SECTION 3 FIELD TRAFFIC SURVEY

SECTION 3
FIELD TRAFFIC SURVEY

3.01 OBJECTIVES OF THE FIELD TRAFFIC SURVEY

(01)Deficiencies of Existing Data: The existing data obtained were inadequate for the comprehensive traffic demand forecast, since the Origin/Destination (hereinafter abbreviated as "OD") data were mixed up with gross and net movement of passengers and cargo. And, traffic flows in some airports and ports are missing. Therefore, several assumptions had to be adopted to supplement these data. In addition, the characteristics of passengers were also not available.

(02)Objectives: In order to forecast the actual movements of passengers and cargo, it was necessary to determine either the net movements of them or the correlation between the existing gross movement data and the net movements. For this purpose, field traffic surveys for air passengers (hereafter termed 'the air passenger survey') and sea passengers (hereafter termed 'the sea passenger survey') were planned and executed with the kind cooperation extended from several agencies concerned. This section describes the methods and results of these surveys.

(03)Importance: Up to the present, no actual field origin/destination survey on air transport movements has been carried out in Indonesia. As stated in the Report, the role of air transportation has been increasing yearly with the desire to save travel time and the gradual rise of time value. The actual traffic flow must be known to plan the future transportation system. In this regard, the actual survey conducted for the Study provides information about the true origin/destination and characteristics of passengers, and gives an example of a survey to be carried out in the future.

3.02 SURVEY METHOD

3.02.1 Air Passenger Survey

(04)Selection of Airport: For the selection of airports to be surveyed, due consideration was paid to the number of passengers at each airport, the functional importance of airports in the current air transport network, the future potential for further development in each region, and the possible coverage of air routes by the survey. Conclusively, 19 airports, as indicated in Table-3.1, were selected for the air passenger survey.

Table-3.1 Airports Surveyed and Survey Schedule

Region	City	Airport Name	Survey Date
Jawa/Bali	Jakarta Surabaya Denpasar	Soekarno-Hatta Juanda Ngurah Rai	22nd July (Wed) 4th & 6th August (Tue) & (Thu) 31st July (Fri)
Sumatera	Medan Padang Palembang	Polonia Tabing Talangbetutu	27th & 28th July (Mon) & (Tue) 29th & 30th July (Wed) & (Thu) 31st July (Fri) & 1st August (Sat)
Kalimantan	Banjarmasin Balikpapan Pontianak	Syamsudin Sepinggan Supadio	3rd & 4th August (Mon) & (Tue) 5th August (Wed) 6th & 7th August (Thu) & (Fri)
Sulawesi	Ujungpandang Palu Manado	Hasanudin Mutiara Sam Ratulangi	3rd & 4th August (Mon) & (Tue) 27th & 28th July (Mon) & (Tue) 29th & 30th July (Wed) & (Thu)
Nusa Tenggara	Kupang Mataram	El Tari Selaparang	28th & 29th July (Tue) & (Wed) 29th July (Wed)
Maluku	Ternate Ambon	Babullah Pattimura	30th & 31st July (Thu) & (Fri) 5th, 6th & 7th August (Wed), (Thu) & (Fri)
Irian Jaya	Sorong Biak Jayapura	Jefman & Sorong Daratan Frans Kaisiepo Sentani	1st August (Sat) 2nd August (Sun) 3rd & 4th August (Mon) & (Tue)

(05)Design of Questionnaire: A questionnaire for the air passenger survey was designed in a fashion to fit to the direct interview method. The direct interview method was adopted for the air passenger survey, since some questions, especially origin/destination/transit locations of trips had to be answered correctly. In the design of the questionnaire, due considerations was paid to the following points.

- Questions should be easy to understand, both by passengers and interviewers.
- Questions related to the privacy of passengers should not be included.
- The questionnaire should be easy for interviewers to fill in, in order that the duration of passenger interviews is reduced to a limited time.
- Completed questionnaires must be directly used as coding sheets for the input of data into the computer.

(06)Contents of Questionnaire: The contents of the questionnaire are summarized below. Two kinds of questionnaires, one in Indonesian and one in English were prepared, since several airports were considered to serve a high proportion of foreigners.

- Origin/destination airports of flight.
- Trip purpose and travel frequency.
- Reason for travel by air transport.
- Past experience of traveling on the same route by another transport mode.
- Sex, occupation and address of passenger.
- Trip to the departure airport (origin, transit place, transport mode and travel time)
- Trip from the arrival airport (transit place, final destination, transport mode and travel time).
- Opinion for new air route.

(07)Survey Team: Since airports to be surveyed were spread across Indonesia, the air passenger survey was executed by 3 survey teams. Each survey team consisted of one or two Japanese experts and their Indonesian counterparts, and several interviewers.

(08)Execution of Air Passenger Survey: At each airport, interviewers directly interviewed passengers waiting for flights, either at waiting lounge(s) or the transit lounge, if any. Military personnel and police officers in uniform were excluded from the interview. Interviewers had been instructed not to force reluctant passengers to answer questions. Passengers of the following airlines were interviewed.

- PT. Garuda Indonesia (GA)
- PT. Merpati Nusantara Airlines (MZ)
- PT. Bouraq Indonesia Airlines (BO)
- PT. Mandala Airlines (QH)
- PT. Sempati Air Transport (VJ)
- PT. Deraya (DC)
- PT. Dirgantara Air Service (DS)
- PT. Sabang Merauke Air Charter (SM)
- PT. International Nickel Indonesia (INCO)

(09)Number of Passenger: In parallel with the direct interview of passengers, data related to the number of departing and transit passengers on each flight was collected either from airline offices or from actual counting. These data are essential to calculate sampling rate, load factors and expansion factors, used for analyses of both passenger characteristics and traffic demand forecasts.

3.02.2 Sea Passenger Survey

(10)Objective: The main objective of the sea passenger survey was to obtain data of trips and characteristics of sea passengers on several types of sea routes, which would

be utilized for construction of the modal split model in the Study. Therefore, for the selection of ports to be surveyed, due consideration was paid to whether the sea routes from the ports were competitive with air routes to be surveyed by the air passenger survey and those sea routes were placed under different categories. As a result, 4 ports with 6 sea routes were selected, as shown in Table-3.2.

Table-3.2 Surveyed Ports, Routes and Survey Schedule

Port Name	Ship Type & Route	Survey Date
Merak	Ferry (Merak - Bakauheni)	24th July (Fri)
Tenau (Kupang)	1. PT.PELNI (Km.KELIMUTU) *1 (Tenau - Ende, Waingapu, Bima) 2. Ferry (Tenau - Larantuka)	26th July (Sun) 27th July (Mon)
Lembar (Mataram)	1. PT.PELNI (Km.KELIMUTU) *1 (Lembar - Padangbai, Tg.Perak) 2. Ferry (Lembar - Padangbai)	30th July (Thu) 30th July (Thu)
Tg. Perak (Surabaya)	PT.PELNI (Km.KAMBUNA) *2 (Tg.Perak - Makasar, Balikpapan)	6th August (Thu)

Note *1 Ports of call by Km.KELIMUTU from Tenau are as follows; Ende, Waingapu, Bima, Makasar, Lembar, Padangbai, Tg.Perak, Banjarmasin and Semarang
*2 Ports of call by Km.KAMBUNA from Tg.Perak are as follows; Makasar, Balikpapan, Pantoloan and Bitung

(11)Design of Questionnaire: By the same logic of the air passenger survey, questionnaires for the sea passenger survey were prepared both in Indonesian and in English. The contents of these questionnaires were similar to the questionnaires designed for the air passenger survey, as summarized below.

- Origin/destination ports of passengers.
- Trip purpose and travel frequency.
- Reason to travel by ship.

airplane.

- Sex, occupation and address of passenger.
- Trip to the departure port (origin, transit place, transport mode and travel time).
- Trip from the arrival port (transit place, final destination, transport mode and travel time).

(12)Execution of Survey: The sea passenger survey was executed, just similarly to the air passenger survey. Interviewers who carried out the air passenger survey also conducted the sea passenger survey. At each port, interviewers interviewed passengers directly, either at a waiting room or on board. In addition, the survey team obtained the number of departing and transit passengers on each ship from operators.

(13)Data Processing: The collected questionnaires were statistically processed. The data were checked manually, and respective codes, especially zone codes for origin, destination, transit places and address, were recorded on the questionnaires. The questionnaire data were then entered as data files into computer and logical checks were carried out to identify coding and data punching errors prior to finalization of the data files. The finalized data files of the air and the sea passenger survey results were then utilized for the air traffic demand forecast and the analyses of air and sea passenger characteristics.

3.03 SURVEY RESULTS

3.03.1 Air Passenger Survey

(14)Sample Size: The total number of air passengers on board the flights during the survey period were 17,687 in total, while 6,795 of them were picked up as samples by the air passenger survey. As a result, the average sample rate for all the surveyed airports was 38.4%, while the sample rates varied from 78.3% at Kupang El Tari Airport to 24.3% at Jakarta Soekarno-Hatta Airport.

(15)Load Factor: The load factors of flights by airline during the air passenger survey are assessed. Flight capacity is calculated based on the type of aircraft utilized for each flight in operation on the survey dates. In total, the average load factor for all flights is 63.2%. However, the load factors for Garuda flights (59.9%) is much lower than those for flights of other airlines (72.6%). This finding may be attributed to the fact that other airlines utilize smaller aircraft and also offer cheaper air fairs to passengers than Garuda.

(16)Trip Purpose: Trip purpose of air passengers is found that, as a whole, 28.8% of passengers took air transport for 'official' purposes, followed by 'go back home' (19.6%), 'social' (19.1%), 'tourism' (16.9%) and 'business' (14.0%). These composition rates, however, are much different at each airport. In addition, from the viewpoint of the nature of airlines, nearly half of the passengers on Garuda flights are responded with 'official' or 'business' purpose. In contrast, 'go back home' and 'social' purposes, which are more personal, accounted for more than half of the passengers on other flights, while responses of 'official' and 'business' purpose were limited to about 30% of the passengers.

(17)Travel Frequency: Regarding the travel frequency of air passengers, 80.8% of passengers took airplanes on the same routes less than 5 times per year, while only 4.5% of passengers are classified as frequent air travelers flying more than 2 times a month. The average travel frequency of air passengers is cal ulated to be 4.5 times per year.

(18)Occupation: Air passengers' occupations in total is composed of 25.8% of company staff, 22.9% of government officials, 17.2% of foreigners, 11.1% of housewives, and 9.7% of company executives. In contrast, the ratio of farmers and workers is as low as 1.9%. However, composition rates differed greatly between airports, and tended toward a similar distribution to that of trip purpose. In addition, Garuda flights are found to carry more company executives and foreigners than other flights, while the proportions of housewives, students, farmers and workers are higher on other flights.

(19)Change of Flight: The majority of passengers (80.6%) took only one flight (through flight) to their destinations. The remaining 19.4% of passengers had to take more than two flights to reach their destinations, resulting in losses of some of their precious time waiting for connecting flights.

(20)Access Mode: Most passengers used land transport modes for access to/from airports; by private cars (36.9%), taxis (38.1%) and buses (20.7%).

3.03.2 Sea Passenger Survey

(21)Sample Size: The total number of sea passengers on board the ships/ ferries during the survey period were 4,354 in total. Out of which, 953 passengers were picked up as samples by the sea passengers survey. As a result, the average sample rate for all the sea routes surveyed is 21.9%.

(22)Trip Purpose: In respect to the trip purpose of sea passengers, it is found that, in total, 36.6% of passengers took ships/ ferries for 'go back home' purpose, followed by 'social' (29.7%), 'business' (15.1%), 'official' (9.0%) and 'tourism' (8.0%).

(23)Travel Frequency: Regarding the travel frequency of sea passengers, 92.0% of passengers took ships/ ferries on the same routes less than 5 times per year. The average travel frequency of sea passengers is calculated to be 4.3 times per year.

(24)Occupation: Sea passengers' occupations is composed of 22.6% of farmers, 17.6% of students, 17.1% of company staff, 13.1% of housewives, and 10.1% of government officials. In contrast, the ratio of foreigners is low at 5.0%.

(25)Access Mode: The access modes taken by sea passengers to/from ports are found that 62.1% of passengers took buses, followed by taxis (18.1%) and ships (10.1%). In contrast, only 6.6% of passengers took private cars.

3.03.3 Comparison of Characteristics between Air and Sea Passengers

(26)Trip Purpose: About 40% of air passengers replied with 'official' and 'business' purposes, and 'go back home' and 'social' purpose also accounted about 40%. On the other hand, about 65% of sea passengers responded that 'go back home' and 'social' was the trip purpose, while 'official' and 'business' purposes accounted for only about 25%. In fact, the distribution of trip purpose for sea passengers is rather similar to that of the non-Garuda passengers.

(27)Travel Frequency: The majority of both air and sea passengers have traveled on the same routes less than 5 times per year, however, air passengers tend to travel more frequently than sea passengers.

(28)Occupation: About 60% of air passengers are government officials and company executives/staff, while about 15% are foreigners. In contrast, the proportion of government officials and company executives/staff is limited to about 30% of the sea passengers, and farmers and workers accounts for about 30%.

(29)Access Mode: The majority of air passengers took taxis and private cars to/from airports, while 60% of sea passengers preferred buses, which are a cheaper transport mode than others.

3.03.4 Opinions for Conceivable New Air Routes

(30)From Passengers: During the course of the air passenger survey, the survey team queried passengers about desired new air routes. As a result, 368 passengers responded with ideas for 204 new air routes. These requests include direct connections, instead of existing through flights or connecting flights, and even completely new air routes to locations without existing airports.

(31)From Regional Officials: The survey team interviewed DGAC regional officers and airport officers for their opinion on the potential new air routes in their jurisdictions. As a result, 26 new air routes are suggested as potential new air routes in the future. In fact, the information obtained both from passengers and regional officials consisted only of personal opinions, including some impossible requests. This information could be used as a reference to verify new air routes to be studied through the traffic demand forecast.

SECTION 4 TRAFFIC DEMAND FORECAST

SECTION 4
TRAFFIC DEMAND FORECAST

4.01 METHODOLOGY

(01)Phasing: The demand forecast of inter-island traffic for all of Indonesia was conducted in two separate phases as defined below:

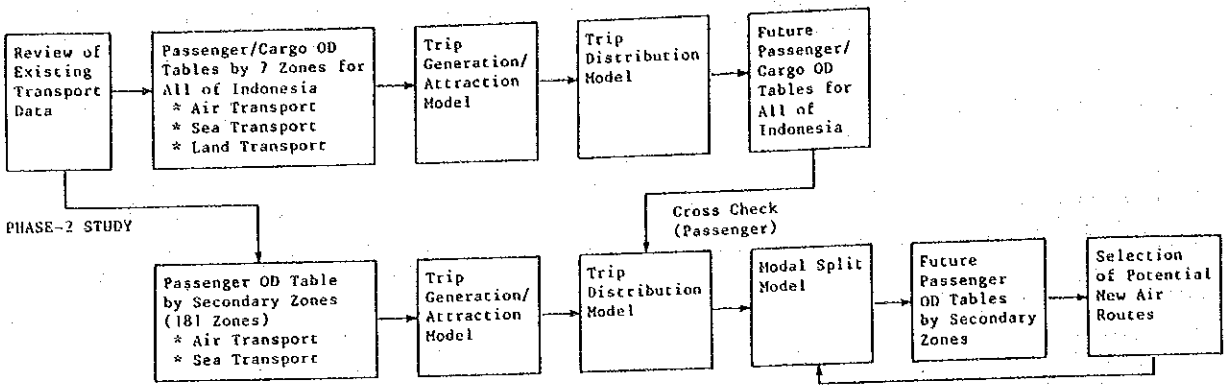
- Phase-1 : Inter-Regional traffic demand forecast
- Phase-2 : Inter-Zonal traffic demand forecast

(02)Definitions: The terms "Regional or Region" and "Zonal or Zone" used herein are defined as follows:

- "Region" refers to a unit area defined by dividing all of Indonesia into 7 unit areas (Primary Zones). Unit areas are represented by one of the seven major islands in Indonesia, i.e. Sumatera, Jawa/Bali, Nusa Tenggara, Kalimantan, Sulawesi, Maluku and Irian Jaya. Thus, "Inter-Regional Traffic" refers to traffic movement between respective Regions.
- "Zone" refers to a unit area defined by dividing all of Indonesia into 181 unit areas (Secondary Zones). A unit zone largely corresponds to the administrative unit of a Kabupaten. Thus, "Inter-Zonal Traffic" refers to the traffic movement between respective Zones.

(03)Relation between Phases: The relationship between the Phase-1 and the Phase-2 studies is illustrated in a flow chart shown in Figure-4.1. The Phase-1 study of the comparatively large 7 zones provided an approximate inter-regional traffic demand volume, combined with the net and gross movements, which was employed as a reference indicator for the subsequent Phase-2 study, by examining the available data. The Phase-2 study of 181 zones determined the inter-zonal traffic demand with sufficient accuracy to allow the identification of specific potential new air routes.

Figure-4.1 Relation Between Phases



(04)Inter-Region Traffic Demand: The inter-regional traffic demand forecast covers three modes of transport, air, sea and land, and was based on existing traffic and socioeconomic data. No substantial traffic survey was conducted in this step.

(05)Inter-Zonal Traffic Demand: The projections for inter-zonal traffic demand were principally based on the results of the actual traffic survey delineated in Section 3 hereinbefore. The daily net movements of air passengers obtained by the air passenger survey was expanded to a yearly basis to provide the present net movement origin/destination (hereafter referred as "OD") table of air passengers. The study mainly focused on air transport and the zonal demand forecast was designed to assess potential new air routes.

(06)Base Year: In considering the availability of data, especially air and sea transport data, 1984 was established as the base year, and the OD data for land transport was calibrated to the base year values. Each demand forecast was made in 10 year intervals from the base year; i.e. 1994 and 2004.

(07)Concerned Authorities: In the course of the Study, concerned authorities summarized in Table-4.1 provided valu-

able data, information and advice in respect to each mode of transport.

Table-4.1 Agencies Concerned with Each Transport Mode

Agency	Transport Mode
Directorate General of Air Communications (DGAC)	Air Transportation
Directorate General of Sea Communications (DGSC)	Sea Transportation Ferry Boats
Directorate General of Land Communications (DGLC)	Railway Ferry Boats Inland Waterway Transport
Directorate General of BINA MARGA (BINA MARGA)	Road
Indonesian State Railways (PJKA)	Railway

4.02 WORK FLOW

(08)Work Flow: As shown in Figure-4.1, the final results of the traffic demand forecast for the Study were obtained by conducting the Phase-2 study, which was supported or verified by the outcomes of the Phase-1 study. Thus, we will mainly focus on the Phase-2 study here. Figure-4.2 presents the work flow for the Phase-2 study, which may be broadly itemized as follows:

- Actual air and sea passenger survey
- Zoning
- Preparation of present air passenger OD table
- Preparation of present sea passenger OD table
- Forecast of future trip generation/attraction volume
- Preparation of future OD table combined with air and sea passenger volume
- Construction of Modal Split Models
- Identifying potential new air routes goes hand in hand with the demand forecast

- Forecast of future air and sea passenger demand
- Sensitivity analysis
- Preparation of present and future air cargo OD tables

The first of these work items, the actual air and sea passenger surveys, was dealt with in the previous Section 3. The other items will be described hereafter.

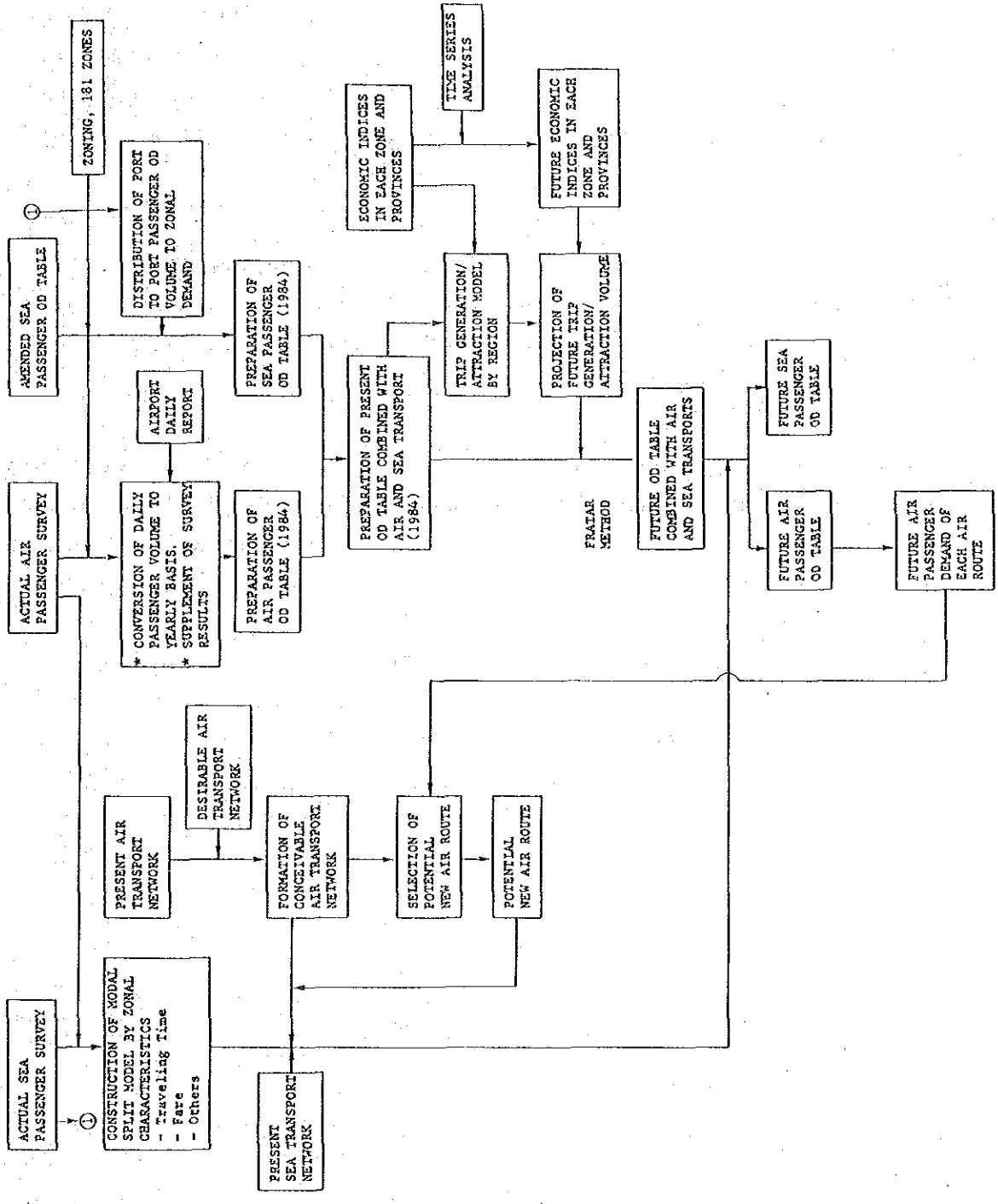


Figure-4.2 Work Flow of the Inter-Zonal Traffic Demand Forecast

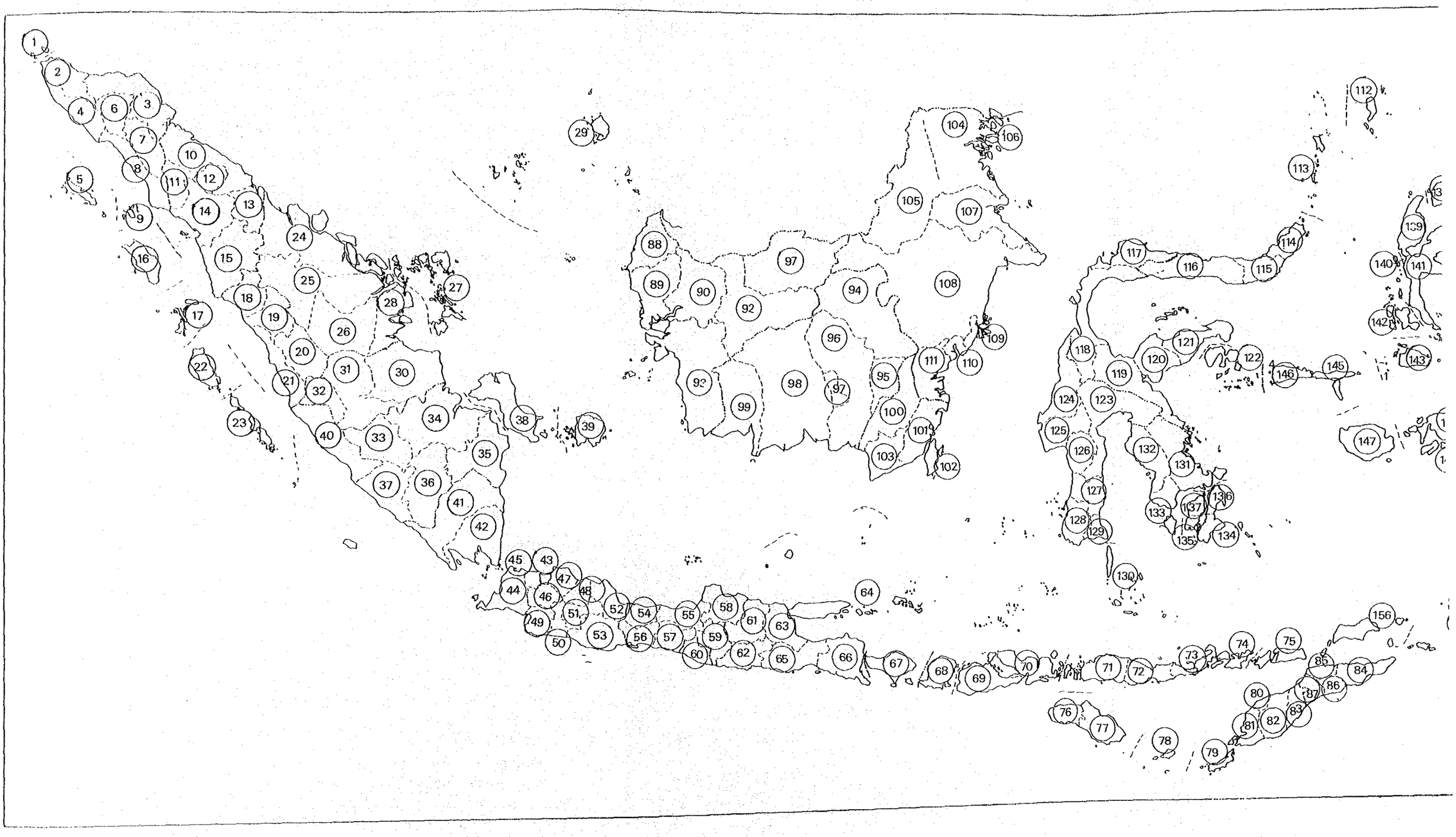
4.03 ZONING

(09)Unit Zone: The whole Indonesia was divided to 181 zones. Basically, a kabupaten is considered as a minimum unit of a zone due to the availability of socioeconomic data. For the final determination of zones, however, three factors were taken into account; i.e., the accessibility to airports, the development potential of zones and the composition of the transport network. Consequently, several kabupatens had to be combined or split in the extreme areas such as Jawa and south Sulawesi, and Irian Jaya, respectively.

(10)Zoning: Figure-4.3 illustrates boundaries of secondary zones applied for the inter-zonal traffic demand forecast, while the number of zones in each region are summarized in Table-4.2.

Table-4.2 Number of Secondary Zones in each Region

Region	No. of Secondary Zone
Sumatera	42
Jawa/Bali	25
Nusa Tenggara	20
Kalimantan	24
Sulawesi	26
Maluku	20
Irian Jaya	24
Total	181
Foreign Countries	1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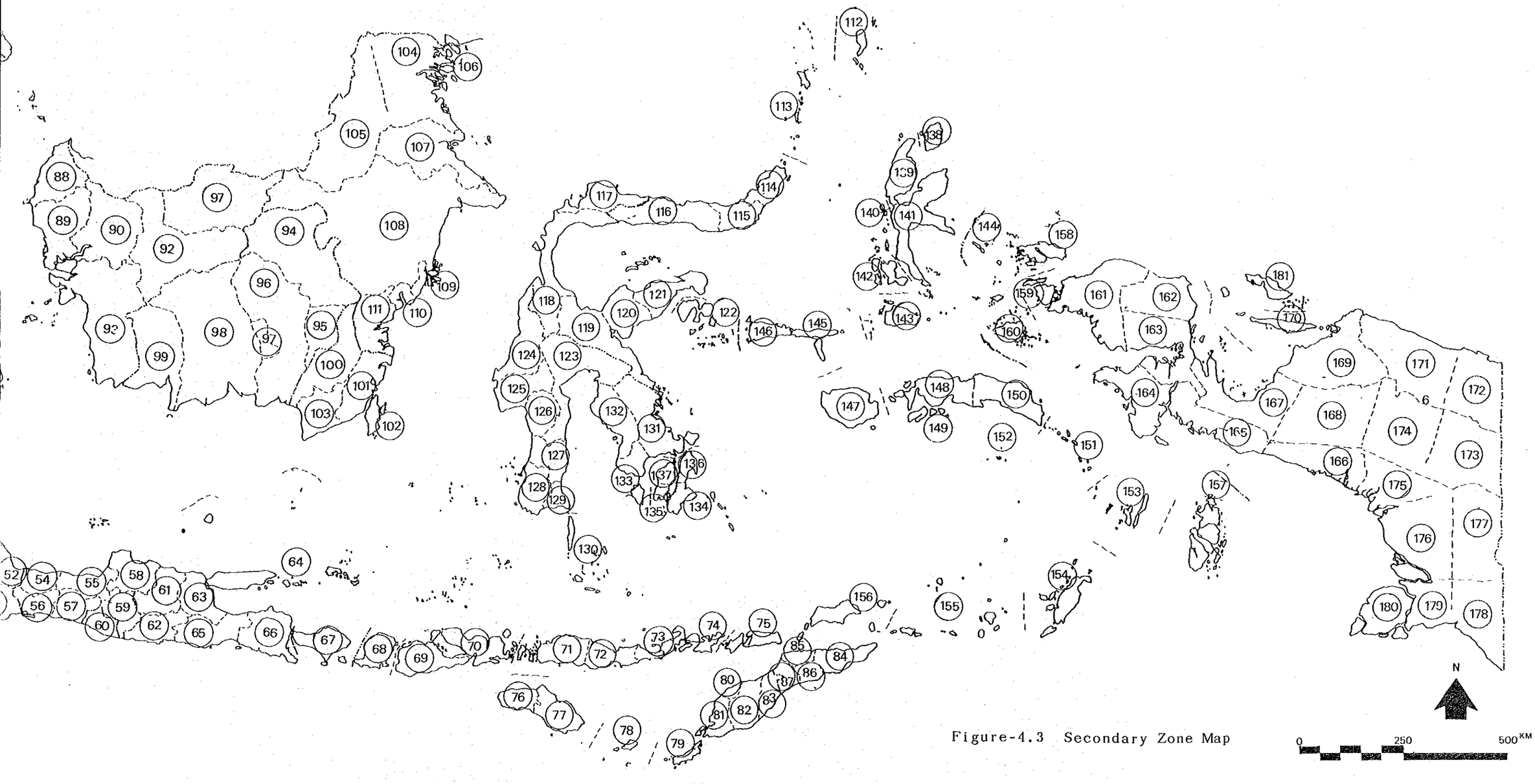


Figure-4.3 Secondary Zone Map

4.04 PRESENT AIR PASSENGER OD TABLE

(11)Key OD Tables: Passengers of more than 80% of all air routes, including most trunk air routes and secondary air routes, were picked up as samples by the survey. Thus, the results of the air passenger survey were considered to be valid and reliable to use as the bases for the present net movement OD Table.

(12)Processing of Surveyed OD Data: The following tasks were required to prepare the present net movement OD table of air passengers based on the results of the air passenger survey:

- Conversion of daily passenger volume to yearly basis.
- Supplement of survey results, mainly for OD pairs not covered by the survey.
- Conversion of the 1987 OD table to 1984 level, in order to keep pace with other transport modes.

(13)Conversion of Daily Passenger Volume to Yearly Basis:
The conversion of daily passenger volume to yearly basis was carried out in three steps.

- Samples of transit passengers were examined in detail, and samples which appeared to have overlap with samples from another airport were deleted from the original data file.
- The daily passenger volume obtained from the air passenger survey conducted at each airport was expanded to weekly passenger volume. In this case, expansion factors were determined individually at each airport for flights to the same direction, under considerations of sample rates of flights, frequencies of flights per week and coverages of flights by the survey.
- These weekly passenger volume data at each airport were converted to 2 months' volume and then to a yearly basis by using expansion factors calculated from the seasonal fluctuations in the number of air passengers at major airports.

(14)Supplementation: Yearly passenger volume data at every airport was then combined to form a tentative net movement OD table based on the survey results. To supplement the OD pair blank not covered by the survey, two kinds of gravity models were constructed, in order to insert reasonable number of passengers. The basic formula of these gravity models is shown below.

$$Tij = K \frac{(Pi * Pj)^X}{Dij^Y}$$

where Tij : Trip distribution between i and j zones
Pi : Population in i zone
Pj : Population in j zone
Dij : Distance between i and j zones
K, X, Y, : Parameters

(15)Conversion of 1987 OD Table to 1984 OD Table:
The formulation of the net movement OD table of air passengers in 1987 was followed by converting it to the 1984 OD table, because most OD data for other transport modes are only available up to year 1984. To carry out this operation, a conversion factor from 1987 OD volume to 1984 OD volume was determined based on the annual growth rate in the number of passengers at 9 major airports between 1984 and 1987.

(16)1984 OD Table: The net movement OD table of air passengers in 1984 was generated by using this conversion factor. Then, in order to verify the reliability of this OD table, it was converted into a gross movement OD table by traffic assignment, and compared with the OD table prepared in the Phase-1 study. Since OD patterns of these two tables were found to be similar, the net movement OD table of air passengers in 1984 was finalized.

(17)Present Air Passenger OD Table: Table-4.3 shows the net movement OD table of air passengers between provinces in 1984. The total net movement demand of air passengers in 1984 was projected as approximately 6,869,000 trips. This table shows that the greatest traffic demand is related to Jakarta (about 25% of the total demand) with major destinations (more than 100,000 trips) such as Jawa Timur (including Surabaya), Sumatera Selatan (including Palembang), Jawa Tengah (including Semarang and Solo), Sumatera Utara (including Medan) and Riau (including Pekanbaru). Other than Jakarta, large traffic demand is related to Jawa Timur (9.8%), Sumatera Selatan (5.9%), Bali (4.8%) and Kalimantan Timur (4.6%) with more than 300,000 trips annually and respectively.

Table-4.3 Present Air Passenger OD Table Between Provinces - 1984

0 0	1 ACEH	2 SUM.UT	3 SUM.BA	4 RIAU	5 JAMBI	6 SUM.SE	7 BENKUL	8 LAMPUN	9 JAKARTA	10 JAW.BA	11 JAW.TE	12 YOGYA	13 JAW.TM	14 BALI	15 NT.BA	16 NT.TM	17 TIM.TM	18 KAL.BA	19 KAL.TE	20 KAL.SE	21 KAL.TM	22 SUL.UT	23 SUL.TE	24 SUL.SE	25 SUL.TR	26 MALUKU	27 IRIAN	TOTAL
ACEH	3375	13153	5001	14199	3043	10571	3114	11551	35652	5635	1568	0	3919	4205	0	0	0	2304	0	3599	180	267	0	289	0	0	0	121625
SUM.UTA	13153	5097	9921	24020	2423	10841	1880	6648	126004	20112	4568	14523	7696	12356	295	0	0	6432	2518	4645	4365	2595	1602	4542	2906	0	0	289142
SUM.BAR	5001	9921	1886	8324	1627	7502	1028	5058	87362	5318	1668	7255	3147	4266	0	0	0	3631	2424	2586	2747	287	735	4505	109	204	0	166591
RIAU	14199	24020	8324	1164	2237	14353	2476	6935	121843	6206	986	2462	3408	4873	0	0	0	1563	1653	3193	663	1214	0	2058	0	0	0	223830
JAMBI	3043	2423	1627	2237	0	9070	0	2887	55644	1178	840	0	2319	1777	0	0	0	1454	0	1536	0	299	0	1010	0	0	0	87344
SUM.SEL	10571	10841	7502	14352	9070	43621	6731	2844	205548	17095	4880	2068	11283	3761	0	0	0	5565	3296	4525	3725	2177	1455	5025	3218	0	347	379500
BENGKUL	3114	1880	1028	2476	0	6731	0	1023	9459	2924	0	0	600	615	0	0	0	459	0	516	0	0	0	342	0	0	0	31167
LAMPUNG	11551	6648	5058	6935	2887	2844	1023	0	38789	3982	0	0	3850	1985	0	0	0	881	0	1032	0	540	0	666	0	0	0	88671
JAKARTA	35652	126004	87362	121843	55644	205548	9459	38789	10113	21720	138365	75606	205756	75195	16865	10871	4104	89179	18474	34988	54309	20566	10235	50178	7778	32182	14672	1571457
JAW.BAR	5635	20112	5318	6206	1178	17095	2924	3982	21720	2735	11945	6428	23809	19325	2081	1740	304	11481	2130	11017	10357	4899	1624	8556	7087	5117	3726	218531
JAW.TEN	1568	4568	1668	986	840	4880	0	0	138365	11945	840	0	13727	6889	1664	1935	2540	5416	3543	9353	12001	3727	0	3761	7087	2323	3143	242769
YOGYA	0	14523	7255	2462	0	2068	0	0	75606	6428	0	0	4709	22489	1663	1012	6562	2328	271	1391	8063	400	306	2239	0	389	3537	163701
JAW.TIM	3917	7696	3147	3408	2319	11282	600	3850	205756	23809	13727	4709	1731	41176	12290	21084	1539	9715	20788	55796	77602	4993	8855	49587	13506	13888	9651	626421
BALI	4205	12356	4266	4873	1777	3761	615	1989	75195	19325	6889	22489	41176	17812	28989	20609	6310	2396	4085	2787	4423	664	4300	44620	5334	6781	5955	355977
NT.BAR	0	299	0	0	0	0	0	0	16865	2081	1664	1663	12290	28989	14899	10640	2090	1113	0	2202	0	981	0	2105	0	0	182	98059
NT.TIM	0	0	0	0	0	0	0	0	10871	1740	1935	1012	21084	20609	10640	53460	11472	3651	348	6648	3108	4628	0	10921	0	1681	0	163808
TIM.TIM	0	0	0	0	0	0	0	0	4104	304	2540	6562	1539	8310	2090	11472	0	874	0	1518	385	1256	0	1889	0	0	0	42843
KAL.BAR	2304	6432	3631	1563	1454	5565	459	881	89179	11481	5416	2328	9715	2396	1113	3651	874	21612	13534	4959	12684	2497	1577	5747	3447	0	0	214499
KAL.TEN	0	2518	2424	1653	0	3296	0	0	18474	2130	3543	271	20788	4085	0	348	0	13534	5224	20910	11824	2374	0	3249	0	0	347	116992
KAL.SEL	3599	4645	2586	3193	1536	4525	516	1032	34988	11017	9353	1391	55796	2787	2202	6648	1518	4959	20910	11932	25058	4597	3993	8581	5033	0	0	232395
KAL.TIM	180	4365	2747	663	0	3725	0	0	54309	10357	12001	8063	77603	4423	0	3108	385	12684	11824	25058	49536	7563	2757	11480	0	851	0	303682
SUL.UTA	267	2595	287	1214	299	2177	0	540	20566	4899	3727	400	4993	664	981	4628	1256	2497	2374	4597	7563	22223	8564	11560	11236	16308	8772	145187
SUL.TEN	0	1602	735	0	0	1455	0	0	10235	1624	0	306	8855	4300	0	0	0	1577	0	3993	2757	8564	21526	19520	11911	3577	1155	103692
SUL.SEL	289	4542	4505	2058	1010	5025	342	666	50178	8556	3761	2239	49589	44620	2105	10921	1889	5747	3249	8581	11480	11560	19520	8122	17363	19439	24639	321995
SUL.TGR	0	2906	109	0	0	3218	0	0	7778	7087	7087	0	13506	5334	0	0	0	3447	0	5033	0	11236	11911	17363	0	4252	371	100638
MALUKU	0	0	204	0	0	0	0	0	32182	5117	2323	389	13888	6781	0	1681	0	0	0	0	851	16308	3577	19439	4252	44990	10697	162679
IRIAN	0	0	0	0	0	347	0	0	14672	3726	3143	3537	9652	5955	182	0	0	0	347	0	0	8772	1155	24639	371	10697	208426	295621
TOTAL	121623	289142	166591	223829	87344	379500	31167	88671	1571457	218531	242769	163701	626428	355977	98059	163808	42843	214499	116992	232395	303681	145187	103692	321993	100638	162679	295620	6868816

4.05 PRESENT SEA PASSENGER OD TABLE

(18)Influence Area of Sea Port: In the Phase-1 study, existing data of sea passenger movements were modified to generate the OD table of sea passengers in 1984. Since this OD table is based mainly on trips between ports, it was necessary to distribute OD volume to zonal demand. These distributions were carried out by each ship type.

(19)Distribution of Passengers: In the case of the RLS, Local, Rakyat and Pioneer ships, projections of zonal demands were based on the zonal distribution of populations in the hinterland of each port. The zonal demands of ferry passengers were projected by a gravity model (shown below) developed from the results of ferry passenger surveys at Merak and Tenau Ports.

$$Tij = K \frac{(Pi \times Pj)^X}{Dij^Y}$$

where Tij : Trip distribution between i and j zones
Pi : Population in i zone
Pj : Population in j zone
Dij : Distance between i and j zones

The projected zonal demands of sea passengers on all ship types were combined to obtain the present OD table of sea passengers.

(20)Present Sea Passenger OD Table: The present sea passenger OD table between provinces in 1984 is given in Table-4.4. The total net movement demand of sea passengers in 1984 is projected as approximately 18,566,000 trips. As clear in this table and figure, the trip distribution volume of sea passengers in Jawa Timur is highest at 40% of the total sea passenger demand in Indonesia, followed by Jawa Barat (14.0%) and Jawa Tengah (11.3%). Most of these passengers are thought to be ferry passengers.

Table-4.4 Present Sea Passenger OD Table Between Provinces - 1984

D O	1 ACEH	2 SUM.UT	3 SUM.BA	4 RIAU	5 JAMBI	6 SUM.SE	7 BENKUL	8 LAMPUN	9 JAKARTA	10 JAW.BA	11 JAW.TE	12 YOGYA	13 JAW.TM	14 BALI	15 NT.BA	16 NT.TM	17 TIM.TM	18 KAL.BA	19 KAL.TE	20 KAL.SE	21 KAL.TM	22 SUL.UT	23 SUL.TE	24 SUL.SE	25 SUL.TR	26 MALUKU	27 IRIAN	TOTAL
ACEH	235034	4171	1408	50	103	0	0	0	13122	67980	46664	5587	50895	0	0	0	0	3	7	66	61	45	100	126	25	18	43	425508
SUM.UTA	4171	32311	4148	7787	295	956	0	4	61773	250488	141483	17619	155206	26	315	0	0	297	36	345	529	959	512	926	122	110	223	680641
SUM.BAR	1408	4148	6837	0	101	2073	1439	0	35244	123421	57276	6824	61063	0	0	0	0	0	8	62	405	111	640	2993	116	573	0	304742
RIAU	50	7787	0	34877	858	5097	0	0	24514	90354	50098	5740	52051	18	2	35	6	356	4	39	4105	4	9	333	22	218	0	276577
JAMBI	103	295	101	858	1291	9096	104	16	12649	54388	35169	4154	36518	22	0	0	0	0	1	5	194	9	47	220	9	42	0	155291
SUM.SEL	0	956	2073	5098	9096	52091	38	5956	40134	157975	97193	11292	103042	1075	789	0	0	533	114	0	1295	538	0	129	0	0	56	489473
BENGKUL	0	0	1439	0	104	38	0	0	4896	25675	18569	2211	18923	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71855
LAMPUNG	0	4	0	0	16	5956	0	0	28455	141514	91574	10762	90628	0	0	0	0	19	0	0	0	0	0	0	0	0	0	368928
JAKARTA	13122	61773	35244	24514	12649	40134	4896	28455	62	126	275	2	220775	44689	3	77	15	9466	362	1558	5621	6369	394	31987	893	1554	1009	546024
JAW.BAR	67980	250488	123421	90354	54388	157975	25675	141514	126	586	30808	5	1254588	251934	7	203	44	19300	1032	4461	11935	18396	1730	75183	3857	6337	4118	2596445
JAW.TEN	46664	141483	57276	50098	35169	97193	18569	91574	275	30808	349	29	1244381	235962	145	89	17	14696	4906	5112	4829	1707	2942	7509	1765	2848	2534	2098929
YOGYA	5587	17619	6824	5740	4154	11292	2211	10762	2	5	29	0	153649	29351	0	0	0	0	35	11	0	0	18	2	0	0	0	247291
JAW.TIM	50897	155206	61063	52051	36518	103043	18923	90628	220775	1254588	1244381	153649	3429579	480817	4556	11939	2252	1323	8915	42469	46101	14264	11523	50896	7674	15435	12761	7582226
BALI	0	26	0	18	22	1075	0	0	44689	251934	235962	29351	480817	0	122961	14	3	0	106	1249	1829	0	550	1291	1223	24	3	1173147
NT.BAR	0	315	0	2	0	789	0	0	3	7	145	0	4556	122961	232395	6260	106	50	65	268	128	0	0	578	16	321	71	369036
NT.TIM	0	0	0	35	0	0	0	0	77	203	89	0	11939	14	6260	18384	708	28	14	16	0	0	0	1934	0	629	53	40383
TIM.TIM	0	0	0	6	0	0	0	0	15	44	17	0	2252	3	106	708	95	6	2	4	0	0	0	933	0	4	8	4203
KAL.BAR	3	297	0	356	0	533	0	0	9466	19300	14696	0	1323	0	50	28	6	2574	143	42	23	17	0	11	0	735	0	49603
KAL.TEN	7	36	8	4	1	114	0	0	362	1032	4906	35	8915	106	65	14	2	143	2052	2113	850	378	121	1864	60	76	3	23267
KAL.SEL	66	345	62	39	5	0	0	19	1558	4461	5112	11	42469	1249	268	16	4	42	2113	948	1330	3488	1122	9820	556	1168	37	76308
KAL.TIM	61	529	405	4105	194	1295	0	0	5621	11935	4829	0	46100	1829	128	0	0	23	850	1330	17326	10485	2845	45384	1830	0	0	157104
SUL.UTA	45	959	111	4	9	538	0	0	6369	18396	1707	0	14264	0	0	0	0	17	378	3488	10485	11189	5757	14547	690	7854	7326	104133
SUL.TEN	100	512	640	9	47	0	0	0	394	1730	2942	18	11523	550	0	0	0	0	121	1122	2845	5757	1485	5670	400	43	0	35908
SUL.SEL	126	926	2993	333	220	129	0	0	31987	75183	7509	2	50894	1291	578	1934	933	11	1864	9820	45384	14547	5670	134393	8788	14109	14217	423841
SUL.TGR	25	122	116	22	9	0	0	0	893	3857	1765	0	7674	1223	16	0	0	0	60	556	1830	690	400	8788	726	14884	3604	47260
MALUKU	18	110	573	218	42	0	0	0	1554	6337	2848	0	15435	24	321	629	4	735	76	1168	0	7854	43	14109	14884	38214	11157	116353
IRIAN	43	223	0	0	0	56	0	0	1009	4118	2534	0	12760	3	71	53	8	0	3	37	0	7326	0	14217	3604	11157	43812	101034
TOTAL	425510	680641	304742	276578	155291	489473	71855	368928	546024	2596445	2098929	247291	7582219	1173147	369036	40383	4203	49622	23267	76289	157105	104133	35908	423843	47260	116353	101035	18565510

4.06 FORMATION OF FUTURE OD TABLE COMBINED WITH AIR AND SEA PASSENGERS

(21)Combined Air and Sea Passenger OD Table: The generated present air and sea passenger OD tables were combined in order to forecast the future OD volume of air and sea passengers.

(22)Forecast of Future Trip Generation/Attraction Volume: In order to forecast the future trip generation/ attraction volume, it is necessary to consider various future economic indices in each zone. However, the current economic indices in each zone could not be obtained, except population. Therefore, the following procedure was adopted to ensure the reliability of the forecast demand of each zone:

- To project future economic indices in provinces and population in zones.
- To project trip demand in provinces.
- To project trip demand in zones.
- To finalize trip demand in zones by using demand in provinces as control totals.

Future economic indices were projected by using a moderate annual growth rate of GDP, i.e. 5% from 1989.

(23)Correlation Analysis: Correlational analyses were then performed between traffic demand and economic indices in provinces, and multiple regression models were constructed in order to project the future trip generation/attraction volume in each province. By using these multiple regression models, trip generation/attraction volume in each province was projected. These projected demands were used as control totals of projected demand by zone. Another correlational analysis was carried out between traffic demand and population in each zone, and several types of regression models were developed with population as an explanatory variable.

(24)Model for Projection of Traffic Demand in Provinces:

The model formulae developed for the projection of traffic demand in provinces are shown below. The results of this projection were utilized as control totals of zonal demands projected by the above mentioned formula.

- Model for provinces with large population cities

$$Y = 0.81211E\text{-}01 + 0.54778\ X1 + 0.034269\ X2 \qquad (R = 0.99)$$

where,

Y : Passenger demand in each province (person)

X1 : Total number of workers in each province (person)

X2 : Total GRDP in each province (mill. Rp.)

- Model for other provinces

$$Y = 0.10498E\text{-}06 + 49.299\ X1 + 0.02675\ X2 + 0.66508\ X3 \qquad (R = 0.987)$$

Y : Passenger demand in each province (person)

X1 : Population in each province (person)

X2 : Total number of workers in each province (person)

X3 : GRDP of tertiary industry in each province (mill. Rp.)

(25)Model for Projection of Traffic Demand in Zones:

The following linear model formulae are trip generation/attraction models developed to project the future zonal traffic demands based on population in each zone. Projected zonal trip generation/attraction demands were amended and finalized using the demands in provinces as control totals.

- Model for zones in Sumatera

$$Y = 0.09706 * X + 26018.489 \qquad (R = 0.890)$$

- Model for zones in Jawa/Bali

$$Y = 0.08637 * X + 37740.132 \qquad (R = 0.904)$$

- Model for zones in other regions

$$Y = 0.13769 * X + 2025.270 \qquad (R = 0.730)$$

where,

Y : Traffic demand in each region (person)

X : Population in each region (person)

(26)Total Trips: The future traffic demand of air and sea passengers are projected as approximately 42,455,000 trips by the year 2004. Traffic demand in year 1994 is also projected as approximately 32,750,000 trips. The future passenger OD table combined with air and sea transport were then formulated by the Frater method (the present pattern method).

4.07 CONSTRUCTION OF MODAL SPLIT MODEL

(27)Selection of Model: The present and future OD tables produced in the Study are based on different sources of data; i.e., field traffic survey results for the air passenger OD table, and existing data for the sea passenger OD table. Therefore, the utilization of a popular aggregate behavioral model as a modal split model may result in modal split differences between the actual situation and the forecast situation. To overcome this problem, a disaggregate behavioral model was used as a modal split model in the Study. The details of this disaggregate behavioral model is described in the Section 3 of the Study Report Part I.

(28)Modal Split Model: Three types of modal split models were generated in the Study; i.e., a Sumatera and Jawa/Bali regions model, an intra-region model other than these two regions, and an inter-region model other than between Sumatera and Jawa/Bali. The basic model formulae of the disaggregate behavioral model are presented below, while parameters of each type of model are summarized in Table-4.5.

$$Pn(i) = \frac{1}{1 + e^{Vjn - Vin}}$$

$$Vin = A * Xin + B * Yin + C$$

$$Vjn = A * Xjn + B * Yjn$$

where,

Pn(i) : Choice probability of air transport

e : Exponential

Xin : Travel time by air transport

Yin : Travel cost by air transport

Xjn : Travel time by sea transport

Yjn : Travel cost by sea transport

A, B, C : Parameters

Table-4.5 Parameter of Modal Split Models

Type of Model	Parameters			Goodness-of-Fit Measure
	A	B	C	
Jawa/Bali Sumatera Model	-0.13948E-02	-0.12064E-05	-0.25724	0.229
Intra-Region Model	-0.2573187E-02	-0.1879735E-04	-0.3943310	0.2752
Inter-Region Model	-0.2652544E-02	-0.8245695E-05	-0.4862035E+01	0.4769

4.08 FORECAST OF FUTURE AIR AND SEA PASSENGER DEMAND

(29)Methodology: The main objective of the Study is to forecast the future air transport demand under conditions of competition with sea transport. In the Study, it was necessary to conduct future traffic demand forecast of air and sea passengers in parallel with the selection of potential new air routes, since openings of new air routes will generate new air passenger demands. The details of selection of potential new air routes is described in the following Section 5.

(30)Future Air and Sea Passenger Demand: Table-4.6 summarizes the future traffic demand of air and sea passenger movements and the expected modal split between air and sea transports. The air passenger demands in 1994 and 2004 are expected to be 8,953,000 trips and 12,060,000 trips, respectively, while the expected annual growth rate of air passengers is 2.8%. In addition, the share of the air transport is expected to be increased from 27.0% in 1984 to 28.1% in 2004. The future net movement OD tables of air and sea passengers are shown in Tables-4.7 and 4.8.

Table-4.6 Future Traffic Demand of Air and Sea Passenger

Year	Total Demand			Excluding Ujng-Kamal Ferry Pax.		
	Air Passengers	Sea Passengers	Total	Air Passengers	Sea Passengers	Total
1984	6,869 (27.0%)	18,566 (73.0%)	25,435 (100.0%)	6,869 (33.3%)	13,729 (66.7%)	20,598 (100.0%)
1994	8,953 (27.3%)	23,794 (72.7%)	32,747 (100.0%)	8,953 (33.8%)	17,534 (66.2%)	26,487 (100.0%)
2004	12,060 (28.1%)	30,848 (71.9%)	42,908 (100.0%)	12,060 (34.7%)	22,739 (65.3%)	34,799 (100.0%)

Note : Figures in ( ) are Modal Splits

Table-4.7 Future Air Passenger OD Table between Provinces - 2004

O	1 ACEH	2 SUM.UT	3 SUM.BA	4 RIAU	5 JAMBI	6 SUM.SE	7 BENKUL	8 LAMPUN	9 JAKARTA	10 JAW.BA	11 JAW.TE	12 YOGYA	13 JAW.TM	14 BALI	15 NT.BA	16 NT.TM	17 TIM.TM	18 KAL.BA	19 KAL.TE	20 KAL.SE	21 KAL.TM	22 SUL.UT	23 SUL.TE	24 SUL.SE	25 SUL.TR	26 MALUKU	27 IRIAN	TOTAL
ACEH	4153	17025	6269	18082	3531	14379	3376	14323	49479	7535	2013	0	4984	4661	0	0	0	2713	0	4975	236	334	0	308	0	0	0	158376
SUM.UTA	17025	6979	13299	32340	2987	15571	2156	8716	186501	27648	6208	20223	11107	14491	387	0	0	8058	3079	6787	6191	3582	1907	5244	3320	0	0	403806
SUM.BAR	6269	13299	2416	10860	1927	10436	1141	6423	123525	7116	2182	9166	4228	4844	0	0	0	4383	2872	3654	3780	348	846	5064	119	236	0	225136
RIAU	18082	32340	10860	1542	2805	22326	2794	8947	183398	8399	1318	3237	4739	5644	0	0	0	1902	1990	4587	926	1576	0	2346	0	0	0	319758
JAMBI	3531	2987	1927	2805	0	12339	0	3399	73718	1380	1025	0	3259	1875	0	0	0	1628	0	2017	0	349	0	1078	0	0	0	113317
SUM.SEL	14379	15971	10438	22326	12339	65860	8106	3916	315862	24741	6830	2708	15692	4644	0	0	0	7333	4227	6958	5570	3131	1828	6117	3885	0	442	562903
BENGKUL	3376	2156	1141	2794	0	8106	0	1123	11550	3269	0	0	667	604	0	0	0	479	0	633	0	0	0	332	0	0	0	36230
LAMPUNG	14323	8716	6423	8947	3399	3915	1123	0	55053	5362	0	0	5174	2229	0	0	0	1042	0	1447	0	683	0	739	0	0	0	118575
JAKARTA	49479	186501	123525	183398	73718	315862	11550	55053	15699	31804	200199	102688	290655	93862	23029	11550	3203	119639	24097	54524	83131	30342	13030	61922	9509	41601	19678	2229248
JAW.BAR	7535	27648	7116	8399	1380	24741	3269	5362	31804	3686	16339	8235	31794	23665	2673	1655	204	14686	2575	16168	14942	7626	1935	9967	8125	6344	4706	292579
JAW.TEN	2013	6208	2182	1318	1025	6830	0	0	200199	16339	1116	0	18089	8015	2109	1876	1840	6701	4297	13688	16946	4840	0	4211	8055	2725	3838	334460
YOGYA	0	20223	9166	3237	0	2708	0	0	102688	8235	0	0	5823	24560	1987	941	4481	2704	306	1893	10706	492	340	2418	0	436	4136	207482
JAW.TIM	4982	11107	4228	4739	3259	15691	667	5174	290655	31794	18089	5823	2225	49878	15291	20247	1088	11922	24719	79313	107862	6596	10204	56583	15217	16063	12071	825487
BALI	4661	14491	4844	5644	1875	4644	604	2229	93862	23665	8015	24560	49878	17876	31816	17596	5212	2559	4283	3492	5422	750	4402	44295	5242	7009	6397	395323
NT.BAR	0	387	0	0	0	0	0	0	23029	2673	2109	1987	15291	31816	17837	9887	1428	1291	0	3004	0	1210	0	2268	0	0	202	114419
NT.TIM	0	0	0	0	0	0	0	0	11550	1655	1876	941	20247	17596	9887	38480	6076	3308	300	7079	3229	4441	0	9194	0	1462	0	137321
TIM.TIM	0	0	0	0	0	0	0	0	3203	204	1840	4481	1088	5212	1428	6076	0	580	0	1188	294	886	0	1168	0	0	0	27648
KAL.BAR	2713	8058	4383	1902	1628	7333	479	1042	119639	14686	6701	2704	11922	2559	1291	3308	580	24594	15086	6598	16457	2994	1718	6064	3605	0	0	268044
KAL.TEN	0	3079	2872	1990	0	4227	0	0	24097	2575	4297	306	24719	4283	0	300	0	15086	5706	27368	15036	2799	0	3351	0	0	387	142478
KAL.SEL	4975	6787	3654	4587	2017	6958	633	1447	54524	16168	13688	1893	79313	3492	3004	7079	1188	6598	27368	18650	38148	6481	5095	10631	6177	0	0	330555
KAL.TIM	236	6191	3781	926	0	5570	0	0	83131	14942	16946	10706	107864	5422	0	3229	294	16457	15036	38148	73446	10379	3419	13775	0	1070	0	430968
SUL.UTA	334	3582	348	1576	349	3131	0	683	30342	7626	4840	492	6597	750	1210	4441	886	2994	2799	6481	10379	28237	9850	12857	12426	18947	10513	182670
SUL.TEN	0	1907	846	0	0	1828	0	0	13030	1935	0	340	10204	4402	0	0	0	1718	0	5095	3419	9850	22432	19610	11929	3739	1263	113547
SUL.SEL	308	5244	5064	2346	1078	6117	332	739	61922	9967	4211	2418	56585	44295	2268	9194	1168	6064	3351	10631	13775	12857	19610	7978	16857	19825	25980	350184
SUL.TGR	0	3320	119	0	0	3885	0	0	9509	8125	8055	0	15217	5242	0	0	0	3605	0	6177	0	12426	11929	16857	0	4294	381	109141
MALUKU	0	0	236	0	0	0	0	0	41601	6344	2725	438	16064	7009	0	1462	0	0	0	0	1070	18947	3739	19825	4294	47698	11788	183240
IRIAN	0	0	0	0	0	442	0	0	19678	4706	3838	4136	12072	6397	202	0	0	0	387	0	0	10513	1263	25980	381	11789	238537	340321
TOTAL	158374	403806	225137	319758	113317	562901	36230	118576	2229248	292579	334460	207482	825497	395323	114419	137321	27648	268044	142478	330555	430965	182669	113547	350182	109141	183240	340319	8953216

Table-4.8 Future Sea Passenger OD Table between Provinces - 2004

D O	1 ACEH	2 SUM.UT	3 SUM.BA	4 RIAU	5 JAMBI	6 SUM.SE	7 BENKUL	8 LAMPUN	9 JAKARTA	10 JAW.BA	11 JAW.TE	12 YOGYA	13 JAW.TM	14 BALI	15 NT.BA	16 NT.TM	17 TIM.TM	18 KAL.BA	19 KAL.TE	20 KAL.SE	21 KAL.TM	22 SUL.UT	23 SUL.TE	24 SUL.SE	25 SUL.TR	26 MALUKU	27 IRIAN	TOTAL
ACEH	5203	22442	8069	23505	4161	19829	3710	17819	65911	10107	2552	0	6561	5376	0	0	0	3486	0	6377	322	428	0	396	0	0	0	206254
SUM.UTA	22442	9679	17999	44196	3700	22579	2492	11404	261259	39902	8122	25765	15323	17577	534	0	0	10896	4014	9181	8925	4833	2457	7112	3870	0	0	554261
SUM.BAR	8069	17999	3194	14493	2331	14812	1288	8205	168974	9947	2939	11616	5480	5737	0	0	0	5787	3652	4814	5299	458	1065	6694	135	305	0	303293
RIAU	23505	44196	14493	2080	3425	31904	3182	11540	253285	11681	1792	4142	6172	6750	0	0	0	2535	2596	6098	1310	2097	0	3134	0	0	0	435877
JAMBI	4161	3700	2331	3425	0	15986	0	3972	92276	1739	1263	0	3849	2031	0	0	0	1967	0	2432	0	421	0	1306	0	0	0	140859
SUM.SEL	19829	22579	14812	31904	15986	99872	9794	5356	463206	37217	9849	3676	22035	5896	0	0	0	10370	5761	9816	8398	4421	2465	8670	4728	0	609	817244
BENGKUL	3710	2492	1288	3182	0	9794	0	1225	13484	3843	0	0	734	610	0	0	0	540	0	711	0	0	0	375	0	0	0	41988
LAMPUNG	17819	11404	8205	11540	3972	5356	1225	0	72766	7134	0	0	6451	2551	0	0	0	1329	0	1841	0	869	0	946	0	0	0	153408
JAKARTA	65911	261259	168974	253285	92276	463206	13484	72766	22221	45319	278805	134636	388024	115013	30713	15050	3753	163434	31719	74424	120768	41371	16956	84739	11231	55971	26164	3051472
JAW.BAR	10107	39902	9947	11681	1739	37212	3843	7134	45319	5287	22900	10869	42788	29397	3585	2170	240	20427	3413	22246	21837	10810	2534	14025	9641	8660	6422	404135
JAW.TEN	2552	8122	2939	1792	1263	9849	0	0	278805	22900	1529	0	23758	9661	2764	2402	2119	9007	5567	18349	24292	6633	0	5669	9384	3585	5019	457960
YOGYA	0	25765	11616	4142	0	3676	0	0	134636	10869	0	0	7200	27874	2453	1135	4862	3422	373	2388	14383	621	414	3065	0	542	5091	264527
JAW.TIM	6558	15323	5480	6172	3849	22033	734	6451	388024	42788	23758	7200	2802	124431	19239	24711	1323	15356	30693	102895	149327	8582	12587	73114	17251	20869	15329	1146879
BALI	5376	17577	5737	6750	2031	5895	610	2551	115013	29397	9661	27874	124431	18959	36687	19827	5283	3025	4884	4172	6902	885	4957	52460	5159	8113	7358	531574
NT.BAR	0	534	0	0	0	0	0	0	30713	3585	2764	2453	19239	36687	22272	12063	1568	1663	0	3854	0	1553	0	2919	0	0	252	142119
NT.TIM	0	0	0	0	0	0	0	0	15050	2170	2402	1135	24711	19827	12063	45880	6521	4171	363	8877	4312	5570	0	11566	0	1795	0	166413
TIM.TIM	0	0	0	0	0	0	0	0	3753	240	2119	4862	1323	5283	1568	6521	0	659	0	1340	353	993	0	1321	0	0	0	30340
KAL.BAR	3486	10896	5787	2535	1967	10370	540	1329	163434	20427	9007	3422	15357	3025	1663	4171	659	32420	19169	8674	23034	3939	2157	8013	4092	0	0	359573
KAL.TEN	0	4014	3652	2556	0	5761	0	0	31719	3413	5567	373	30693	4884	0	363	0	19169	6988	34690	20345	3548	0	4268	0	0	478	182481
KAL.SEL	6377	9181	4814	6098	2432	9816	711	1841	74424	22246	18349	2388	102895	4172	3854	8877	1340	8674	34690	24458	53263	8722	6383	14187	6988	0	0	437180
KAL.TIM	322	8925	5299	1310	0	8398	0	0	120768	21837	24292	14383	149329	6902	0	4312	353	23034	20345	53263	107018	14573	4559	19164	0	1467	0	609853
SUL.UTA	428	4833	458	2097	421	4421	0	869	41371	10810	6633	621	8583	885	1553	9570	998	3939	3547	8722	14573	37077	12342	16940	14066	25570	13450	240777
SUL.TEN	0	2457	1065	0	0	2465	0	0	16956	2534	0	414	12587	4957	0	0	0	2157	0	6383	4559	12342	26812	24662	12880	4592	1542	139364
SUL.SEL	396	7113	6694	3134	1306	8670	375	946	84739	14025	5669	3065	73118	52460	2919	11566	1321	8013	4268	14187	19164	16940	24662	10552	19145	25753	33395	453595
SUL.TGR	0	3870	135	0	0	4728	0	0	11231	9641	9384	0	17251	5199	0	0	0	4092	0	6988	0	14066	12880	19145	0	4767	419	123756
MALUKU	0	0	305	0	0	0	0	0	55971	8660	3585	542	20871	8113	0	1795	0	0	0	0	1467	25570	4592	25753	4767	60474	14783	237248
IRIAN	0	0	0	0	0	609	0	0	26164	6422	5019	5091	15330	7358	252	0	0	0	478	0	0	13450	1542	33395	419	14784	297168	427481
TOTAL	206251	554262	303293	435877	140859	817241	41988	153408	3051472	404135	457960	264527	1146895	531575	142119	166413	30340	359572	182480	437180	609851	240777	139364	453590	123756	237247	427479	12059911

(31)Desire Line of Air Passenger Demand: Figure-4.4 illustrates the future desire lines of air passenger demand between provinces in the year 2004. Strong desire lines can be observed for intra-region OD pairs of the Jawa/Bali region, and inter-region OD pairs between Jawa/Bali, and Sumatera and Kalimantan. Although about 74% of traffic demand of air passengers will still be related to Jawa and Sumatera, traffic demands in other regions will gradually increase, especially in Sulawesi and Maluku. The future zonal traffic demands for each region in 2004 are illustrated in Figures-4.5 to 4.11. The major findings from these figures by region are as follows:

- Sumatera :

  The majority of demand in Sumatera is inter-region traffic with Jawa. Most of intra-region traffic demands are limited, except Medan- Pekanbaru and Palembang-Jambi pairs.

- Jawa/Bali :

  There are very strong desire line for inter-region traffic demands with Sumatera. Jakarta-Surabaya, Jakarta-Yogyakarta, Jakarta-Semarang and Jakarta-Bali pairs have high intra-region traffic demand.

- Nusa Tenggara :

  The majority of demand in Nusa Tenggara is concentrated on inter-region traffic with Jawa/Bali to/from Mataram and Kupang, while inter-region traffic demands are limited.

- Kalimantan :

  Balikpapan-Tarakan, Balikpapan-Banjarmasin, Balikpapan-Samarinda and Banjarmasin-Kotabaru pairs have high intra-region traffic demands, however the majority passenger trips are related to inter-region traffic with Jawa/Bali.

- Sulawesi :

  Strong desire lines can be observed for Ujung Pandang-Jawa/Bali, followed by Manado-Jawa/Bali, Ujung Pandang-Kalimantan, Kendari-Jawa/Bali, Ujung Pandang-

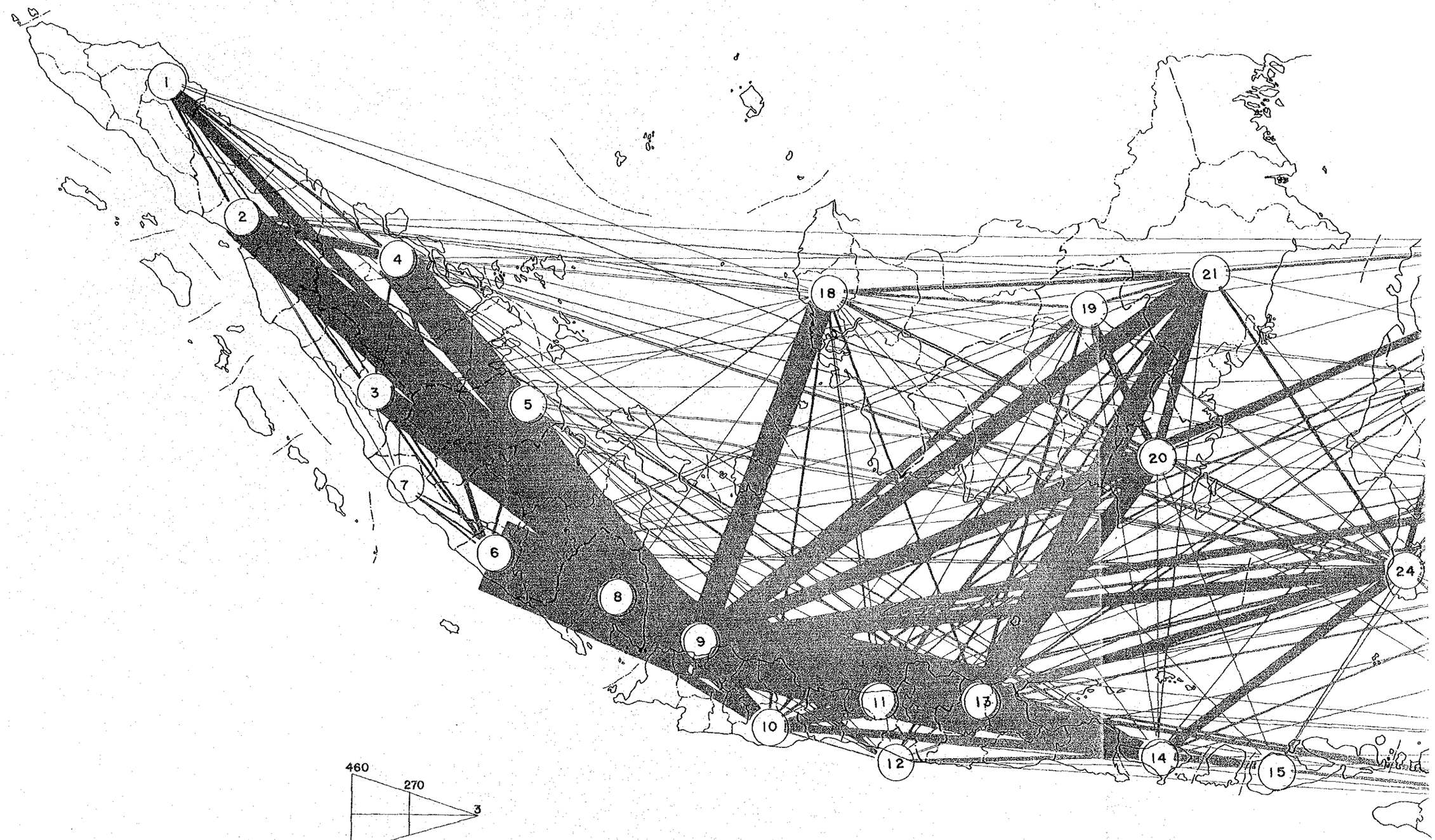
Sumatera.

- Maluku :

  Ambon-Ternate and Ambon-Mangole are relatively high demand OD pairs in this region, however, the majority of passenger trips are related to Jawa/Bali.

- Irian Jaya :

  Strong desire lines for intra-region traffic demands appear for Jayapura-Wamena and Jayapura-Biak pairs, followed by Biak-Timika, Jayapura-Merauke, Biak-Sorong and Biak-Nabire pairs.



Unit : 1,000 Trips

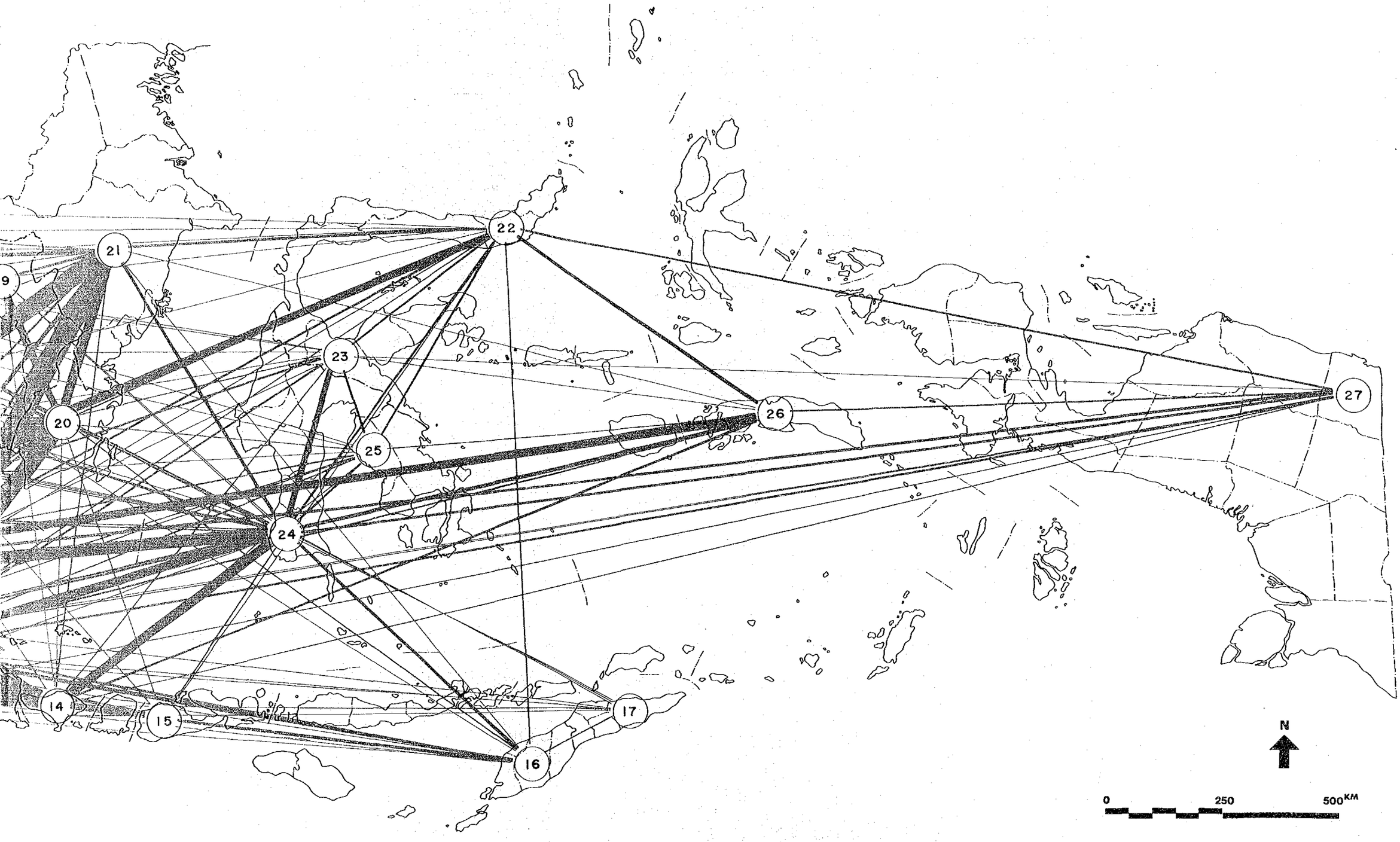


Figure-4.4 Future Desire Line of Air Passenger Demand Between Provinces - 2004

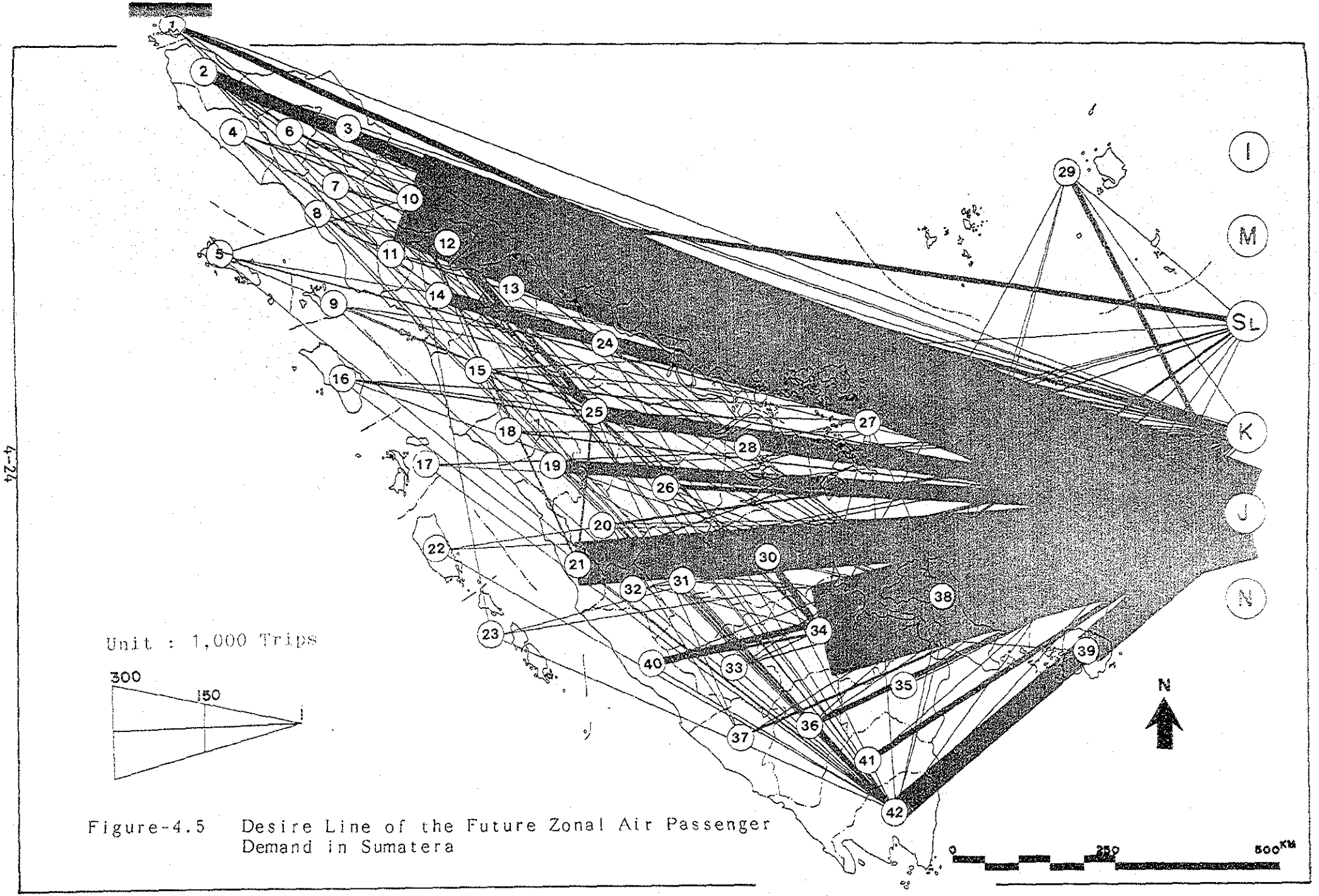


Figure-4.5 Desire Line of the Future Zonal Air Passenger Demand in Sumatera

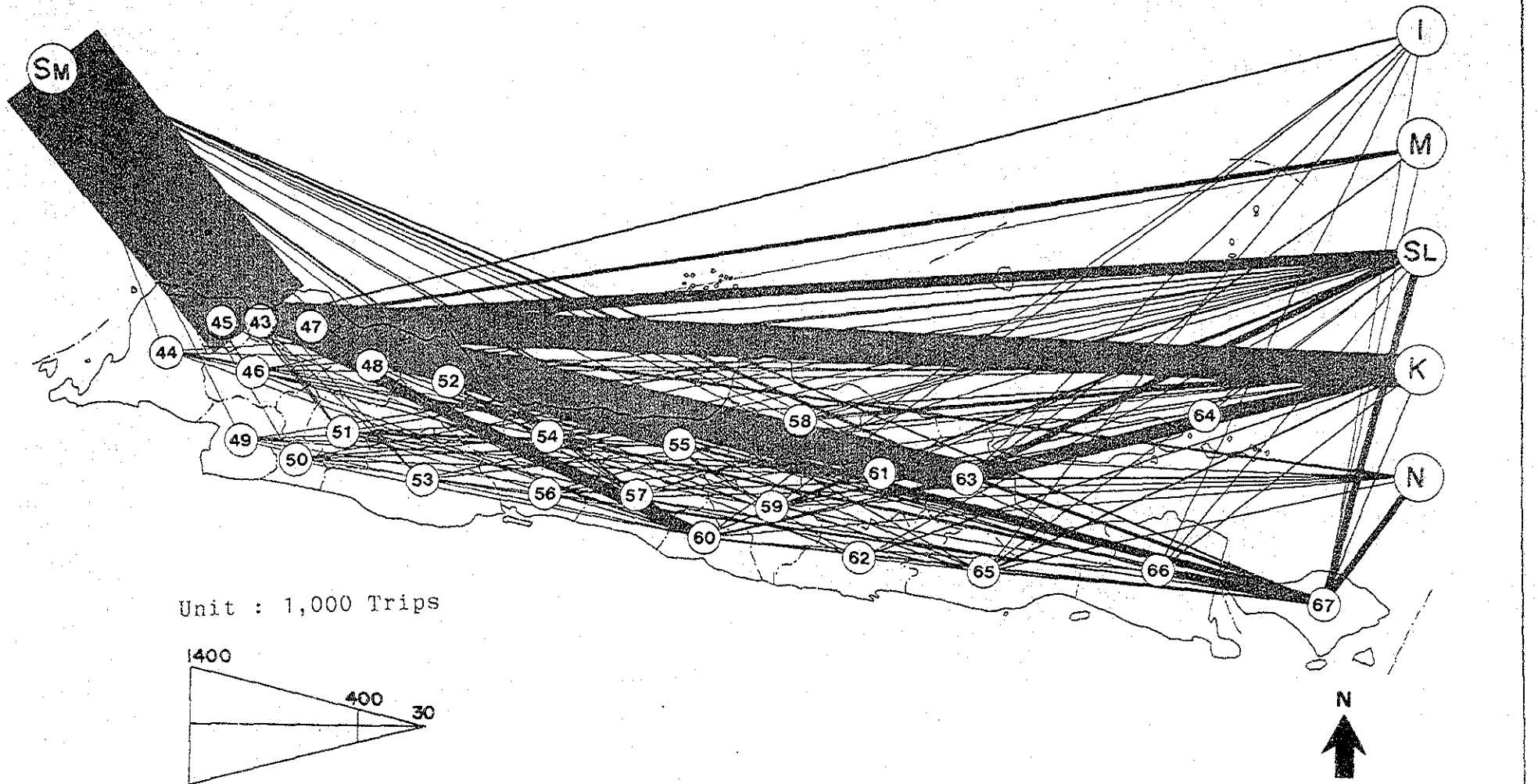
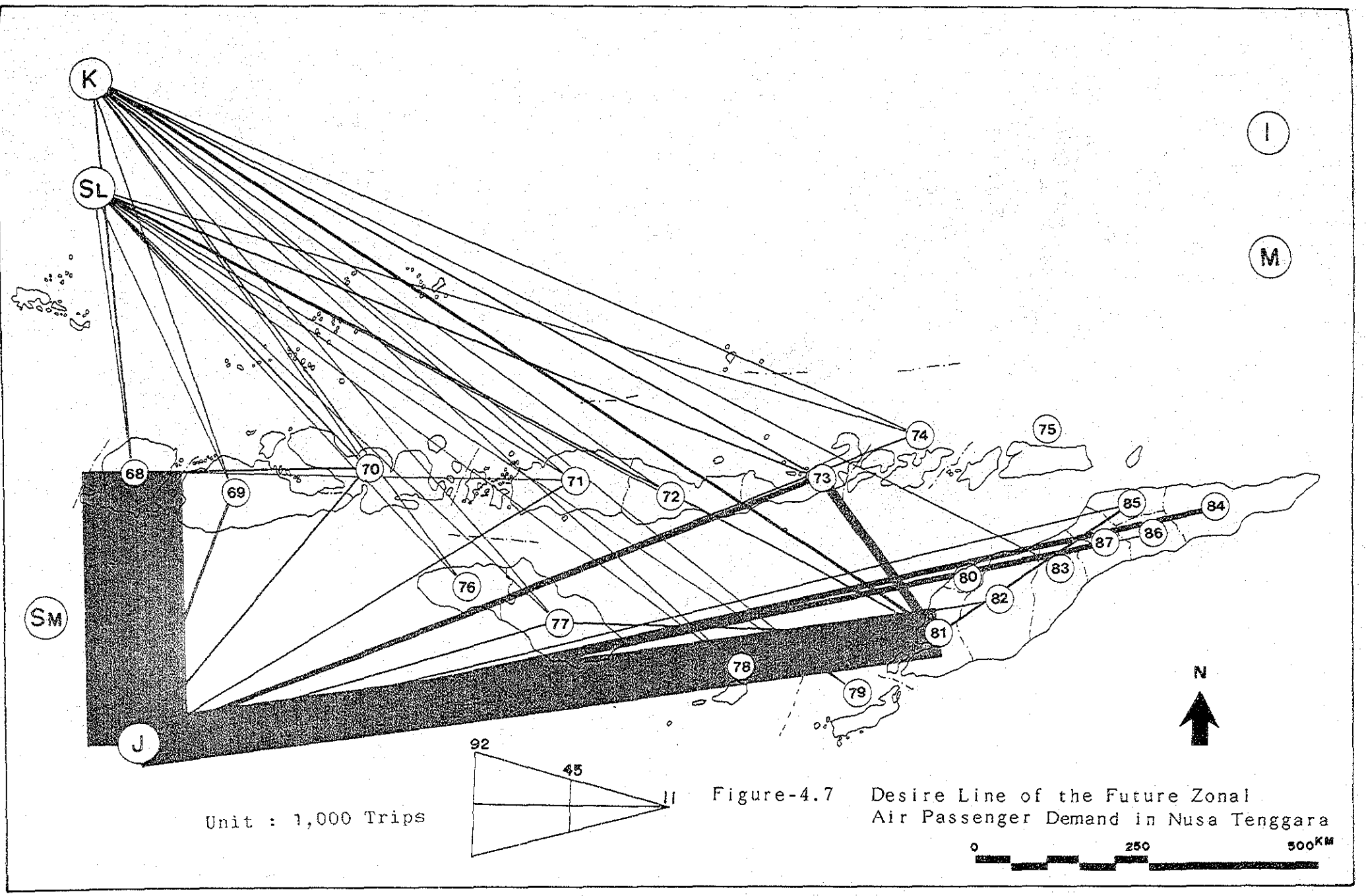


Figure-4.6 Desire Line of the Future Zonal Air Passenger Demand in Jawa/Bali



Unit : 1,000 Trips

Figure-4.7 Desire Line of the Future Zonal Air Passenger Demand in Nusa Tenggara

Figure-4.8 Desire Line of the Future Zonal Air Passenger Demand in Kalimantan

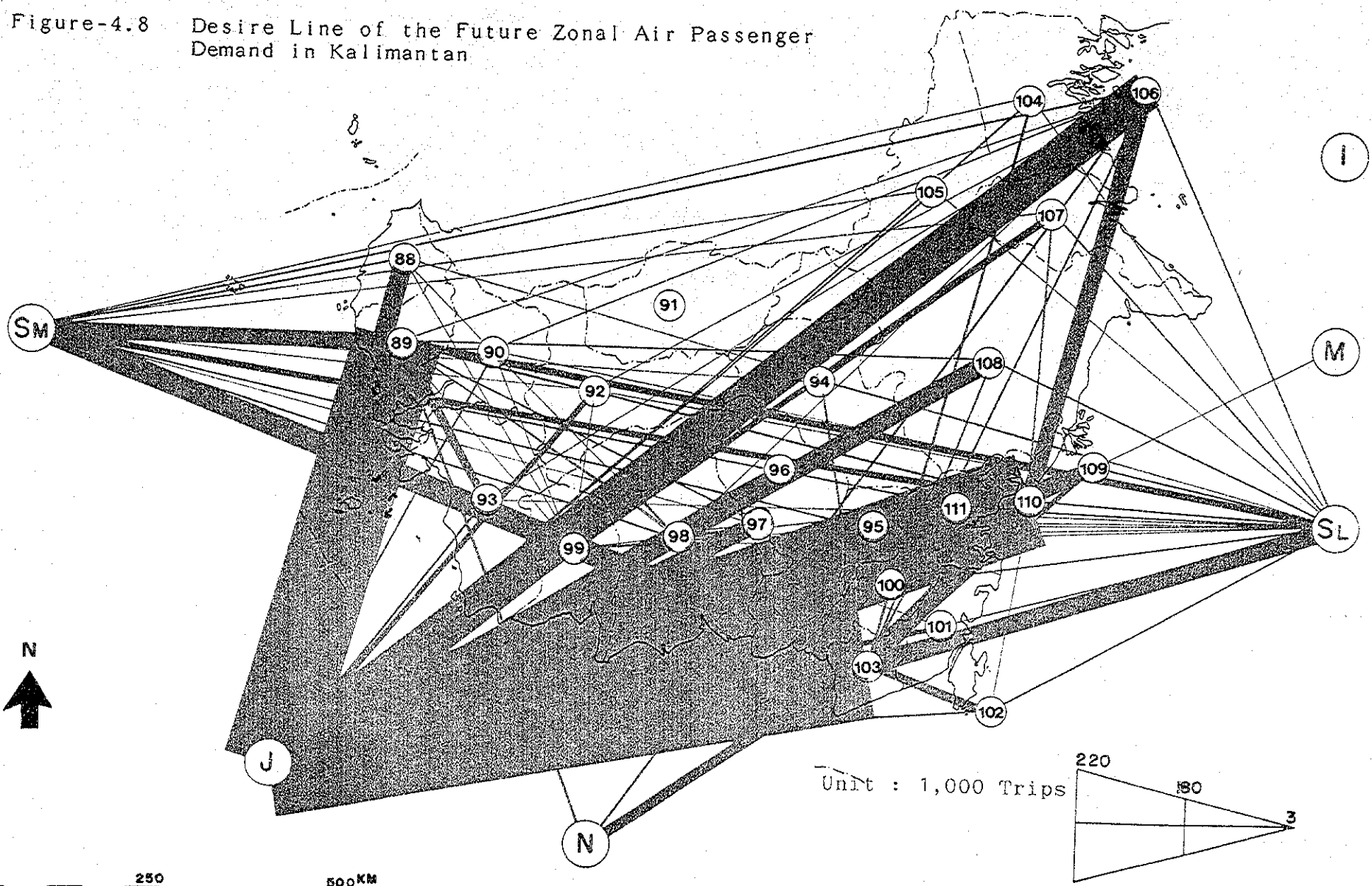


Figure-4.9 Desire Line of the Future Zonal Air Passenger Demand in Sulawesi

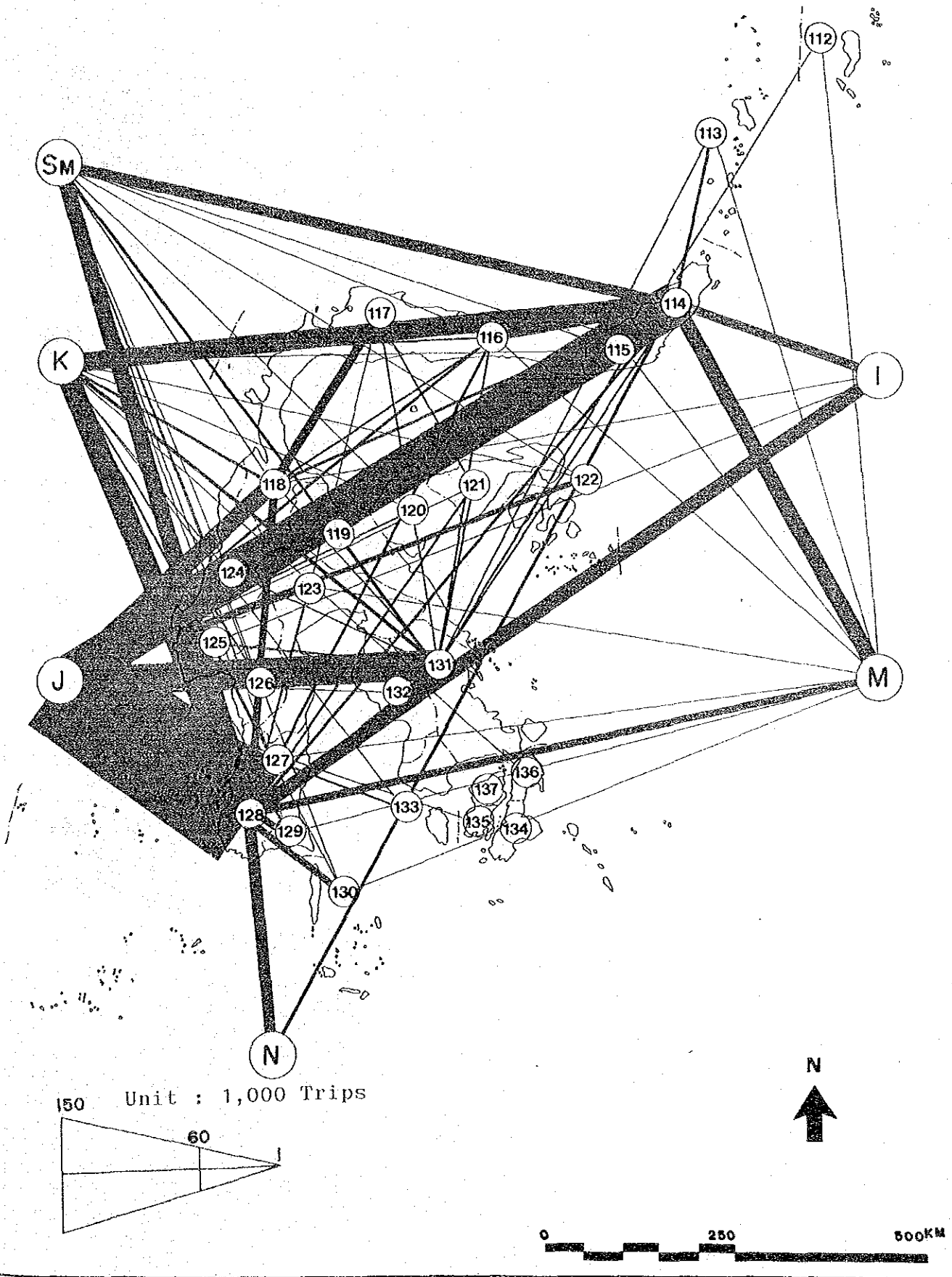


Figure-4.10 Desire Line of the Future Zonal Air Passenger Demand in Maluku

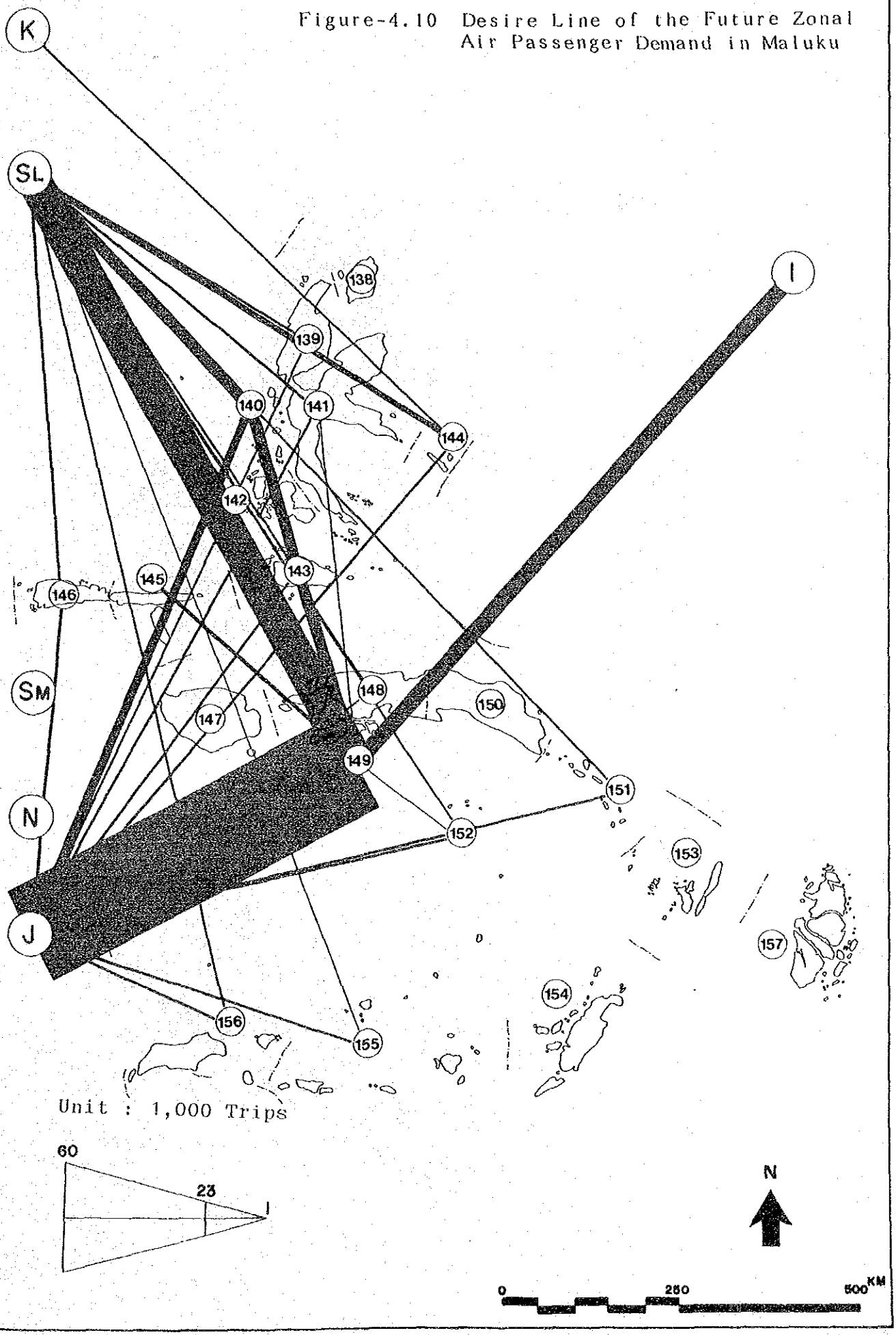
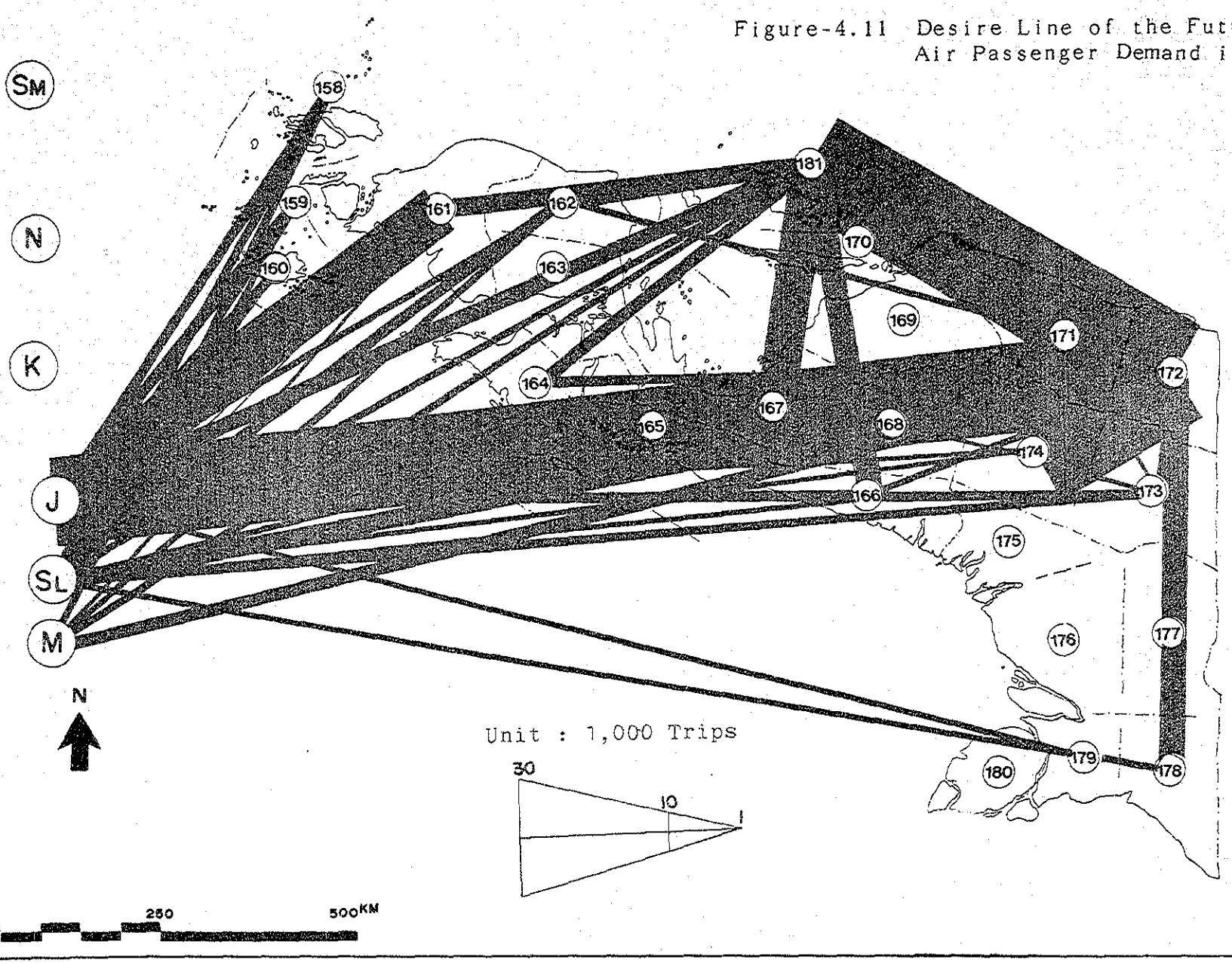
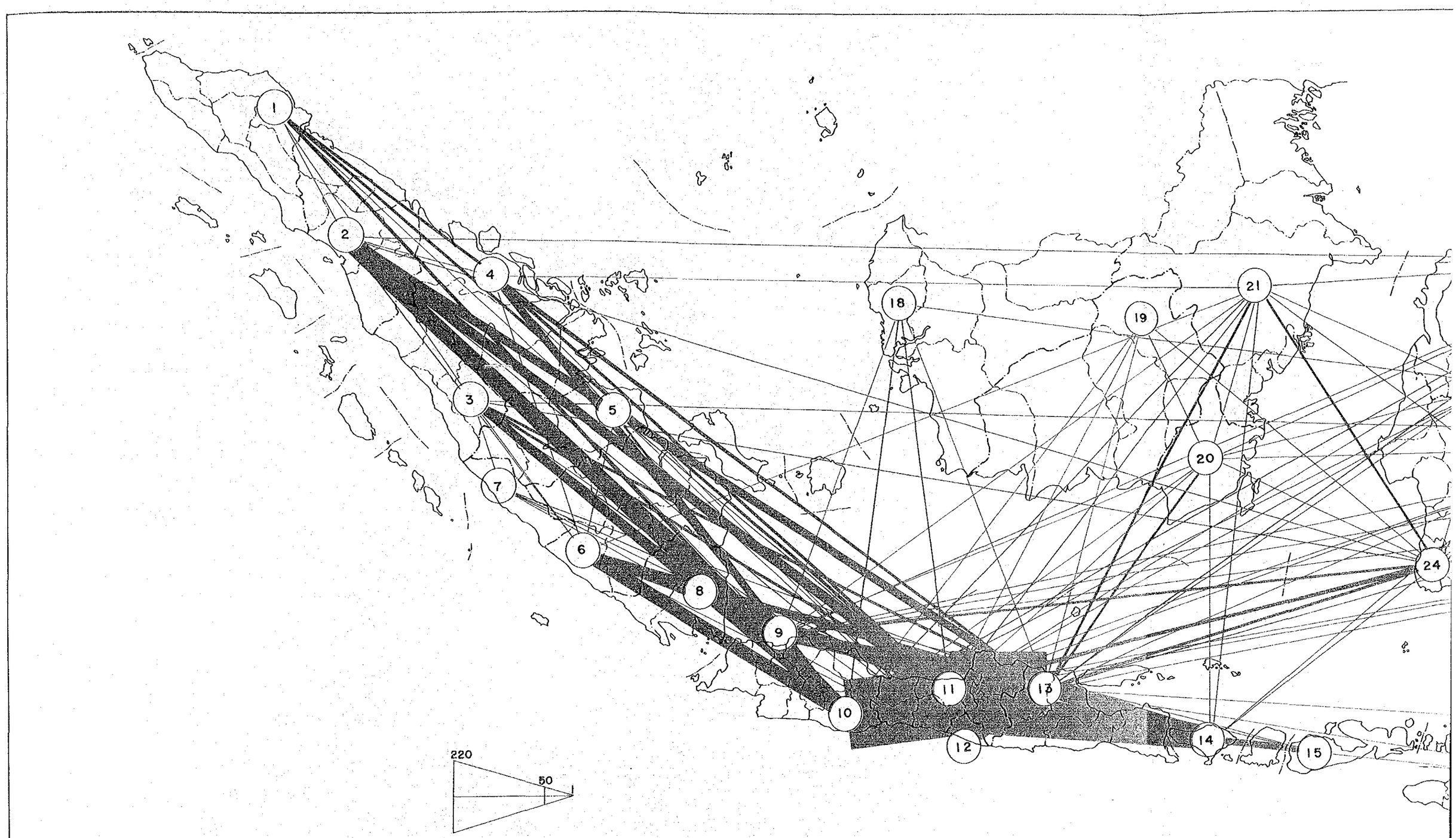


Figure-4.11 Desire Line of the Future Zonal Air Passenger Demand in Irian Jaya



(32)Desire Line of Sea Passenger Demand: Figure-4.12 illustrates the future desire line of sea passengers between provinces in 2004. Since the majority of sea passenger demand will still be generated by ferries, especially Tg.Perak-Madura, Merak-Bakauhuni and Jawa-Bali ferries, the major trip patterns in 2004 will be similar to the present.



Unit : 10,000 Trips

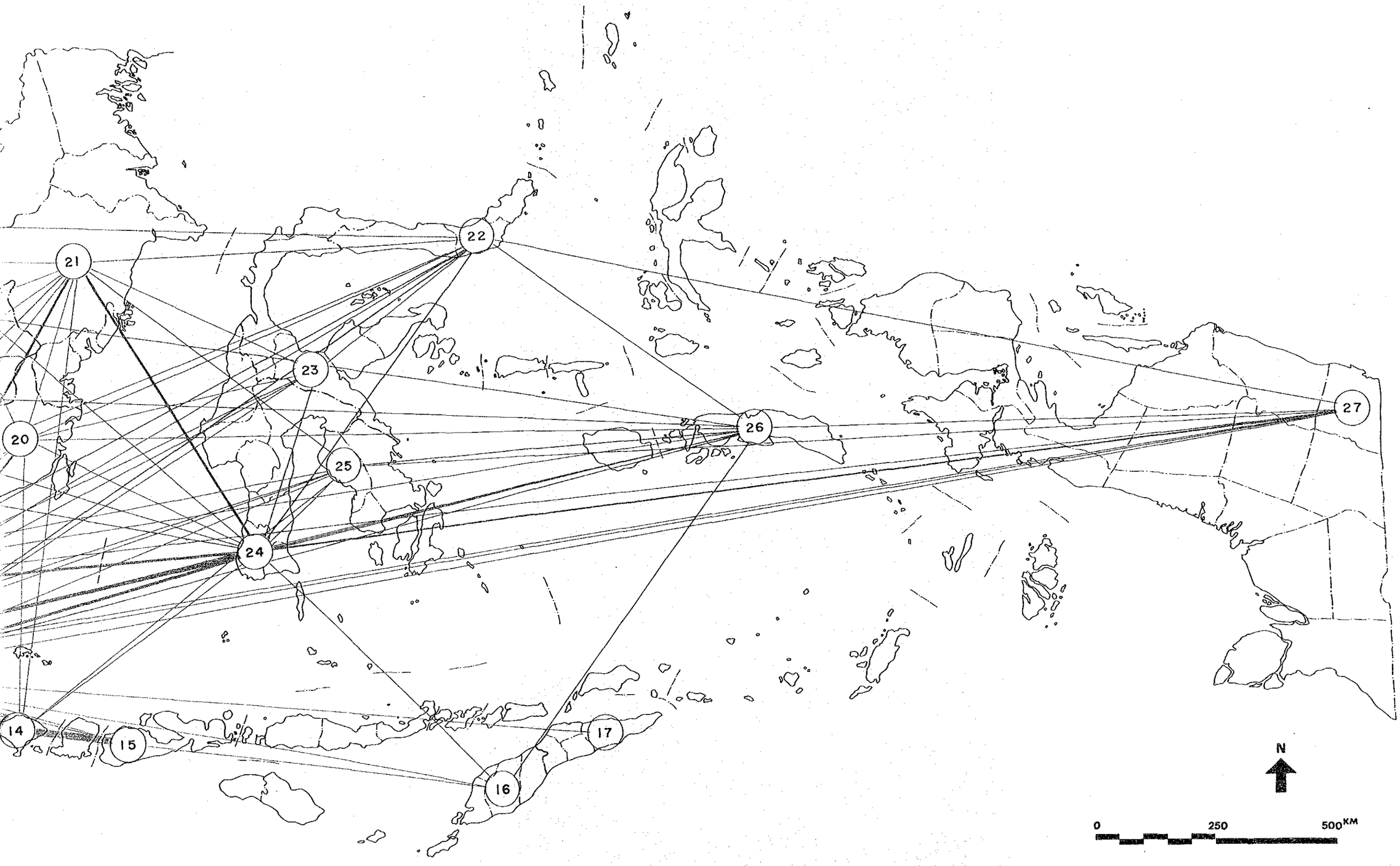
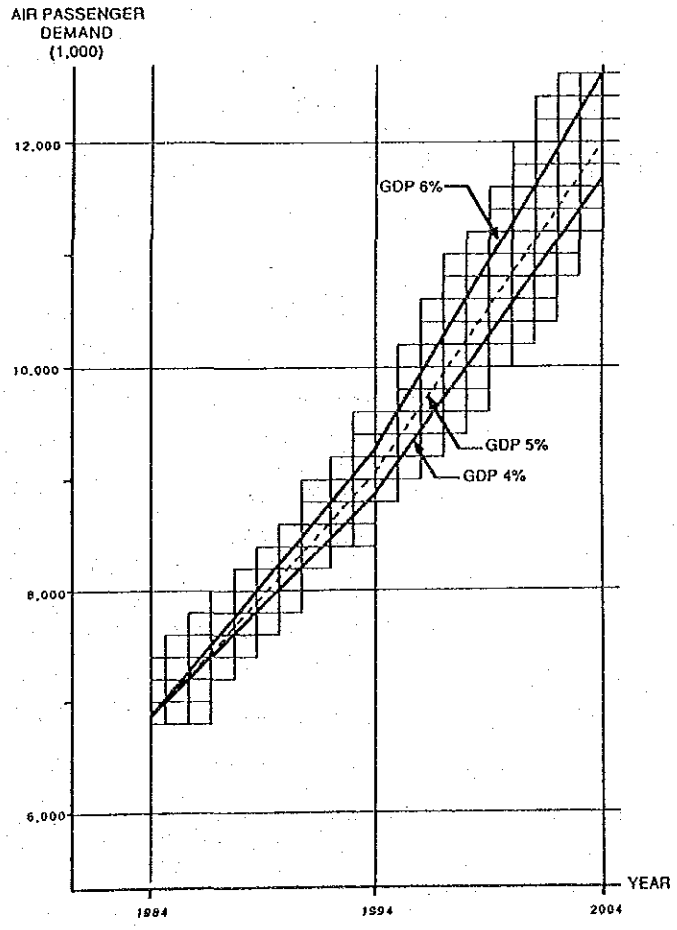


Figure-4.12 Future Desire Line of Sea Passenger Demand Between Provinces - 2004

4.09 SENSITIVITY ANALYSIS

(33)Change of GDP Growth Rate: In order to examine the sensitivity of the results of forecast traffic demand with GDP growth rate, forecasts of trip generation/attraction volume were also carried out in the case of a lower GDP growth rate of 4% per annum and a higher rate of 6% per annum. In this stage, only direct effects of changes in GDP growth rate were taken into consideration. Figure-4.13 show differences in forecasts of future passenger volume for each GDP growth rate. This figure reveals that passenger volume in 2004 will vary between 0.962 (4%), 1 (5%) and 1.044 (6%) depending on GDP growth rate, indicating that a 1% difference in GDP growth rate will result in a 3-4% fluctuation in forecast passenger volume.

Figure-4.13 Fluctuation of Forecast Air Passenger Demand by Changing GDP Growth Rate



(34)Change of Time Value: Assuming that, in Indonesia, time value will increase at the same rate as GDP growth, the future air passenger demand in 2004 is projected to be 15,090,000 trips, which is 25.2% more than the case projected using present time values. The share of air transport in 2004 is estimated to reach 35.2%.

4.10 FORECAST OF PRESENT AND FUTURE AIR CARGO DEMAND

(35)Air Cargo Demand: Forecast of present and future air cargo demands was carried out using the unit cargo volume per passenger calculated from 1984 air transport statistics. The large differences in cargo volume per passenger in internal trips in Irian Jaya led to distinctions between two types of unit cargo volume: one type was employed for evaluating all of Indonesia, except internal trips in Irian Jaya; and the other for analyzing internal trips in Irian Jaya. These unit cargo volumes were multiplied by the passenger volume of each OD pair to obtain the present and future air cargo demands in 1984, 1994 and 2004, which are presented in the Study Report.

4.11 INTER-REGIONAL TRAFFIC DEMAND FORECAST

(36)Objective: The inter-regional traffic demand forecast was conducted to obtain reference materials for cross-checking with the results of the inter-zonal traffic demand forecast previously presented herein. The forecast was based principally on existing statistics, data and information. Modes of transport processed in the inter-regional traffic demand forecast include air transport, sea transport including ferry services, and land transport, including road, railway and inland waterway. The traffic demand was projected according to each mode of transport.

(37)Study Method: The basic study method of the inter-regional traffic demand forecast is shown in Figure-4.14. As seen in this Figure, the major work items include:

- Zoning
- Collection and review of existing traffic data
- Supplementary arrangement of collected data
- Finalization of present OD table
- Collection and review of economic indices
- Construction of trip generation/attraction model
- Projection of future economic indices
- Forecast of future trip generation/attraction volume
- Finalization of future OD table

(38)Zoning: The Phase-1 study divided Indonesia into 7 regions (primary zones) in order to project inter-region traffic demands. For the determination of zoning, a province was considered as the minimum unit, and either one province or a combination of several provinces was considered as one zone. Table-4.9 shows details of primary zones.

(39)Basic Data: The data related to the Study have been collected from the various authorities concerned. The followings are the fundamental existing available data for the traffic forecast.

- Air passenger OD between major airports, 1976-85
- Sea passenger OD between ports by RLS fleet, 1981-84
- Sea cargo OD between ports by RLS, Local & Rakyat fleet, 1983-84
- Road passenger/cargo OD between 215 zones, 1982
- Railway passenger/cargo OD between stations, 1981
- Inland waterway passenger/cargo volume,1981-86

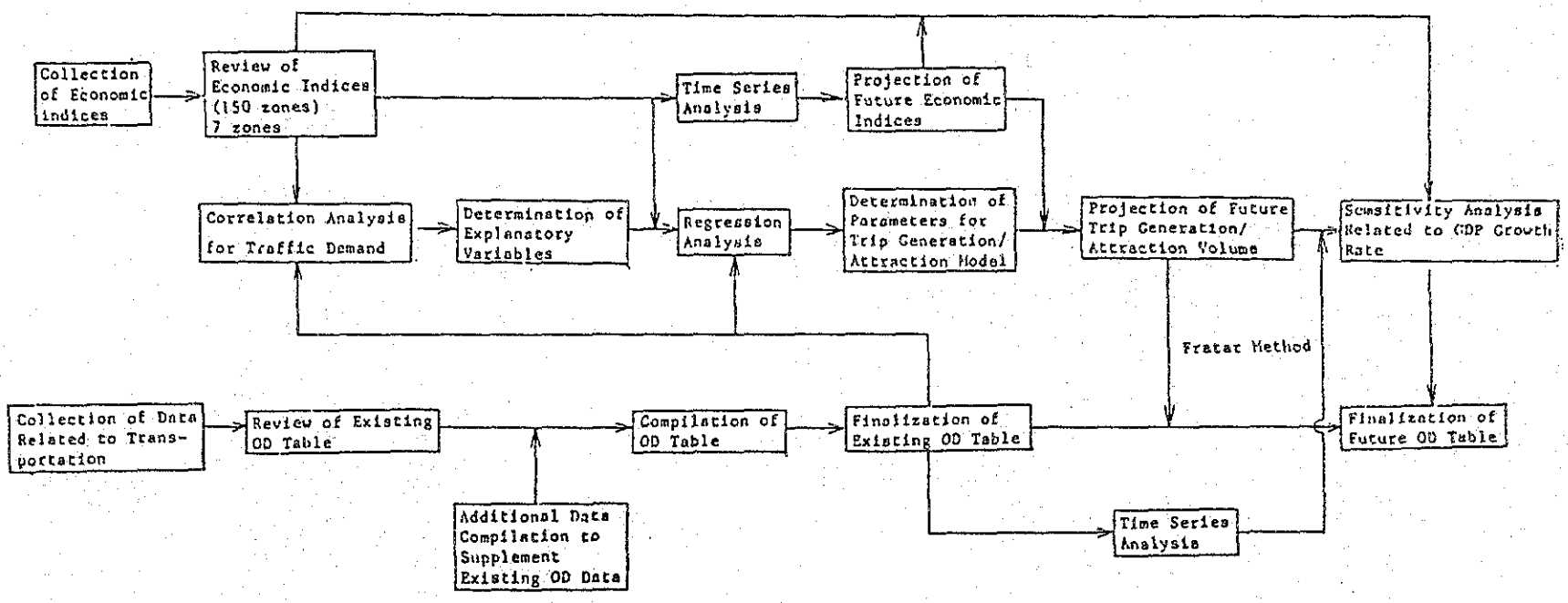


Figure-4.14 Flowchart of Inter-Regional Traffic Demand Forecast

Table-4.9 Details of Primary Zones

Zone No.	Name of Zone	Province
1	Sumatera	D.I.Aceh, Sumatera Utara, Sumatera Barat, Riau, Jambi, Sumatera Selatan, Bengkulu, Lampung.
2	Jawa/Bali	D.K.I.Jakarta, Jawa Barat, Jawa Tengah, D.I.Yogyakarta, Jawa Timur, Bali.
3	Nusa Tenggara	Nusa Tenggara Barat, Nusa Tenggara Timur, Timor Timur.
4	Kalimantan	Kalimantan Barat, Kalimantan Tengah, Kalimantan Selatan, Kalimantan Timur.
5	Sulawesi	Sulawesi Utara, Sulawesi Tengah, Sulawesi Selatan, Sulawesi Tenggara.
6	Maluku	Maluku.
7	Irian Jaya	Irian Jaya.

(40)Similarity: Fundamentally, the study method is mostly similar to that applied in Phase II, except the works concerning preparation of the present OD tables. However, the outcomes of traffic demand of this study show the demand mixed with the net and the gross movements from the nature of used OD table. The detailed processing and procedure of this works are given in Main Report.

SECTION 5 POTENTIAL NEW AIR ROUTES AND FUTURE AIR NETWORK

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POTENTIAL NEW AIR ROUTES AND FUTURE AIR NETWORK

5.01 CONCEPT OF IDENTIFICATION OF POTENTIAL NEW AIR ROUTES

(01)Concept: One of the major targets of the Study is to identify potential new air routes in the future, which will certainly be beneficial not only individual passenger but for the further development of regions. The method and the task for identification and selection of potential new air routes applied in the Study are described in this Section. The identification of potential new air routes has been elaborated not only from air passenger demand standpoint, but also from the realistic viewpoint.

5.02 BASIC METHOD FOR SELECTION OF NEW AIR ROUTES

(02)Basic Method: A network analysis has been employed as the basis for the selection of potential new air routes. The present air transport network is first classified into trunk routes and feeder routes. Then, air traffic demand is forecast through a process of steps illustrated in Figure-5.1. It should be noted that the selection of new feeder routes is carried out first in order to determine generated traffic demand by passengers who presently have to travel for a long time to make an access to airports, because of lack of scheduled flights.

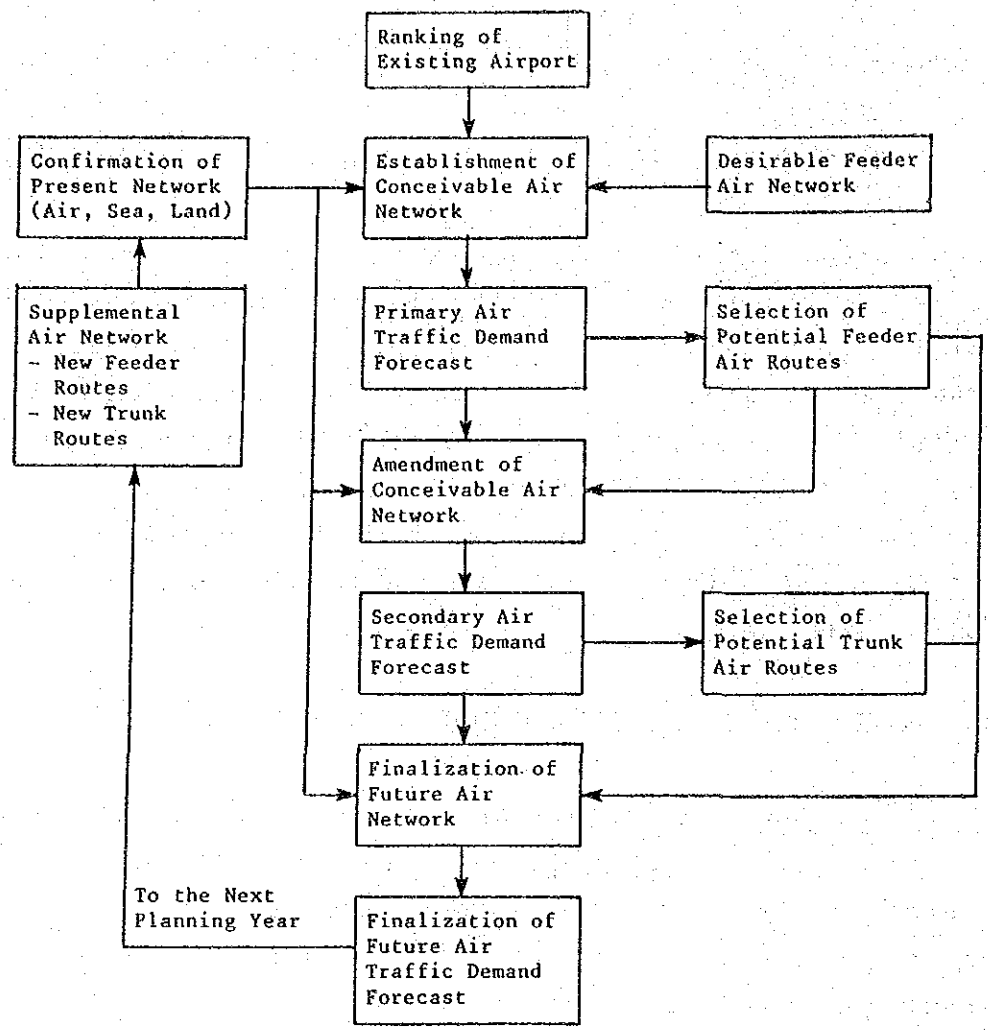


Figure-5.1 Process for the Selection of Potential New Air Routes

(03)Steps for Selection: In the Study, potential new air routes are selected in two steps for years 1994 and 2004; i.e., for feeder air routes and trunk air routes, by the procedure described below:

- New feeder air routes for 1994 are selected by the procedure described in the following five paragraphs.
- The conceivable air transport network is amended by adding the new feeder air routes to the present air transport network and desirable trunk air transport network in order to select new trunk air routes.
- New trunk air routes are then selected through the same procedure.
- The future air transport network is finalized by adding new trunk air routes to the conceivable air transport network.
- The future air traffic demand in 1994 is forecast on the basis of the finalized future air transport network.
- Selection of potential new air routes and forecast of air traffic demand for 2004 are carried out in the same way based on the results of calculation for 1994.

(04)Classification of Air Routes: At the first step, existing airports were classified into major airports and other airports. Major airports are defined as airports served by daily flight of such an aircraft with a capacity of more than 44 passengers, as HS-748 and F-27. Air routes between major airport pair are then considered as trunk routes, while other routes, other airport pair and major-other airport pair, are regarded as feeder routes.

(05)Establishment of Conceivable Air Network: Based on the present air transport network, the conceivable air transport network is established taking into account the desirable feeder air transport networks between major airports and nearby zones without scheduled flights, including zones without airports, unless these zones are within a 60km range from airports with scheduled flights.

(06)Formation of Transport Network: The forecast future air traffic demands has been conducted under the competitive condition with sea transport. As such, the conceivable air transport network and present sea transport network are combined together with land transport (as an access mode between airports/seaports and zone centers) to formulate the transport network for selection of potential new air routes. The transport network is formulated from nodes (such as airports and seaports) and links (such as air, sea and road routes).

(07)Forecast of Future Passenger Demand: The future passenger demand combined with air and sea transport for the transport network with desirable feeder are projected using the future passenger OD table combined with air and sea transport. Then, OD volumes of both air and sea transport are obtained on the basis of these results and developed modal split models. In this case, the modal split of air passenger is varied depending on difference of required times and fares result from the opening of new feeder air routes. Air passenger demand for each air route is calculated through the minimum required time search method of the air OD volume on the conceivable air transport network.

(08)Criteria for Selection of New Air Route: New feeder air routes are selected by a criterion of minimum passenger demand of about 20,000 trips per year. On the other hand, 10 new trunk air routes are selected for each of the years 1994 and 2004 only from the standpoint of traffic demand. In addition, air routes less than 120 km in distance, if there is any road connecting two locations, are excluded from selection because air transport cannot compete with land transport on these routes, even at present.

5.03 SELECTED POTENTIAL NEW AIR ROUTES

(09)Selected New Air Routes: Tables-5.1 and 5.2 show the selected potential new feeder routes and trunk routes, respectively. Potential new air routes for years 1994 and 2004 are illustrated in Figures-5.2 and 5.3, respectively. A total of 19 feeder routes (13 routes for 1994 and 6 routes for 2004) and 20 trunk routes (10 routes each for 1994 and 2004) were selected as potential new routes. It should be noted that the passenger demands shown in these Tables are demands on each route (similar to the gross movement demands).

5.04 FORMATION OF THE FUTURE AIR NETWORK

(10)Future Air Network: Based on the results of selection of new potential air routes, the future air networks in 1994 and 2004 were finalized by adding these selected new air routes to the present air network. These future air networks in 1994 and 2004 were utilized for the aircraft analysis.

Table-5.1 Potential New Feeder Air 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-5.2 Potential New Trunk Air Route

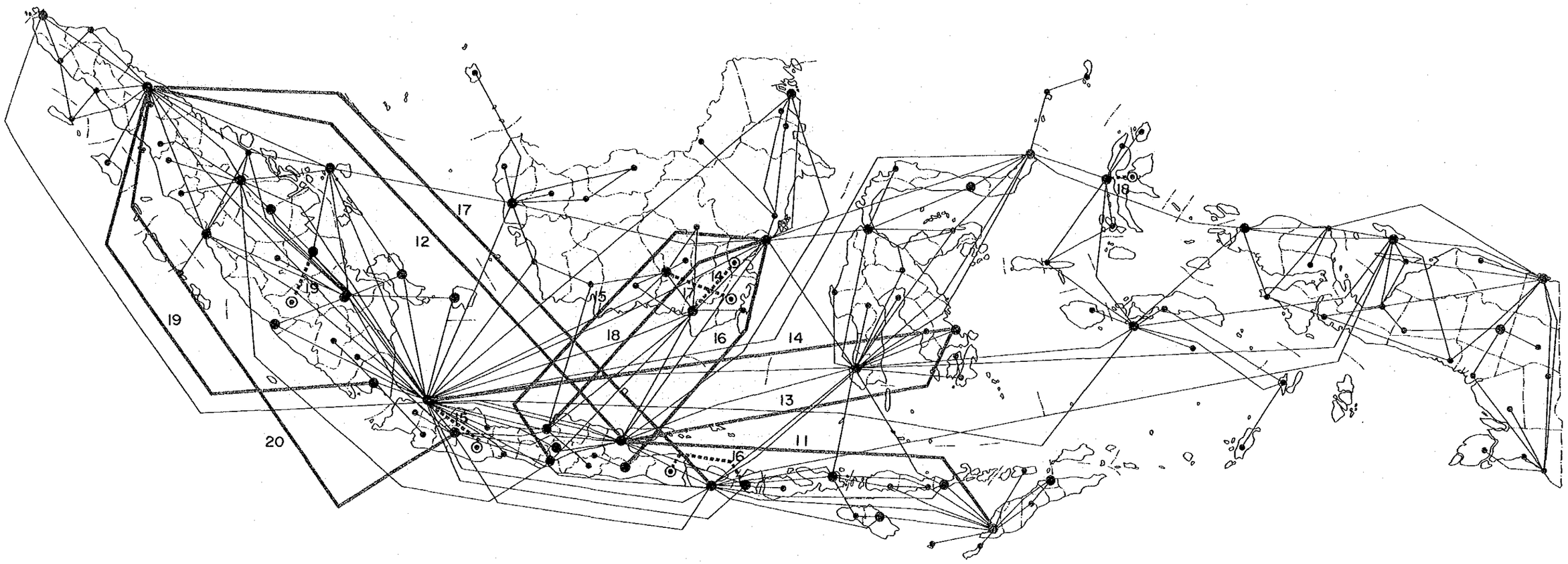
Year	New Trunk Air Routes				Distance	Passenger Demand **
	No. *	City Name (Airport Name)	Zone No.	City Name (Airport Name)	Zone No.	(Km)	(Trips)
1994	1	Banda Aceh (Blang Bintang)	2	Jakarta (Soekarno Hatta)	43	1,803	124,584 156,618
	2	Jakarta (Soekarno Hatta)	43	Ambon (Patimura)	149	2,414	119,894 160,614
	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-5.2 Potential New Air Routes 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-5.3 Potential New Air Routes for 2004