1995	1 dx RTT(500W) and
- 19 feeder airports after 1995	19 RTT(100W)

The cost arising from replacement and provision of the above facilities is approximately estimated at about 29.54 Billions Rupiah in total.

5.3 Rehabilitation of existing system seems of urgent necessity.

Table-12 Navaids(NDB) Replacement Plan

LEGEND: 1 KW, 500 KW, 100 KW

NOTE:
Ideal Coverage 1 KW 200 NM
500 W 150 NM
100 W 60 NM

	RELATED ROUTES	NAVAIDS(NDB) LOCATION	IDENT.	PRESENT POWER(W)	1987/1988	1988/1989	1989/1990	1990/1991
1	T1	BANDA ACED	NZ	500				
2	T1	PADANG	OQ	"				
3	T1·4·14·16·20 F1·11·15	PEKANBARU	NW	"				
4	T1·17 P4·10	BANDAR LUMPUNG	TP	"				
5	T2·4·10·12 T14·16	SEMARANG	OC	"				
6	T2	AMBON	OH	2.5 K				
7	T3·5·8·15 T18·19	BALIKPAPAN	OL	500				
8	T3	MANADO	MD	2.5 K				
9	T3	"	SR	80(LOC)				
10	T4·15	YOGYAKARTA	OF	500				
11	T4·15	SOLO	SO	"				
12	T5·8·18·19 F17	BAJARMASIN	OU	2.5 K				
13	T5·8	TARAKAN	OT	500				
14	T6·7·10·14 T16	CIREBON	CA	100				
15	T6·7·10·14 T16	BLORA	SB	500				
16	T6·7·10·13 T14·15·18	SURABAYA	BA	"				
17	T6·F4	MATARAM	GA	"				
18	F1	SIBOLGA	SK	"				
19	F2·5·13	PONTIANAK	AT	"				
20	F5	NATUNA(RANAI)	RN	"				
21	T11	KUPANG	OK	2.5 K				
22	T11·12	KENDARI	NI	500				
23	T13·14	WAINGAPU	NR	"				
24	T17	SUMBAWA	NQ	"				
25	T20·F8	BANDUNG	OI	"				
26	T20·F8	"	YY	100(LOC)				
27	F18	TERNATE	TR	80(LOC)				
28	APPENDIX See 2(03)	PANGKALAN BUN	ON	100				

REMARKS

* KENDARI is better powered up to 1 kW for more navigational reception over the wide body of water to the east.
* WAINGAPU is also better powered up to 1 kW for a likely one way flow of traffic in future, which might necessiate a double track airway structure.
* PANGKALANBUN should be powered up to 1 kW to make routes for pioneer scattered in the northern area of Kalimantan Barat. In this connection, refer to APPENDIX 2 (03).
* MANAD (SR - 80 W) is added as a suggestion to be replaced by 100 W.

Numbers of NDB to be replaced, and AMS and AFS to be newly installed BY 2004:

Facilities / Routes	NDB Power (W)	NDB No.of Station		VHF(AMS) 50W or 30W No.of Station	RTT(AFS) dx 500W No.of Station	RTT(AFS) 100W No.of Station
Trunk	1K	7		7	5	
	500	13	23			
	100	3				
Feeder	1K	2				19
	500	3	5			
Total	1K	9				19
	500	16	28	7	5	
	100	3				

TRUNK + FEEDER BY YEARS

Facilities / Years	NDB Power (W) 1K	500	100	NDB No.of Station		VHF(AMS) 50W or 30W No.of Station	RTT(AFS) dx 500W No.of Station	RTT(AFS) 100W No.of Station
1987/1988		1		1	By 1994	4	4	10
1988/1989	4	1	1	6				
1989/1990	5	10	2	17	By 2004	3	1	9
1990/1991	1	3		4				
Total	10	15	3	28		7	5	19

Note: 19 feeder airports are assumed to need RTT (100W) by 1994, however, 4 of them have not existed as shown in PART II Table-6. They are better phased into 1995-2004. While, 5 airports related to feeder routes are for 1995-2004, thus totaling 9 airports are to be provided with RTT (100W) in 1995-2004. NATUNA is, however, better provided with RTT (500W).

SECTION 1 INTRODUCTION

SECTION 1
INTRODUCTION

1.01 PREAMBLE

(01)The Report: This is the Final Report for the Study on the Future Demand of Inter-Island Traffic in the Republic of Indonesia (hereinafter referred to as "the Study"), which had been conducted in accordance with the mutual agreement made between the Indonesian Authorities concerned and Japan International Cooperation Agency (hereinafter referred to as "JICA").

(02)Objective: The objectives of the Study , as prescribed in the relevant Scope of Works, are to forecast the future demand of the inter and intra island traffic mainly focused on the air transportation in Indonesia. The scope of the Study encompasses:

1) Analysis and examination of the present traffic situations.
2) Review and evaluation of the existing development plan.
3) Forecast of inter-regional traffic volume by each mode of transportation.
4) Forecast of air traffic volume by air route.
5) Forecast of the regional traffic demand by each mode of transportation within each region.
6) Identification of the potential new air routes and appurtenant facilities required.
7) Investigation of the basic specifications of aircraft applicable to the new air routes identified.

(03)Previous Report: The Study has been in progress from January, 1987 until March, 1988. Prior to compilation of this Final Report (hereinafter referred to as "the Report"), the following reports had been produced and submitted.

- Inception Report : January, 1987
- Progress Report : March, 1987
- Interim Report : October, 1987
- Draft Final Report : January, 1988

(04)Inception Report: The Inception Report presents the general approach and methodology to be taken for the Study including clarification and confirmation of the scope of the Study.

(05)Progress Report: The Progress Report mainly concerned with the study items of 1) through 3) defined in the above paragraph (02). Out of these, the nationwide traffic demand forecast by each mode of transportation has been the main theme of the study in this stage.

(06)Interim Report: The Interim Report dealt with the study items of 4) and of a part of 5) and 6). The regional air and sea traffic demand forecast has been accomplished and the likely potential new air routes have tentatively been identified. In addition, the basic materials necessary for preparation of the aircraft specifications have been collected and analyzed. The airport facilities, Navaids and telecommunication systems have also been studied.

(07)Draft Final Report: The Draft Final Report comprises all the outcomes of the Study executed under the Scope of Works, including the contents presented in the Progress Report and the Interim Report, and the consequences of final study which had been conducted after submission of the Interim Report. The potential new air routes are identified and the basic specifications on the aircraft, the airport facilities, the Navaids and the telecommunication systems necessary for the selected new air routes have been discussed.

(08)Contents: The Final Report consists of the Main Report, the Study Report, and the Data Book. The Main Report presents condensed core of the Study, supported by the Study Report which gives the detailed explanation on the Study executed for understanding of the background and supporting data used for the Study. Data Book compiles the raw unprocessed data and information which had been employed or referred to in carrying out the Study.

(09)Organization: The Study was accomplished directly by the Study Team organized by JICA and Indonesian Counterparts composed of the officials from the Ministry of Communications and BPP. Technology. The above working group was supervised by the Japanese Advisory Committee as well as by the Indonesian Steering Committee.

1.02 GENERAL WORK FLOW

(10)Work Flow: The general work flow of the Study is as illustrated in Figure-1.1, covering the whole Scope of Works. As it is clear in the Figure, the Study has been conducted in 7-stage, out of which the works in stages-2,4 and 5 are essential parts of the Study.

(11)Major Topics: The major topics of studies in each stage are as presented below.

Stage-1: 0.3 month in Tokyo
- Inception works

Stage-2: 2.7 months in Jakarta
- Supplemental data collection
- Evaluation of present situations
- Inter-regional traffic demand forecast

Stage-3: 0.5 month in Tokyo
- Review and evaluation of Stage-2 study

Stage-4: 3.6 months in Jakarta

- Field traffic survey
- Zonal traffic demand forecast
- Tentative selection of the potential new air routes
- Study on aircraft, airport facilities, Navaides and telecommunications

Stage-5: 3.4 months in Tokyo
- Review and evaluation of Stage-4 study
- Selection of the potential new air routes
- Basic specifications of the aircraft
- Basic specifications of airport facilities, Navaids and telecommunications

Stage-6: 0.5 month in Jakarta
- Discussion on the Draft Final Report

Stage-7: 1.0 month in Tokyo
- Finalization of the Final Report

The net months consumed for the Study amount to 13 months in total.

(12)General Approach: To identify the potential new air routes, firstly, the nationwide or inter-regional traffic demand has been assessed to draw an overall picture of a future traffic demand by dividing the whole Indonesia into 7 (seven) regions. The demand, thus forecast, has given the inter-regional gross movements of passenger and cargo by sea and air transport modes and referred to the results of subsequent study. Secondly, the inter-zonal traffic demand has been forecast to predict the more detailed future trend of demand by splitting the whole Indonesia to 181 zones based on the actual traffic survey. Thirdly, the potential new air routes have been set up from the realistic viewpoint based on the outcomes of the inter-zonal traffic demand, and again the demand has been assessed under the assumed new air traffic networks.

FIGURE-1.1 WORK FLOW FOR TH

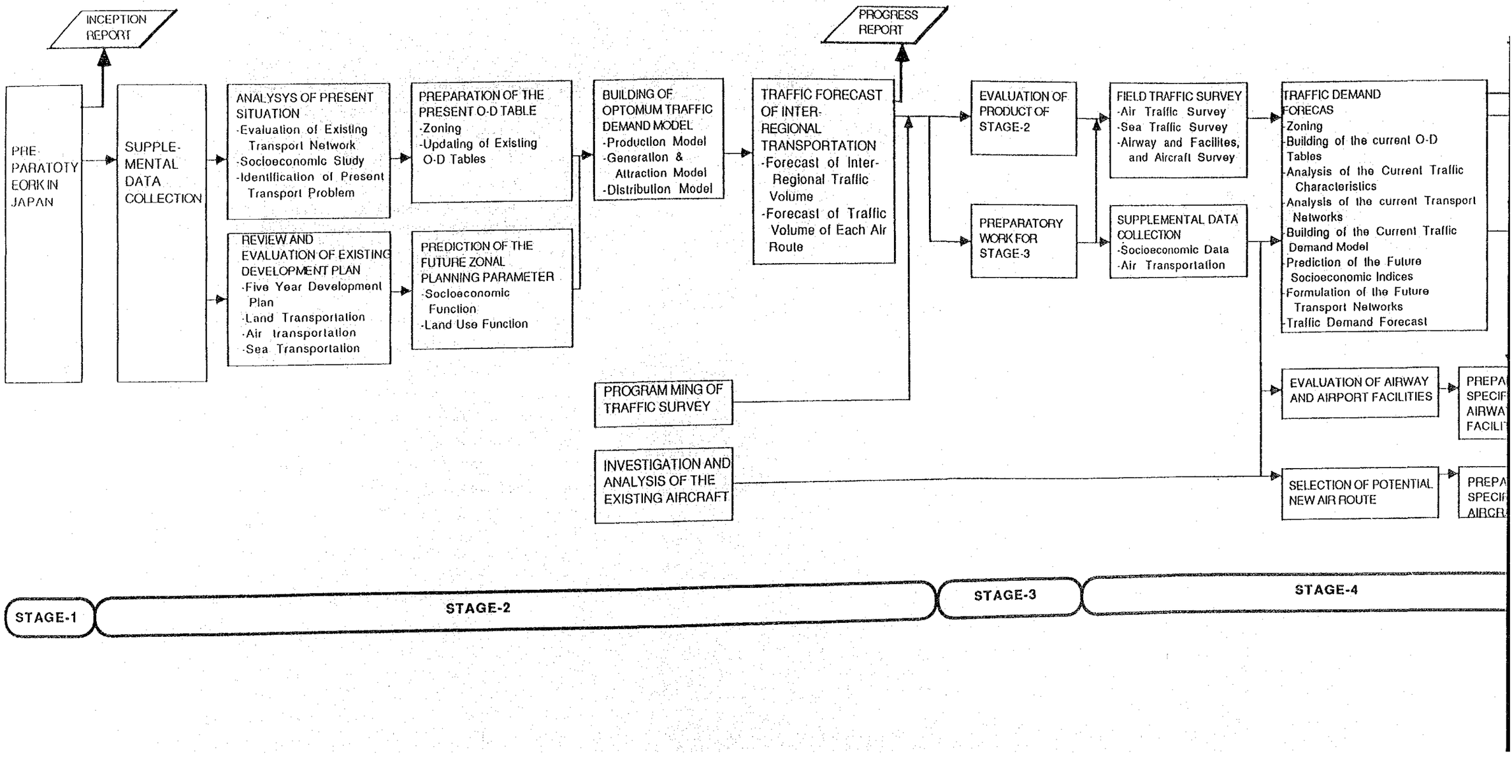
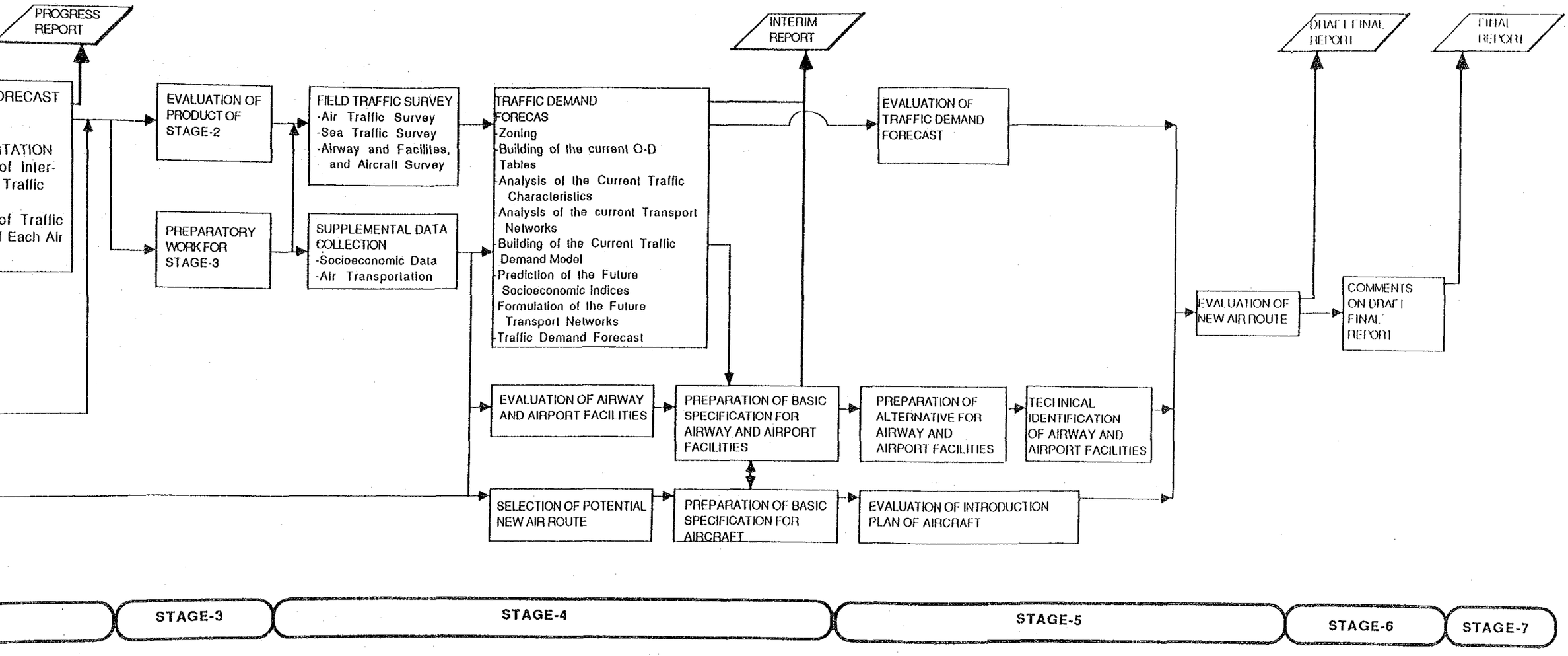


FIGURE-1.1 WORK FLOW FOR THE STUDY



the traffic demand forecast, studies on the aircraft, the airport facilities, the Navaids and the telecommunication systems have been conducted. The basic specifications of these above items, which are to become necessary for materialization of the prospective new air routes, have been worked out.

1.03 PRINCIPAL CONCEPTS OF THE STUDY

(14)Deficiencies of Data: The Study has been hampered, however, by shortage, lack, interruption and inconsistencies of the basic statistic data to be collected. Such deficiencies have been supplemented as much as possible by the actual traffic survey and analytical assessment of the collected data. However, it can not be denied that the Study results, by its nature of predicting future possible affairs, still unavoidably comprise uncertainties to some degree.

(15)Necessity of Updating: As such, the Study results need to be updated and refined after several years from now based on the latest data which would become available by that time, in order to assess the most probable traffic demand volume. To enable such updating works in the future, emphasis has been placed in the Report on the explanation of the methodology that had been employed in the Study. The authorities concerned to the Study could repeat the updating by following the description of the Report.

(16)Definition of Airports: In the Study, the following definition of the airports has tentatively been set up for convenience of the respective study described hereinafter in each Section concerned.

Table-1.1 Definition of Airports

CATEGORY	MAX. AIRCRAFT	MIN. RUNWAY	TENTATIVE CLASSIFICATION
I	B-747	3,000 m	Major National Airports
II	DC-10, A-300	2,300 m	National Airports
III	F-28	1,800 m	
IV & V	F-27, DHC-6	800 m	Regional Airports

In the above, the definition by Tentative Classification is applied to Section 6, Aircraft Study and the definition by Category is employed in Section 7, Civil Aviation Facility Study.

(17)Mode of Transport Studied: The objectives of the Study is to forecast the future demand of the inter and intra island traffic mainly focused on the air transportation. In the inter-regional traffic demand forecast, future demand of three modes of transport, i.e. air, sea and land are projected. In the inter-zonal traffic demand forecast, however, air and sea transportation are mainly studied, while land transportation is considered as access modes to/from airport/seaport. This is mainly because that the purpose of the inter-zonal traffic demand forecast is to identify potential new air routes in the whole Indonesia and these routes are supposed to be competitive with sea transport.

SECTION 2 PRESENT SITUATIONS

SECTION 2
PRESENT SITUATIONS

2.01 GENERAL

(01)Geography: The Republic of Indonesia is the largest archipelago country in the world, composed of some 14,000 islands scattering between 94°45' and 141°05' east longitude and from 6°08' north latitude to 11°15' south latitude. Out of these numerous islands, the major islands are named as Jawa, Sumatera, Kalimantan, Sulawesi and Irian Jaya. Jawa is the economic and administrative center of Indonesia.

(02)Budget of Transportation Sector: Due to such insular characteristics, the development of an inter-island transportation system has been given the high priority for further stabilization of solidarity and economic growth of Indonesia. In the current Fourth Five Year Development Plan (1984/85-1988/89), the transportation sector is allocated a share of 11.6% in the Government Development Budget.

2.02 SOCIOECONOMIC CONDITION

(03)Major Socioeconomic Indices: The major socioeconomic indices are summarized below:

- Area : 1,919,443 km^2
- Population : 165,800,000 (1985)
- Population Growth Rate : 2.3% averaged in 1971 to 1980.
- Gross Domestic Product (GDP)

Description	1980	1983
GDP (Current Prices)	45.4	71.2
GDP (1973 constant prices)	11.2	12.8
Growth Rate (Const.1973,%)	9.9	4.2
GDP per capita (US$)	495	579

GDP : Trillion Rp.

- Gross Domestic Product by Sector (1983)

* Agriculture, Forestry & Fishery	29.2%
* Mining & Quarry	7.4%
* Manufacturing	15.8%
* Construction	6.3%
* Transportation & Communication	6.0%
* Service & Others	35.3%
T o t a l	100.0%

- Composition of Labor Force (1983)

* Agriculture, Forestry & Fishery	26.4%
* Mining & Quarry	19.4%
* Manufacturing	13.2%
* Construction	6.2%
* Transportation & Communication	4.7%
* Services & Others	30.1%
T o t a l	100.0%

(04)PELITA-I: The Government of Indonesia implemented its First 5-Year National Development Plan, PELITA-I (1969/1970-1973/1974). Through implementation of PELITA-I, the inflation was successfully overcome and rice production was increased. The average annual real GDP growth rate during the Plan Period was 7.7%.

(05)PELITA-II: Subsequently, PELITA-II (1974/1975-1978/1979) was implemented. Although the oil price soared in 1973 at the time of the first oil crisis, the attained GDP growth rate of 6.9% was below 7.5% targeted for the second Plan Period; the world economic depression contributed to the missing of the target. The real average annual GDP growth rate from 1970 to 1979 corresponds to 7.7%.

(06)PELITA-III: PELITA-III was inaugurated in April 1979. During the first half of the Plan Period, the economy of Indonesia, supported by the prevailing high oil price, was very active. The serious depression of the world economy

since 1981, however, and the great drop in the price of oil, contributed to significantly lowering the growth rate, which was only 2.2% in 1982. To cope with the situation, the Government devalued the Rupiah currency from, Rp.703/US$1 to Rp.970/US$1 in order to promote exports and to increase revenue. In 1983, the growth rate recovered to 4.2%. The average GDP growth rate over the whole Plan Period was 6.1%, just below the target of 6.5%.

(07)REPELITA-IV: The current plan, REPELITA-IV has been underway since April of 1984. The targeted GDP growth rate is 5%; it has been set somewhat lower than those of the previous PELITAs in view of the unpredictability of the international supply-demand balance for oil. REPELITA-IV, aiming at the restructuring an economy which so far been largely dependent on oil and gas, emphasizes the exportation of a broader range of goods, and the increased development of manufacturing industries. In addition, job creation must be sufficient to meet the new labor force of about 9.3 million that is expected to enter the labor market during the Plan Period.

2.03 AIR TRANSPORTATION

(08)Airlines: The civil air transportation covers domestic and international air routes, including the scheduled flight, the non-scheduled flight, the general aviation flight, Haji flight and transmigration flight. The airlines serving the scheduled flight are PT. Garuda Indonesia, PT. Merpati Nusantara Airlines, (these two airlines are owned by the Government), PT. Bouraq Indonesia Airlines and PT. Mandala Airlines. The non-scheduled flight operators, mostly air charter operators, come to 20 companies. In addition, the general aviation companies registered amount to 44 as of 1987.

(09)Number of Aircraft: The numbers of operational aircraft possessed by the major four airlines which provide the scheduled flights are shown in Table-2.1.

Table-2.1 Number of Aircraft by Airline

Airlines	Numbers of Aircraft
PT. Garuda Indonesia	74
PT. Merpati Nusantara Airlines	59
PT. Bouraq Indonesia Airlines	20
PT. Mandala Airlines	8
T o t a l	161

(10)Air Passengers: Air Transport Statistics for 1985 show that the domestic passengers carried by the Government airlines come up to 4.6 millions and those transported by the private airlines correspond to 0.8 millions approximately in 1985. The international passengers carried by PT. Garuda Indonesia are recorded at about 0.9 millions in the same year. The passenger movement remains almost same level in the recent 4 years.

(11)Air Freight: The domestic air freights are counted at about 49.0 thousands tons for the Government airlines and 4.8 thousands tons for the private airlines. The international air freights are recorded at 24.6 thousands tons. This means that the total air freight carried in 1985 amounts to 78.4 thousands tons. The historical trend of the cargo movement does not show any significant fluctuation.

(12)Airports: There are more than 600 airports in Indonesia including the simple airstrips for the pioneer flight. Out of these, about 146 airports are under control of the Directorate General of Air Communications (DGAC). The major airports servicing the civil aviation come to 93 airports in 1985. Their location by area is shown in Table-2.2.

Table-2.2 Number of Airport by Area

Area	Number of Airport
* Sumatera	17
* J a w a	10
* Bali & Nusa Tenggara	17
* Kalimantan	14
* Sulawesi	10
* Maluku	4
* Irian Jaya	21
Total	93

The nation is divided into six aviation regions (Wilayah). The number of the airports under the control of each aviation region is tabulated in Table-2.3.

Table-2.3 Numbers of Airport by Aviation Region

AVIATION REGION	NUMBERS OF AIRPORT
Wilayah I (North Sumatera)	21
Wilayah II (South Sumatera, West Kalimantan & West Jawa)	25
Wilayah III (East Jawa, East Kalimantan)	30
Wilayah IV (Sulawesi & Maluku)	33
Wilayah V (Irian Jaya)	28
Wilayah VI (Bali, Nusa Tenggara & Timor)	23
T O T A L	160

(13)Air Traffic Service System: The Air Traffic Service System is divided into 4 FIRs(Flight Information Regions), that is, Jakarta FIR, Bali FIR, Ujung Pandang FIR and Biak FIR, and 2 UIRs, Jakarta UIR, Ujung Pandang UIR. This system can also be referred to the geographical configuration of Indonesian archipelago. When the future air traffic movement increases in the next decade, air-space configuration may need to be improved, which will likely restructure of airways as well as communication system especially in the eastern aerial region. Airway restructure will deal with double tracking so as to make a traffic flow on one-way to avoid a head-on traffic movement.

(14)Navaids: In Indonesia at present, there are 284 inventoried Navaids installed in en-route and terminal. Some of them are not functioning well. Nature of problem of existing Navaids are likely to be caused by;

- Lack of spare parts
- Shortage of maintenance technicians
- Malfunction of the system
- Limited fuel supply for electric generation
- Limited operation hour of airport where the station be located
- Uncertain schedule of flight test (non-official on air)

(15)Telecommunications: As to communication for aeronautical services, there are the following systems.

- Aeronautical Fixed Services (AFS)
  * Aeronautical Fixed Telecommunication Network (AFTN)
  * Aeronautical Telecommunication System (ATS), Direct Speech Circuit
- Aeronautical Mobile Service (AMS)
  * VHF Extended Range Communications
  * HF En-Route Communications
  * Terminal VHF Communications
- Meteorological Telecommunications

(16)Aircraft Industries: Indonesian Aircraft Industries have accomplished installation of the necessary factory facilities and the organization of the human power, which make it possible to produce 100 percent of the airframe independently by their own capacities at present. The Industries are now on the stage of the next phase, that is; the research and development of the aircraft.

(17)Aircraft: The aircraft, N-228/N-260, are under development to succeed the aircraft of CN-212 and CN-235. The main specification is as follows:

AIRCRAFT	WEIGHT	SEATS	REMARKS
N-228	9.5 ton	28	STOL
N-260	20-30 ton	60-70	STOL

NTTC-285(ATRA-90) has been developed by international joint works and is to be on sale from 1992. This new aircraft will be equipped with the facilities and materials developed by the advanced technology.

2.04 SEA TRANSPORTATION

(18)Role of Sea Transport: Since Indonesia is the largest archipelago country in the world, composed of about 14,000 inhabited islands, the sea transportation have been playing a very important role in inter-island transport in Indonesia, as well as in international sea transport. Hence, the Government of Indonesia has been allocating a considerable amount of its budget every year to development, rehabilitation and maintenance of the sea transportation sector.

(19)Sea Transport System: The domestic sea transport in Indonesia can be classified as follows.

- Inter-island sea transport
- Local sea transport
- People's (Rakyat) sea transport
- Pioneer sea transport
- Special sea transport
- Sea train
- Ferry services

(20)RLS: The inter-island sea transport, a key sector of the domestic sea transport, has been operated by the Regular Liner Service (RLS). As of 1987, RLS sailed 24 - Nusantara routes, 6 - Penumpang (Passenger) routes and 27 - Singapore/Malaysia routes, 57 sea routes in total. The vessels serving these lines are mostly the cargo/passenger ships,

except Penumpang routes with passenger vessels, and carry a considerable number of the passenger traveling over the inter-island.

(21)Local & Rakyat Sea Transport: The local sea transport has been functioning as a coastal carrier in the specific island, served by the ships less than 175 GRT (Gross Registered Tonnage), and Rakyat transport has been operated by much smaller ships than those of the local sea transport, which are mostly sail boats and motorized sail boats. These carriers supplement the services of RLS by sailing between the major port where the inter-island transport ships calls and minor local port.

(22)Pioneer Sea Transport: The pioneer sea transport was started in 1974 for the development of the remote areas where RLS did not cover, such as Irian Jaya, northern Sulawesi, west coast of Sumatera. In 1984, 25 - vessels are employed for Pioneer transport.

(23)Special Sea Transport: The special sea transport is the tramper liners service transporting homogeneous bulk cargo, such as petroleum and liquid gas, by special vessels; mainly tankers. In 1985, 2,715 vessels were utilized for this special sea transport.

(24)Sea Train: The sea train mostly has been operated as off-shore shipping activities. This kind of transport uses barges which are towed by tug. Usually, used for carrying dry bulk cargo such as iron sand, white sand for glass industry and asphalt (Butas = Buton asphalt), which are commercially better carried by such kind of transportation.

(25)Ferry Services: The above six transport systems are under the control of the Directorate General of Sea Communications. While, the ferry services are under control of

the Directorate General of Land Communications. The ferry services cover about 53 routes established between islands in the comparatively short distance mostly within 50 miles. The ferry services have been playing very important role in the local sea transport between the islands.

(26)Available Ships: The available numbers and tonnage of ships in 1985 are presented in Table-2.4.

Table-2.4 Available Numbers and Tonnage of Ships

Type of Fleet	Number	Tonnage (1000 tons)
Regular liner fleet	486	553 DWT
Local fleet	1,055	126 GRT
Sailing fleet	4,100	210 GRT
Pioneer vessels	25	22 DWT
Port assisting fleet	651	90 GRT
Special vessel	2,715	2,885 DWT
Ferry boat	78	32 GRT

(27)Cargo: The domestic cargo carried by the sea transport amount to 36.5 millions tons in 1984. Out of these, the share of RLS corresponds to 8.8%. The major share of 54.4% is attributable to the petroleum tanker. The cargo transport has been increasing gradually and that growth rate in the latest 5 - years is recorded at 8.6 % on an average for the whole cargo.

(28)Passenger: The passengers carried by shipping sector in 1984 are summarized in Table-2.5. The passengers in each sector of the transports have been carried by the passenger vessels and the cargo/passenger ships except ferry boats which have been operated mainly for the purpose of passenger transport. In 1984, as is clear in Table-2.3, about 20 millions of peoples traveled from islands to islands and approximately 90% of travelers used the ferry boats. And, out of 726.6 thousands passengers traveled by RLS, 701.7 thousands or 96.6% have been carried by the state

owned company of PT.PELNI. Within RLS routes, 6 Penumpang routes has been operating by PT.PELNI since 1983 and 6 passengers ships are used for these routes in 1986. The carrying capacity of the passenger ships ranges from 920 to 1,750 approximately, while number of passengers carried by these passenger ships in 1984 was counted as 654 thousand persons.

Table-2.5 Passengers Carried by Shipping Sector

Transport Sector	No. of Passengers (1000 pax.)
Regular liner	726.6
Local transport	611.0
Rakyat transport	144.1
Pioneer transport	139.8
Ferry boat	17,460.4
T o t a l	19,081.9

(29)Ports: It is said that there are 600 ports approximately. Out of these ports, the ports where the port master is stationed are counted at about 320 ports. In addition, there are the special ports which are operated by the private firms. Out of the public ports, about 91 ports have the port administration office or port office. The public ports are classified to 5 - class, consisting of 4-1st class ports, 15-2nd class ports, 22-3rd class ports, 32-4th class ports and 18-5th class ports.

(30)Water Depth: The water depth of the berth of four major ports are shown in Table-2.6. Since most of the ports are located in the river side or nearby the river, the maintenance dredging has been required. The structure of berthing facilities is mostly the pile supported pier due to the soft foundation prevailing in the site.

Table-2.6 Water Depth of Berth of Four Major Ports

Name of Port	Water Depth
Belawan	7 to 12 m
Tanjung Priok (Jakarta)	7.6 to 10.4 m
Tanjung Perak (Surabaya)	6.2 to 8.4 m
Makassar (Ujung Pandang)	8 to 12 m

2.05 LAND TRANSPORTATION

(31)Definition: The land transportation covers road transportation, railway transportation and inland water transportation. Over 50% of the total development budget for the Transportation, Communication and Tourism Sector have been allocated to the land transportation sub-sector.

(32)Road Length: The total road length under control of the governmental administrative body extends to 194,944 km or 100m/km^2 in 1984, which are broken down in Table-2.7 by the administrative body in charge. National road plays the role of arterial and collector road. While, provincial and Kabupaten roads function mainly as the collector and as the local road respectively. While Kotamadya road plays the role of urban road in large size cities.

Table-2.7 Road Length by Road Classification

Road Type	Road Length (km)
National road	11,938
Provincial road	36,310
Kabupaten road	136,058
Kotamadya road	10,639
Total	194,944

(33)Development: As the results of the positive investments on the road sector since PELITA-I, the total road length is doubled during the period from 1975 to 1984. In the light of a region-wise development, it is remarkable in Kalimantan, about 2.5 times-increase in length, and in Sumatera, about 2 times-increase in length, during the said 10 years.

(34)Road Density: The road density (length/area) varies very widely by region from 0.40 km/km^2 in Jawa & Bali to 0.01 km/km^2 in Irian Jaya, being reflected by difference of population and economic activities. While, the road length per 1,000 population is longer in Irian Jaya, 3.71, than Jawa & Bali, 0.55.

(35)Surface Conditions: In the light of the road surface condition, the existing road can be grouped as shown in Table-2.8.

Table-2.8 Length of Road by Type of Surface

Surface Condition	Road Length (km)	Share
Paved	77,825	40%
Gravel stone	45,768	23%
Earth	57,294	30%
Others	14,057	7%
Total	194,944	100%

Most part of road, except in Jawa & Bali where 66% of road are paved, is surfaced by gravel stone and earth. Especially in Irian Jaya, the paved road runs only 16%. The percentage of asphalt paved road shows increase from 29 % in 1974 to 40 % in 1984, but it still remains low level. There exists significant difference among the islands from the aspect of quality and quantity of road development. In general, improvement of quality has been stressed in Jawa & Bali, and quantity has been emphasized in other regions.

(36)Motorization: Motorization in Indonesia has been rapidly progressed. In the latest 10 years from 1975 to 1984, the numbers of registered vehicles record 3 times increment, or 13% in average annual growth rate. The total numbers of registered vehicles are recorded at 6.5 millions in 1984. The vehicle compositions are 14.3% of passenger car, 12.2% of truck, 3% of bus and 70.5% of motorcycle. The numbers of motorcycle are outstanding, 4.6 millions.

(37)Region-wise Distribution: Region-wise distribution of the vehicles is presented in Table-2.9. About 67% of vehicles are concentrated on Jawa & Bali. The numbers of registered vehicle per 1,000 population come up about 40 vehicles on an average in whole Indonesia. Those in Nusa Tenggara and in Maluku are extremely low, 13.2 and 9.5 per 1,000 persons.

Table-2.9 Number of Registered Vehicles by Region

Region	No. of Vehicles (1000)	Share
Sumatera	1,314	20.5%
Jawa & Bali	4,322	67.1%
Nusa Tenggara	86	1.3%
Kalimantan	293	4.5%
Sulawesi	376	5.8%
Maluku	15	0.2%
Irian Jaya	39	0.6%
Total	6,455	100.0%

(38)Transport Volume: The inter-Kabupaten transport volume carried by the vehicles in 1982, when the origin/destination survey was conducted, recorded the passengers of 1,469 million persons and the cargo of 175 million tons. When compared to those of the year of 1977, the annual average growth rates are 18% for the passenger trip and 15% for the cargo carriage. In the light of the region-wise figures, the transport volume in Jawa & Bali is ranked at the highest

level, followed by that in Sumatera, as numbers of registered vehicles show likewise.

(39)ADT: According to the traffic counts conducted by Bina Marga, the growth rate of Average Daily Traffic (ADT) is null between 1982 and 1983. And, the growth rate is estimated at 5.7% annually from 1983 to 1990 by Bina Marga. Referring to these figures, the transport volume in 1984 might have been around 1,550 millions for passenger traffic and 185 millions tons for cargo flows.

(40)Railway Network: The railway transport networks in Indonesia are composed of the four systems shown in Table-2.10. The gauge is 1,067 mm, and the railway has primarily single track except for the double track section between Jakarta and Cikampek, 163 km. Electrified section is 30 km only in JABOTABEK area, using 1,500 volts D.C. In the other section, diesel locomotives are mainly employed.

Table-2.10 Railway Network

Area	Railway Length (km)
Jawa	4,441
South Sumatera	643
West Sumatera	278
North Sumatera	543
Total	5,905

(41)Motive Power: The numbers of motive power in 1985 amount to 651 in total, about 80% of which is a diesel locomotive. By a general policy, steam locomotives were replaced by diesel locomotives. As to the electric unit, electric rail cars are utilized. Since the age of 40% of diesel locomotives are more than 20 years, replacement by the new one is of urgent need.

(42)Passenger: The passenger transport by railway records 46.8 millions passengers in Jawa and 2.6 millions in Sumatera, which correspond to about 2.5 times increment in Jawa and about 1.7 times increment in Sumatera during the latest 10 years. The average annual growth rate corresponds to 10.6% for Jawa and 6.4% for Sumatera.

(43)Cargo: Similarly to the passenger transport, cargo transport also shows growing trend, that is; 1.5 times growth for Jawa and 3.3imes growth for Sumatera in 10 Years. Sumatera cargo transport recorded 3.9 millions tons with steady upward trend, while Jawa's 3.6 tons with up and down repetition. The section where the maximum transport volume recorded is Jakarta - Cikampek of double track line.

(44)Frequency: Frequency of operation is 80 trains/day for double track line, 50 to 20 trains/day for trunk line and 10 to 5 trains/ day for local line. It seems that the existing railway is operated at its full capacity, but not satisfying the demand adequately. Shortage of rolling stock and signal system constrains appear to be main neck for capacity increase.

(45)Inland Water Transportation: Inland water transportation has been developed in Indonesia due to her geographical features, that is; abundance of the great rivers, the lakes and the swamp, and difficulty in land access, especially in central/south Sumatera and Kalimantan. Inland water transportation is under control of Directorate General of Land Communications.

(46)Boats: Numbers and volume of boats employed in inland water transportation are summarized in Table-2.ii. Sumatera and Kalimantan together own about 90% of the total inland water boat. In terms of volume of boat, Kalimantan occupies 50% of the total volume. The average boat size is 18 m^3.

Table-2.11 Number and Volume of Boat

Region	Number of Boats	Volume of Boat
Sumatera	42,059	680,157 m^3
Jawa & Bali	1,306	34,428 m^3
Nusa Tenggara	-	-
Kalimantan	40,364	848,994 m^3
Sulawesi	4,539	38,005 m^3
Maluku	215	N.A.
Irian Jaya	543	2,745 m^3
Total	89,026	1,602,329 m^3

(47)Service Route: The inland water service routes are 192 in Sumatera, 39 in Jawa & Bali, 221 in Kalimantan, 61 in Sulawesi, 17 in Maluku and 15 in Irian Jaya, totaling 545 inland water service routes in Indonesia. The route length ranges from 1 km to 900 km.

(48)Transport Volume: Transport volume by the inland water boat in 1984 is recorded as shown in Table-2.12. Passenger transport in Kalimantan is registered about 8 millions or 5% of the total, followed by Sumatera, 14%. While cargo transport both in Kalimantan and Sumatera amounts to about 2 millions ton each, corresponding to 88% of the total cargo transport. According to the statistics from 1981 to 1984 prepared by DGLC, both cargo and passenger transport fluctuates every year. Hence, it is difficult to forecast the future trend of demand.

Table-2.12 Transport Volume by Inland Water Boat

Region	No. of Passengers (1000 pax.)	Volume of Cargo (1000 tons)
Sumatera	2,191	1,936
Jawa & Bali	1,158	332
Nusa Tenggara	-	-
Kalimantan	8,392	2,066
Sulawesi	1,419	57
Maluku	1,307	117
Irian Jaya	1,300	14
Total	15,767	4,522