Figure-3.9 Desire Line of the Present Zonal Air Passenger Demand in Kalimantan

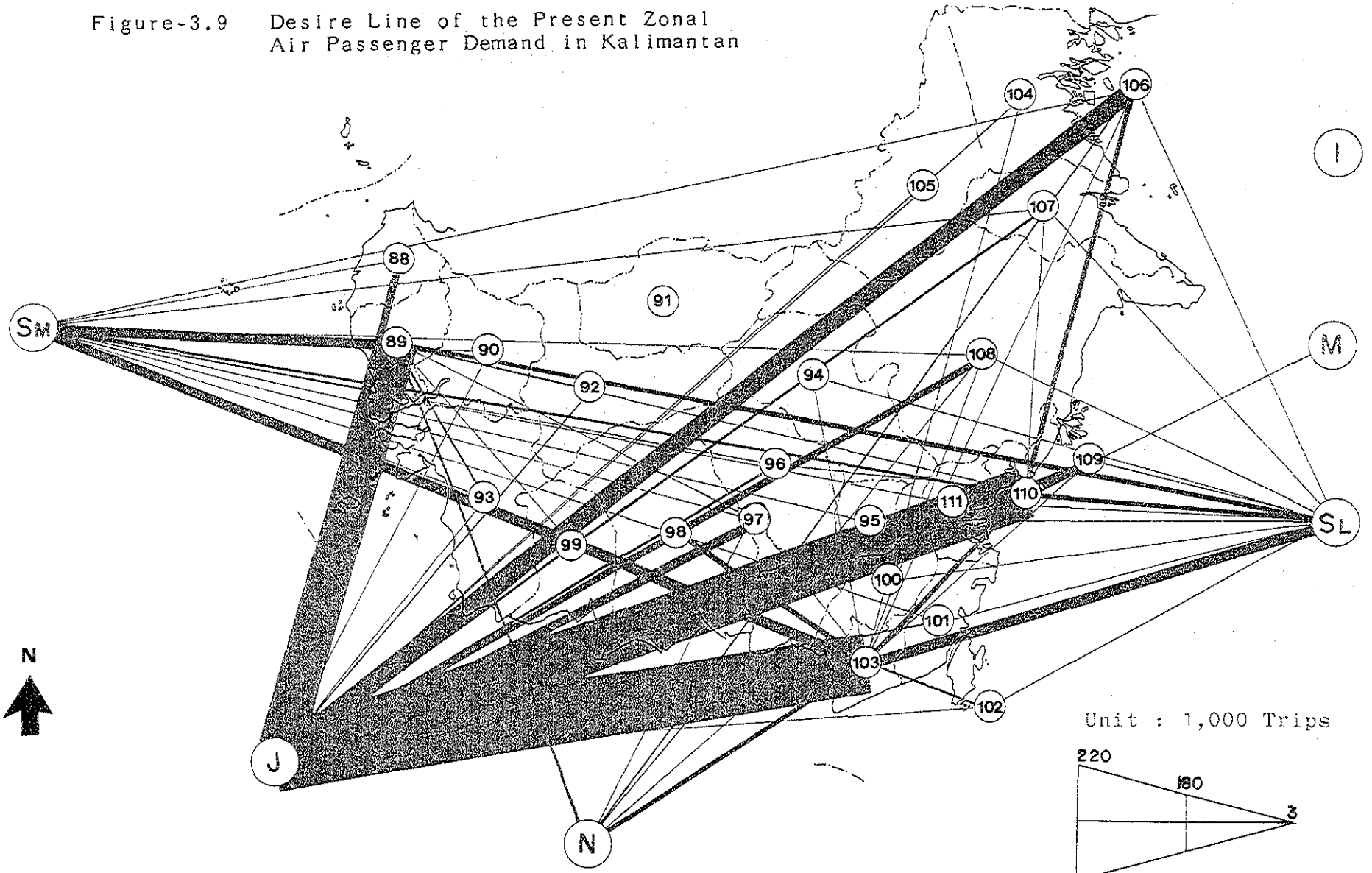


Figure-3.10 Desire Line of the Present Zonal Air Passenger Demand in Sulawesi

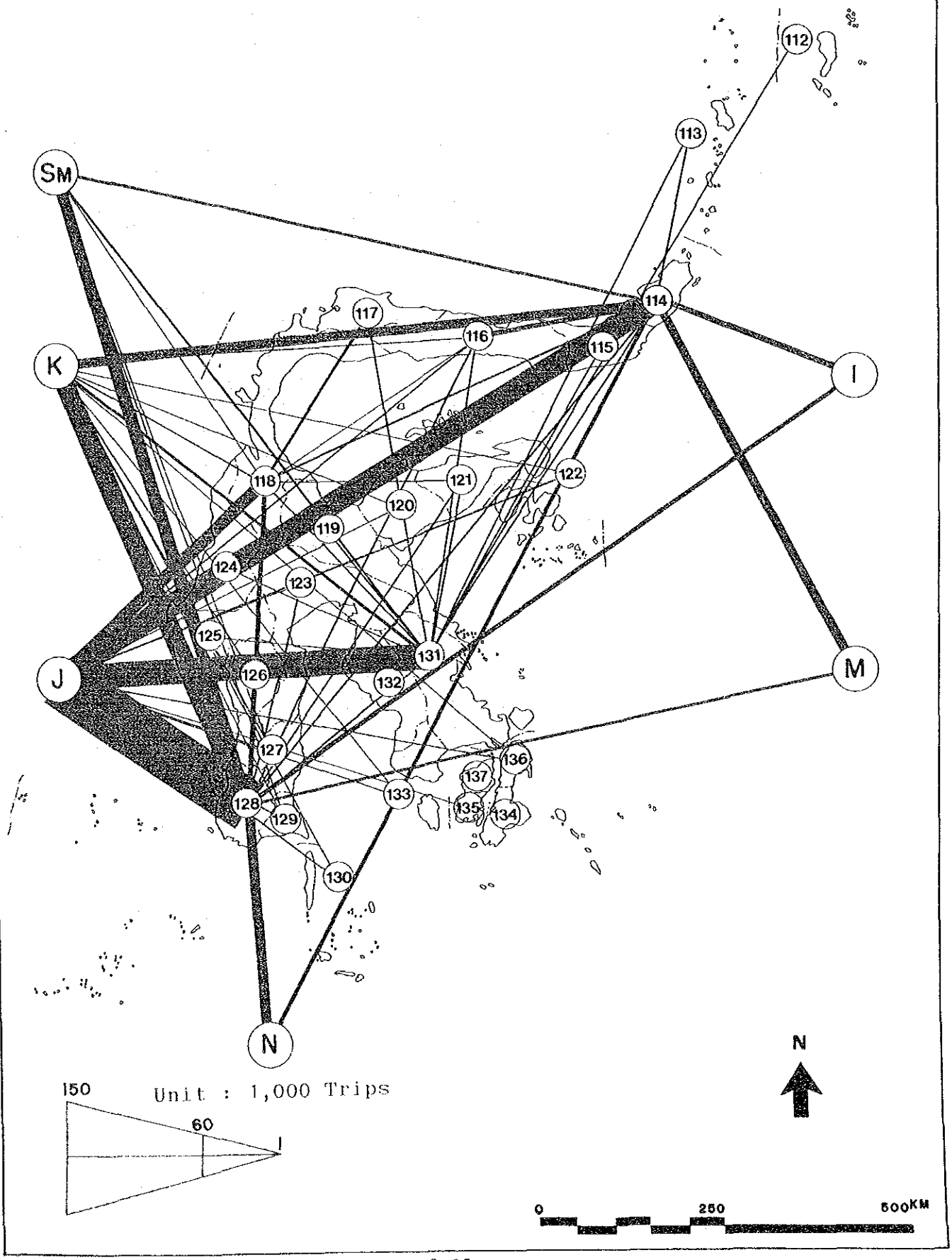


Figure-3.11 Desire Line of the Present Zonal Air Passenger Demand in Maluku

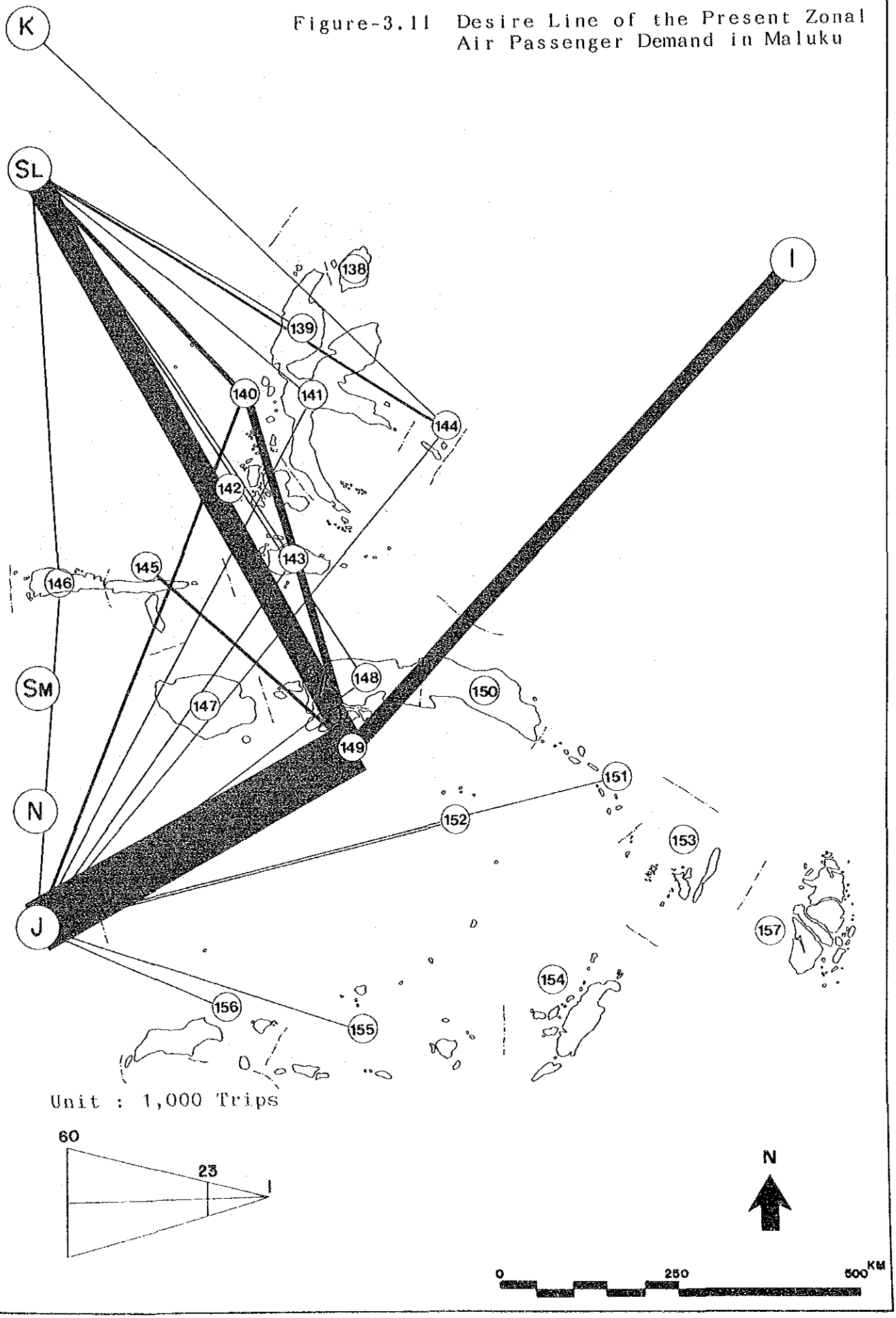
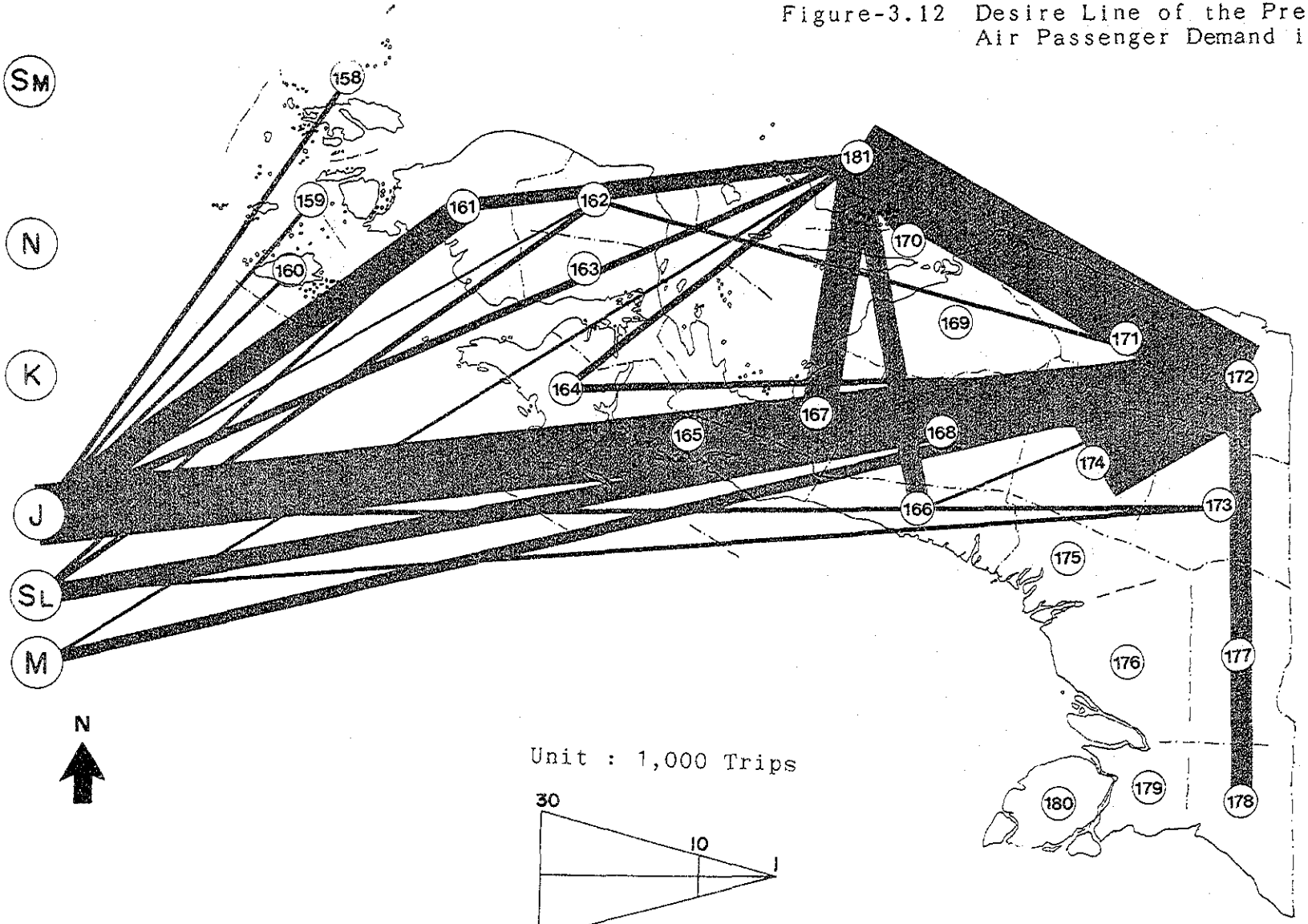


Figure-3.12 Desire Line of the Present Zonal Air Passenger Demand in Irian Jaya



3.02.4 Preparation of Present Sea Passenger OD Table

3.02.4.1 Preparation of Present Sea Passenger OD Table

(27) 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.

(28) 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.

$$Tij = 1.108E\text{-}05 \frac{(Pi \times Pj)^{0.794}}{Dij^{-0.3267}}$$

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

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

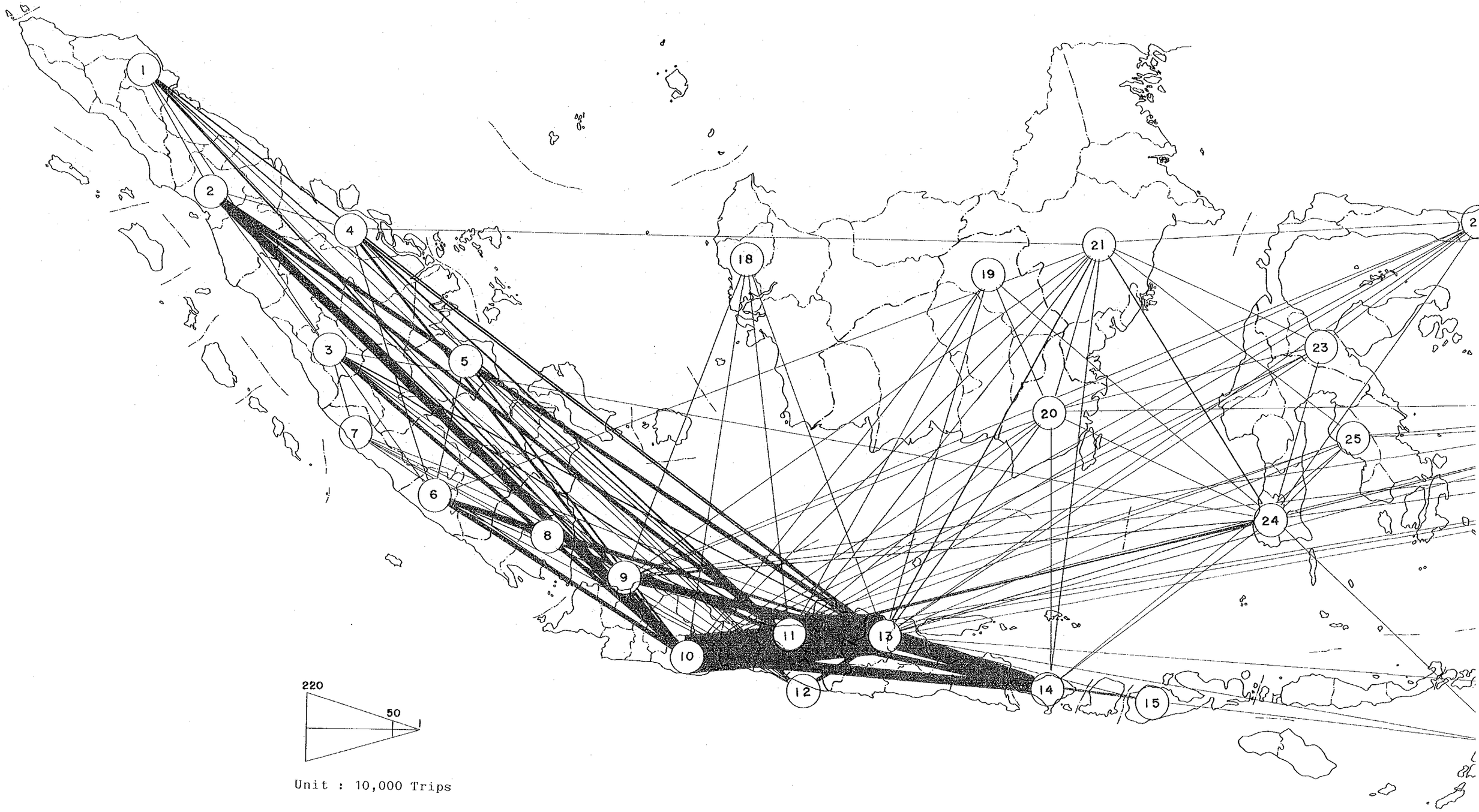
3.02.4.2 Assessment of Present Sea Passenger Demand

(30) The present sea passenger OD table between provinces in 1984 is given in Table-3.9, while the sea passenger OD table between zones in 1984 is presented in the "Data Book", Section 2. In addition, Figure-3.13 illustrates the

present desire lines of sea passenger demand between provinces. 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-3.9 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	3657	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



Unit : 10,000 Trips

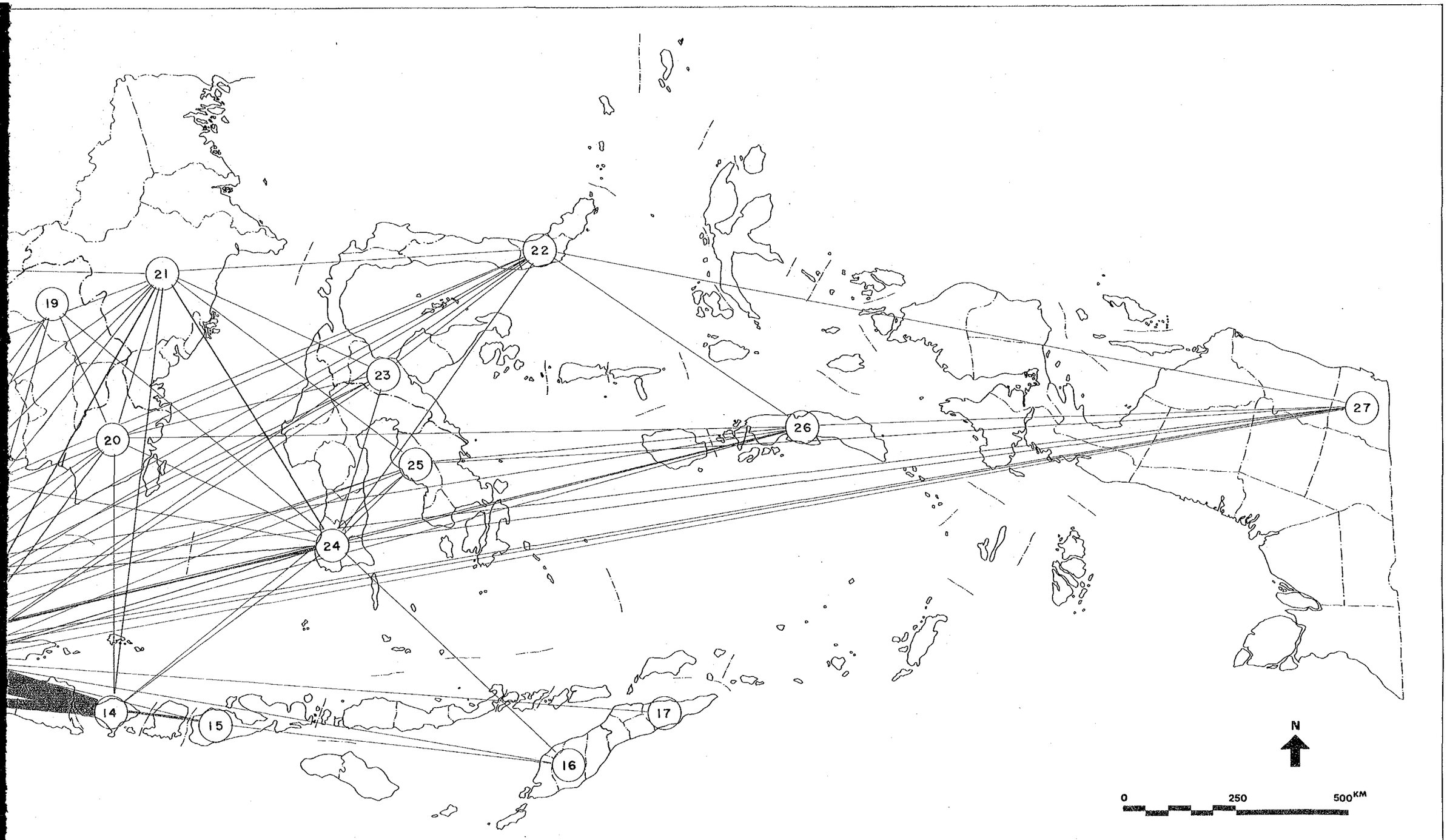


Figure-3.13 Present Desire Line of Sea Passenger
Demand Between Provinces - 1984

3.02.5 Preparation of Future OD Table Combined with Air and Sea Passengers

3.02.5.1 Combination of Present Air and Sea Passenger OD Tables

(31) The generated present air and sea passenger OD tables were combined in order to forecast the future OD volume of air and sea passengers.

3.02.5.2 Forecast of Future Trip Generation/Attraction Volume of each Zone

(32) 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.

(33) Although efforts were made to obtain several economic indices in zones (kabupatens), population was the only available data. Despite this situation, 27 economic indices were available for provincial bases. Therefore, it was possible to project future population in each zone and future economic indices in each province using time series analyses.

(34) Future economic indices, which are only selected indices as explanatory variables, were projected. First, projection of the future socioeconomic and social frame work of Indonesia as well as its industrial sector were mainly based on the REPELITA-IV and its development strategy. The future economic indices in each region were then projected mainly by carrying out time series analyses in each region based on the projected future socioeconomic and social frame work of Indonesia. In general, future economic indices were projected by using a moderate annual growth rate of GDP, i.e. 5% from 1989. In addition, future economic indices based on lower growth rate, i.e. 4% from 1989, and higher rate, i.e. 6% from 1989, were also projected for the sensitivity analyses of traffic demand forecast (see Figure-3.14).

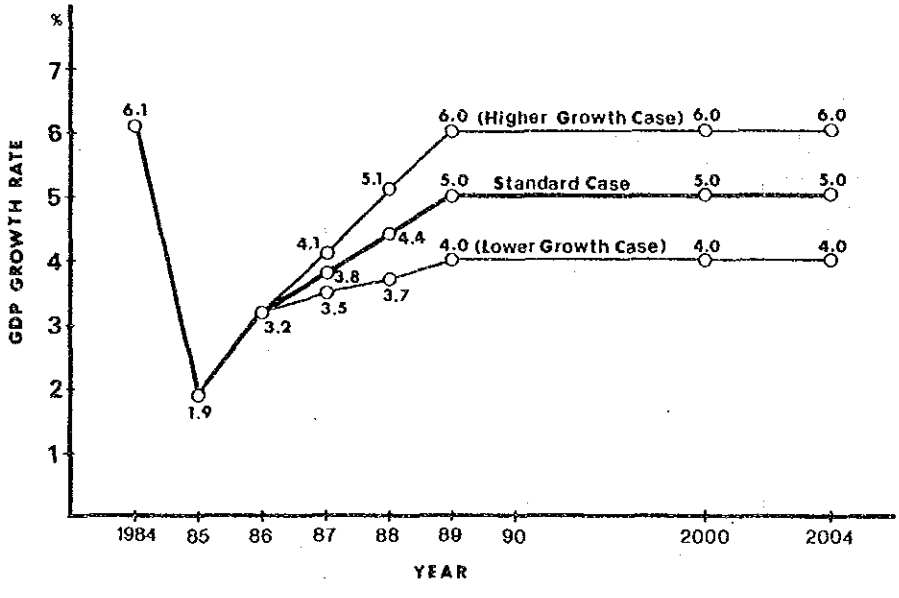


Figure-3.14 Change of GDP Growth Rate Forecast

(35) 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.

(36) 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.)

(37) 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. The following linear model formulae are trip generation/attraction models developed to project the future zonal traffic demands based on population in each zone.

- Model for zones in Sumatera

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

- Model for zones in Jawa/Bali

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

- Model for zones in other regions

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

where,
Y : Traffic demand in each region (person)
X : Population in each region (person)

(38) Zonal trip generation/attraction demands were projected by using these regression models. Projected zonal trip generation/attraction demands were amended and finalized using the demands in provinces as control totals. As a result, the future traffic demand of air and sea passengers are projected as approximately 42,455,000 trips by the year 2004. Traffic demands in years 1989, 1994 and 1999 are also projected as approximately 28,300,000, 32,750,000 and 37,430,000 trips, respectively.

(39) The future passenger OD table combined with air and sea transport were then formulated by the Frater method (the present pattern method).

3.02.6 Construction of Modal Split Model

(40) 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.

(41) Based on the random utility theory, the basic assumption of a disaggregate behavioral model is shown as a formula below;

$$Pn(i) = Prob\ (Uin > Ujn \quad Vj \in Cn)$$

where,

Pn(i) : Choice probability of i transport mode.

Uin : Utility generated by choice of i transport mode.

Cn : Alternative transport mode unit.

In this formula, an utility 'Uin' is considered as a function of the service level of a specific transport mode, the characteristics of passengers (income, occupation, age, etc.) and individual preferences. 'Uin' consists of the following functions;

$$Uin = Vin + Ein$$

where,

Vin : Systematic portion.
Tangible service level of transport mode such as travel time and travel cost.

Ein : Random portion.
Intangible service level of transport mode such as individual preferences.

(42) However, 'Ein' can also be projected from the probability distribution. In the Study, the logit model was therefore employed as a basic model formula for the modal split model between air and sea transport. In fact, a logit model is often utilized since it is a relatively simple projection model. In the construction of the modal split models, the following points were taken into consideration on data obtained from the air and sea passenger surveys.

- Flight time by air and sailing time by ship.
- Fares.
- Access time to/from airport/port.
- Others.

(43) The modal split models utilized for the projection of modal split between air and sea transports were developed from the disaggregate behavioral 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-3.10.

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

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

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

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-3.10 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

3.02.7 Forecast of Future Air and Sea Passenger Demand

3.02.7.1 Preparation of Future Air and Sea Passenger Demand

(44) 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. Figure-3.15 illustrates the process of future air traffic demand forecast, together with selection of new air routes. The details of selection of potential new air routes is described in the following Section 4. A network analysis was basically employed for the future traffic demand forecast.

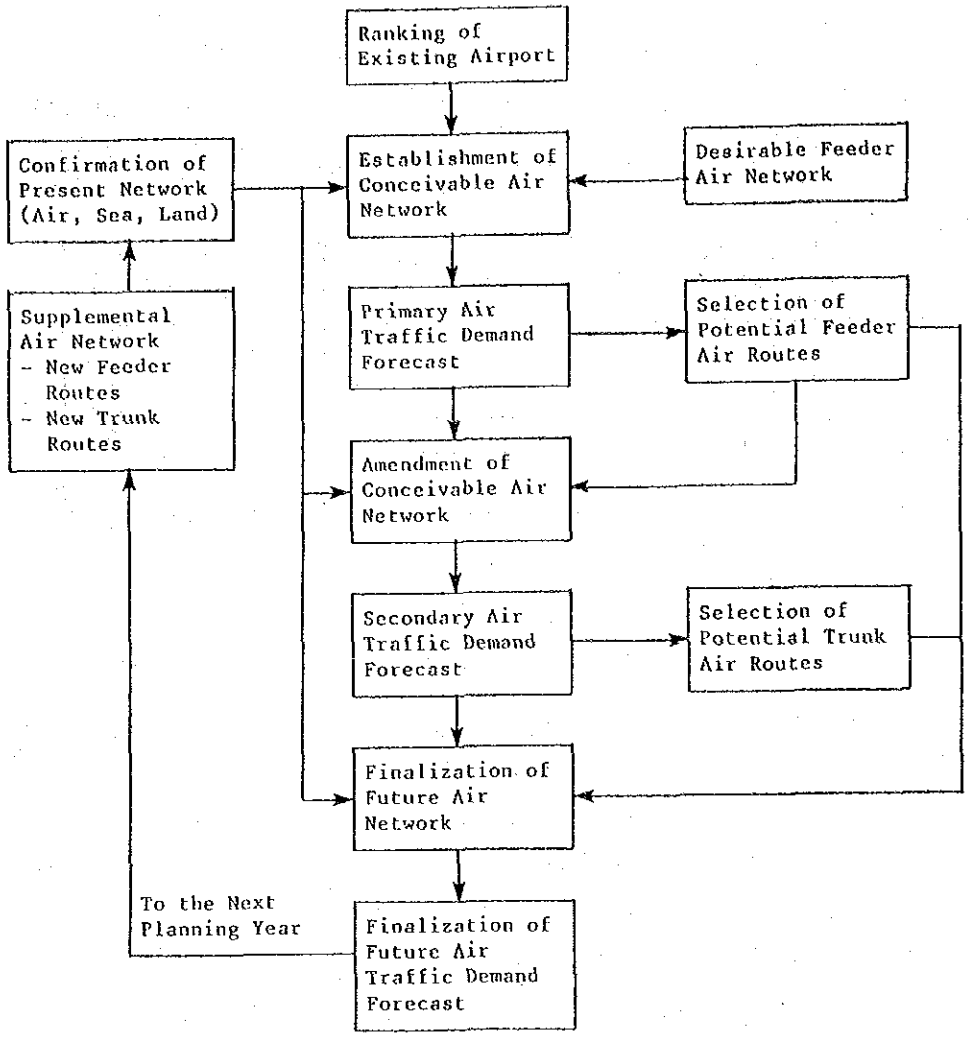


Figure-3.15 Process of Future Air Traffic Demand Forecast

(45) First, the present transport network of air and sea transport, together with the land transport network as modes of access between airports/ports and zone centers, were determined mainly from the latest timetables of airlines and shipping companies. In this case, zones with no operation of scheduled flights, including zones without airports, were also included in the transport network, unless these zones were within a 60km range from airports with scheduled flights. The transport network was formulated from nodes (such as airports and ports) and links (such as air and sea routes, and road).

(46) For the network analysis, necessary information such as required times, fares, etc. were entered for each link. Then, required time and fare for each OD pair for both air and sea transport were obtained through the minimum required time search. On the basis of these results and the developed modal split models, OD volumes of both air and sea transports were obtained. Finally, air traffic demand on every air route was calculated through traffic assignment of the air OD volume on the conceivable air network. In the Study, the future traffic demand forecast of both air and sea transports were carried out for years 1994 and 2004.

3.02.7.2 Assessment of Future Air Passenger Demand

(47) Table-3.11 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 9,036,000 trips and 12,026,000 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 28.0% in 2004. As a reference, the sea passenger demands excluding passenger demands of the ferry between Ujung (Surabaya) and Kamal (Madura) is also shown in the same table. In fact, the operation distance of this ferry is very short and the purpose of the trip for most passengers was considered to be related to their daily life. In this case, the share of the air transport in 2004 is expected to be 34.6% compared with 33.3% in 1984. These figures indicate that the importance of air transport for passenger movements will continuously increase in the future.

Table-3.11 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

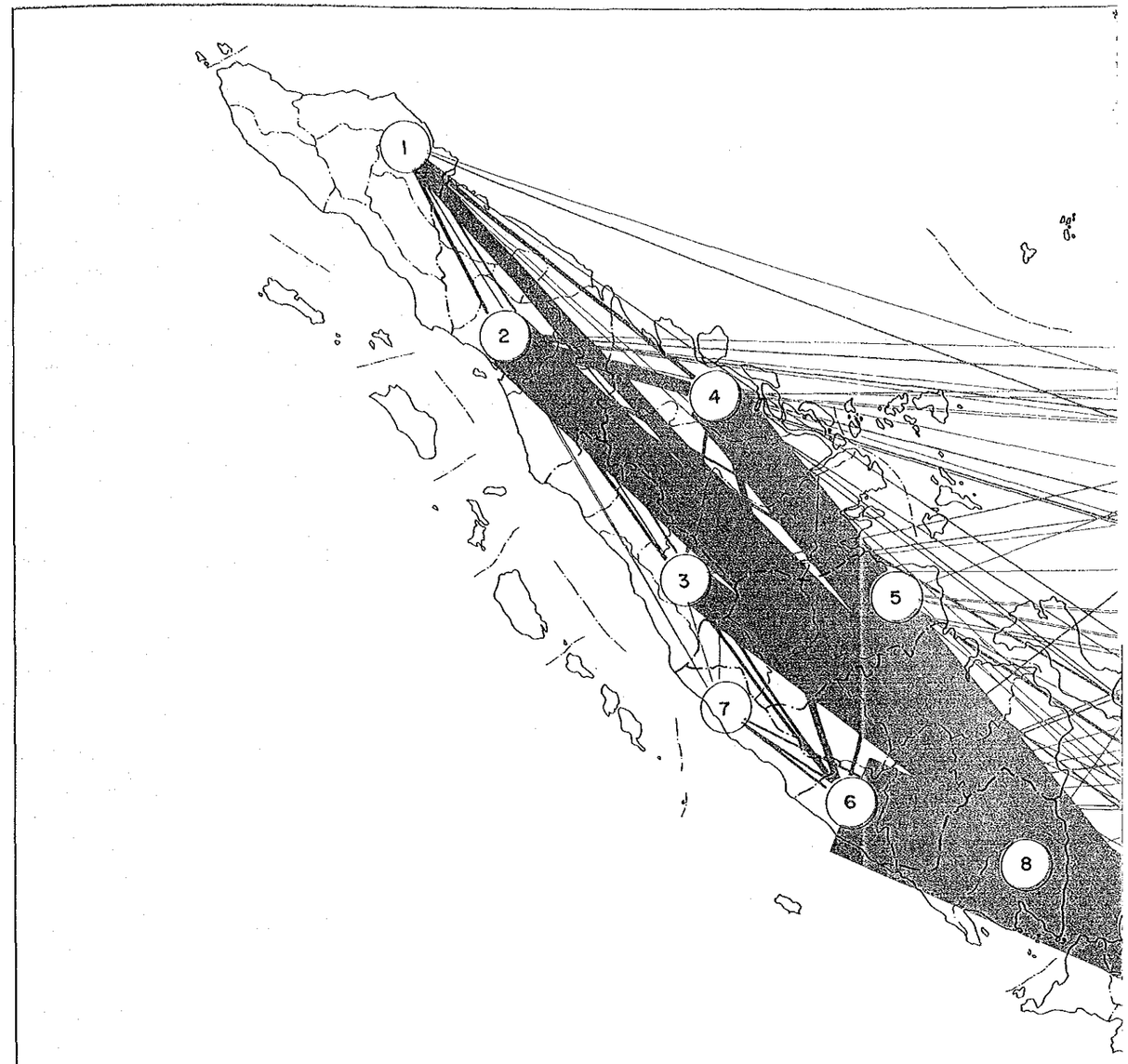
(48) Tables-3.12 and 3.13 show the future air passenger OD tables between provinces in 1994 and 2004, while the future air passenger OD tables between zones in 1994 and 2004 are presented in the "Data Book", Sections 3 and 5, respectively. In addition, Figure-3.16 illustrates the future desire lines of air passenger demand between provinces in the year 2004.

Table-3.12 Future Air Passenger OD Table Between Provinces - 1994

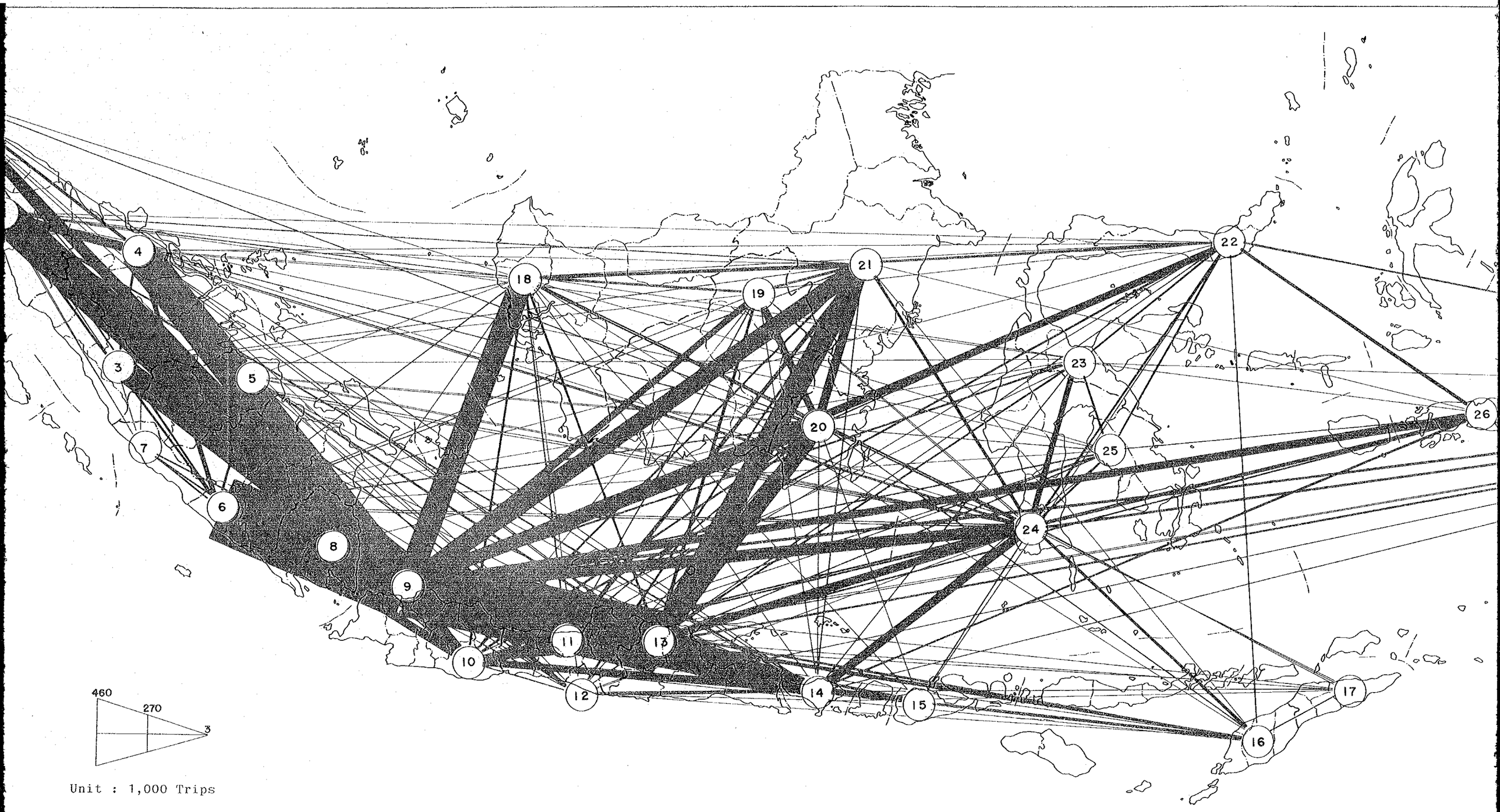
O/D	1 ACEH	2 SUM.UT	3 SUM.BA	4 RIAU	5 JAMBI	6 SUM.SE	7 BENKUL	8 LAMPUN	9 JAKARTA	10 JAW.BA	11 JAW.TE	12 YOGYA	13 JAW.TM	14 BALI	15 NT.BA	16 NT.TM	17 TIM.TM	18 KAL.BA	19 KAL.TE	20 KAL.SE	21 KAL.TM	22 SUL.UT	23 SUL.TE	24 SUL.SE	25 SUL.TR	26 MALUKU	27 IRIAN	TOTAL
ACEH	4153	17025	6269	18082	3531	14379	3376	14323	49479	7535	2013	0	4984	4661	0	0	0	2713	0	4975	236	334	0	308	0	0	0	156376
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	10438	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	15571	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	438	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	6398	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-3.13 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	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	2556	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	37212	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	998	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	16349	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	5570	998	3939	3547	8722	14573	37077	12342	16940	14066	25570	13490	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	5159	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	13490	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



Unit : 1,000 Trips



Unit : 1,000 Trips

Figure-3.16 F
D

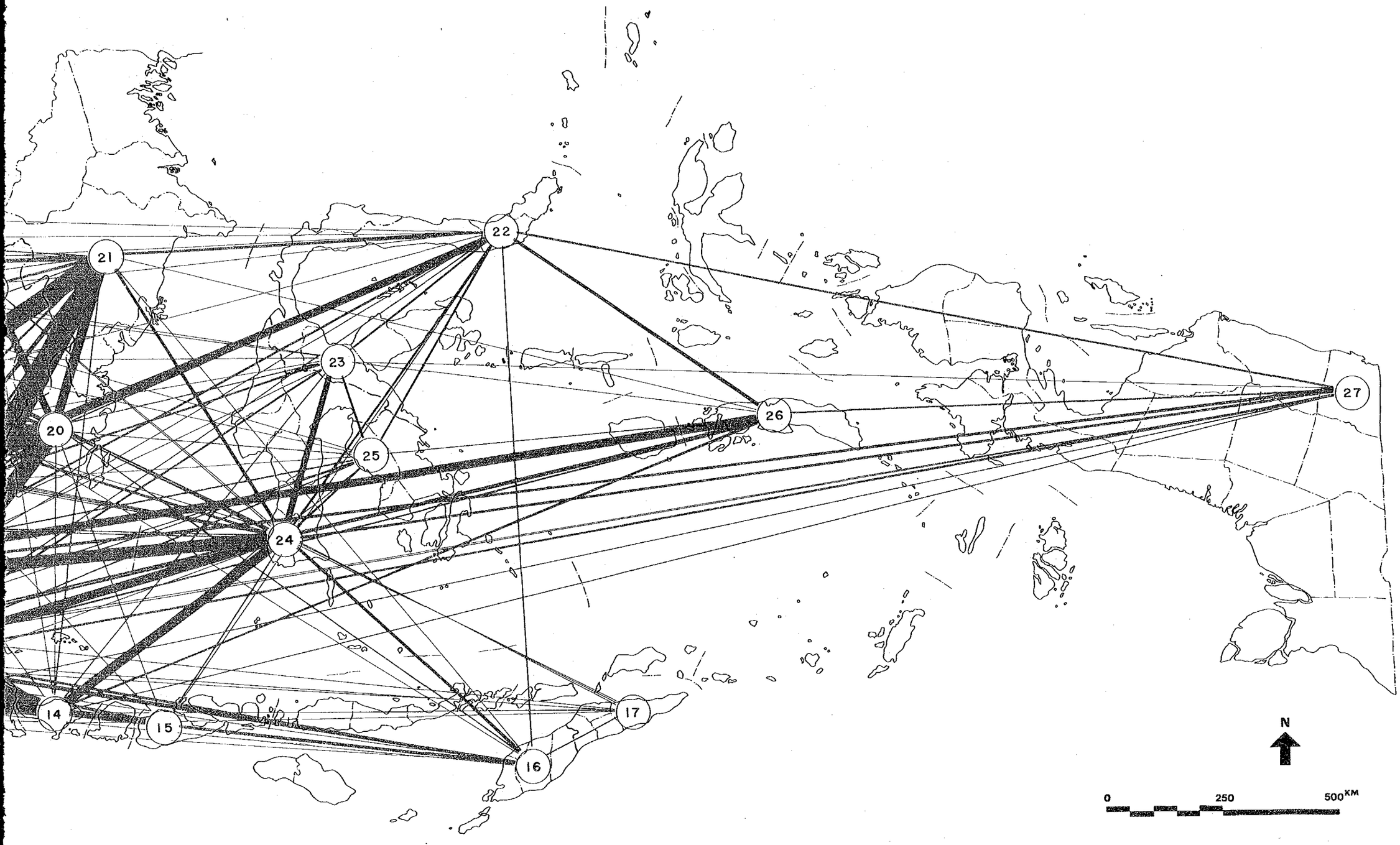


Figure-3.16 Future Desire Line of Air Passenger
Demand Between Provinces - 2004

(49) It can be noticed from Table-3.13 that the highest traffic demands are related to Jakarta (about 26% of the total demand) with major destinations of more than 200,000 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). Aside from Jakarta, high traffic demand is related to Jawa Timur (9.9%), Sumatera Selatan (6.9%) and Kalimantan Timur (5.1%), each with more than 600,000 trips. 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.

(50) The future zonal traffic demands for each region in 2004 are illustrated in Figures-3.17 to 3.23. 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.

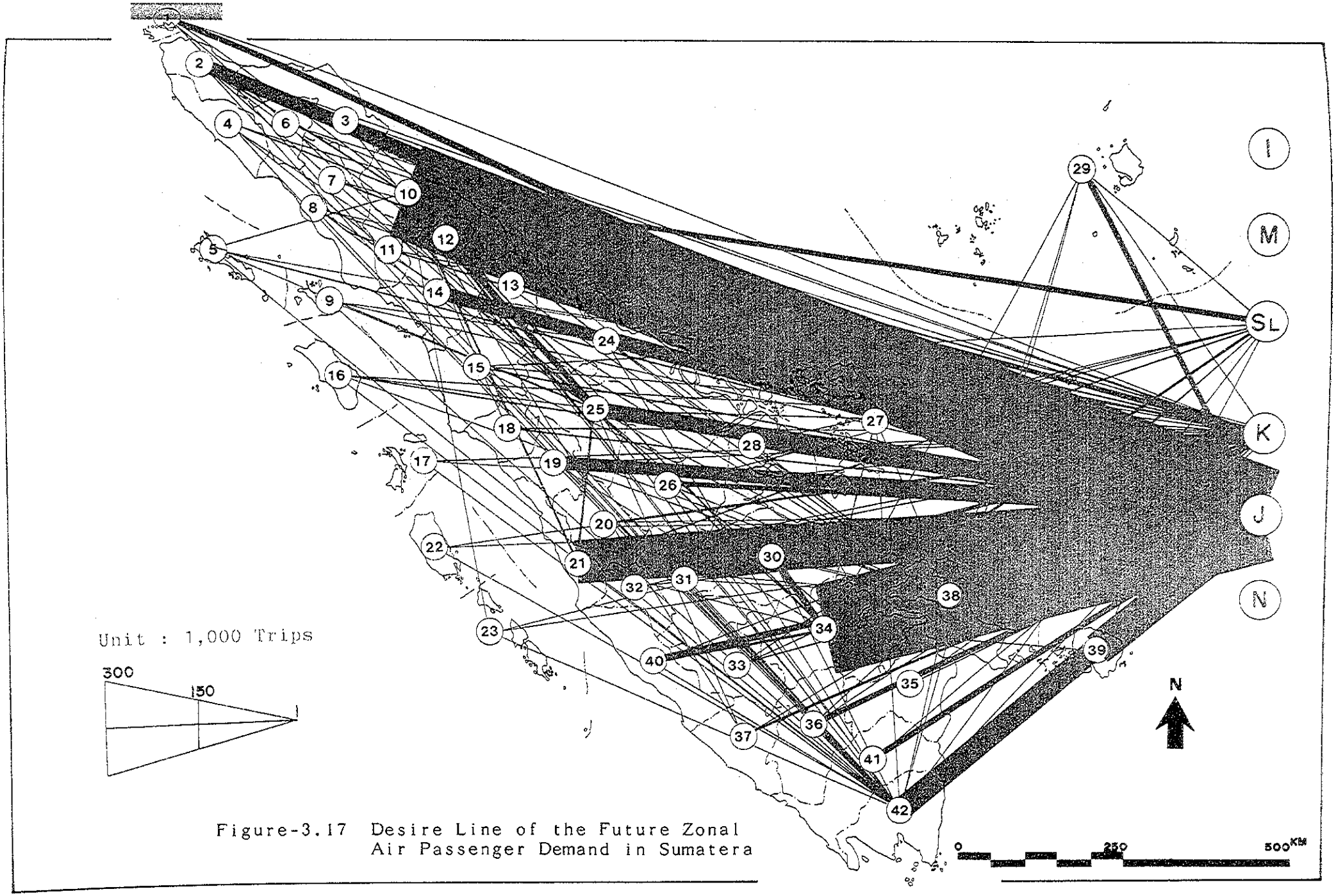


Figure-3.17 Desire Line of the Future Zonal Air Passenger Demand in Sumatera

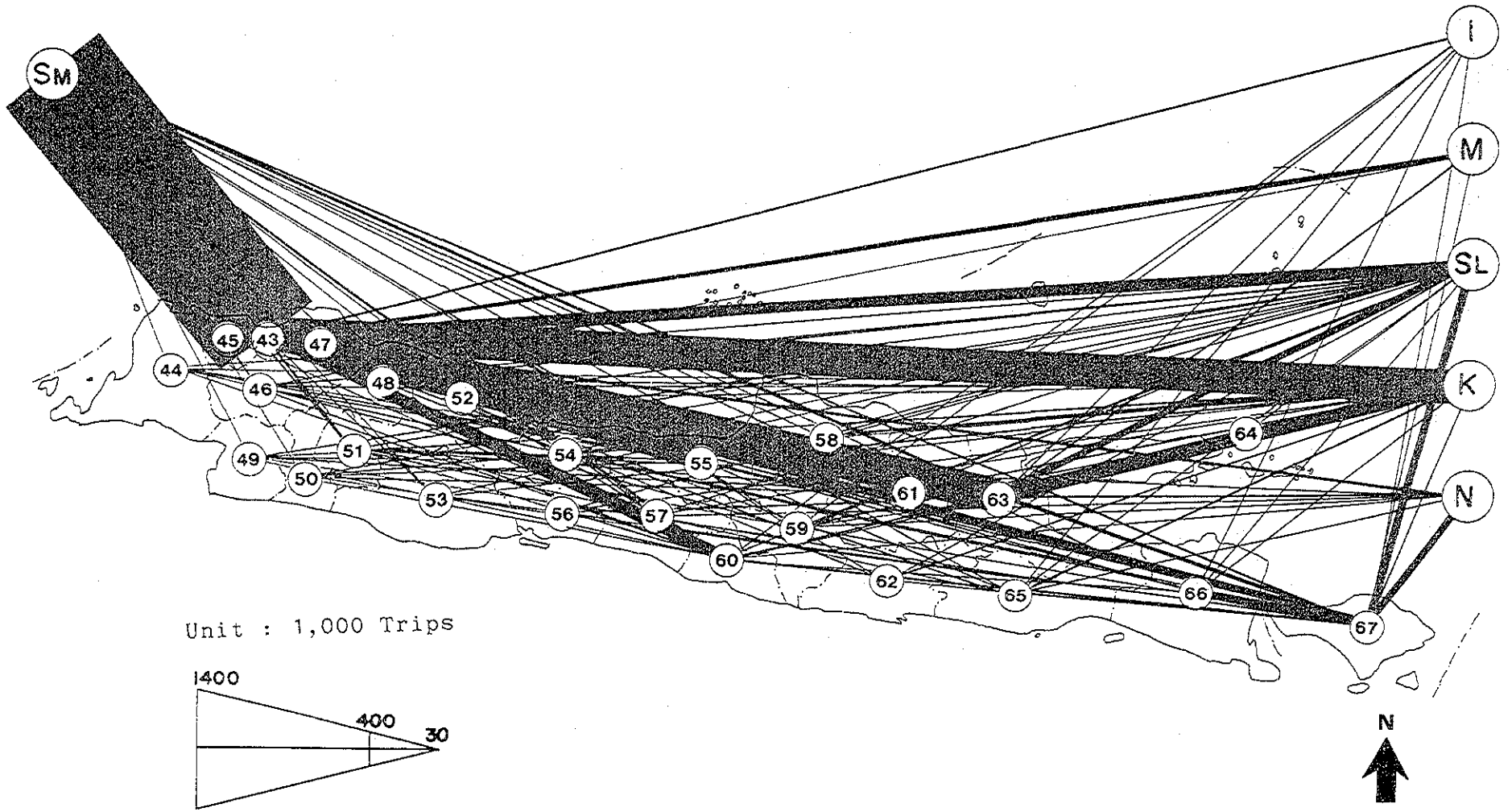
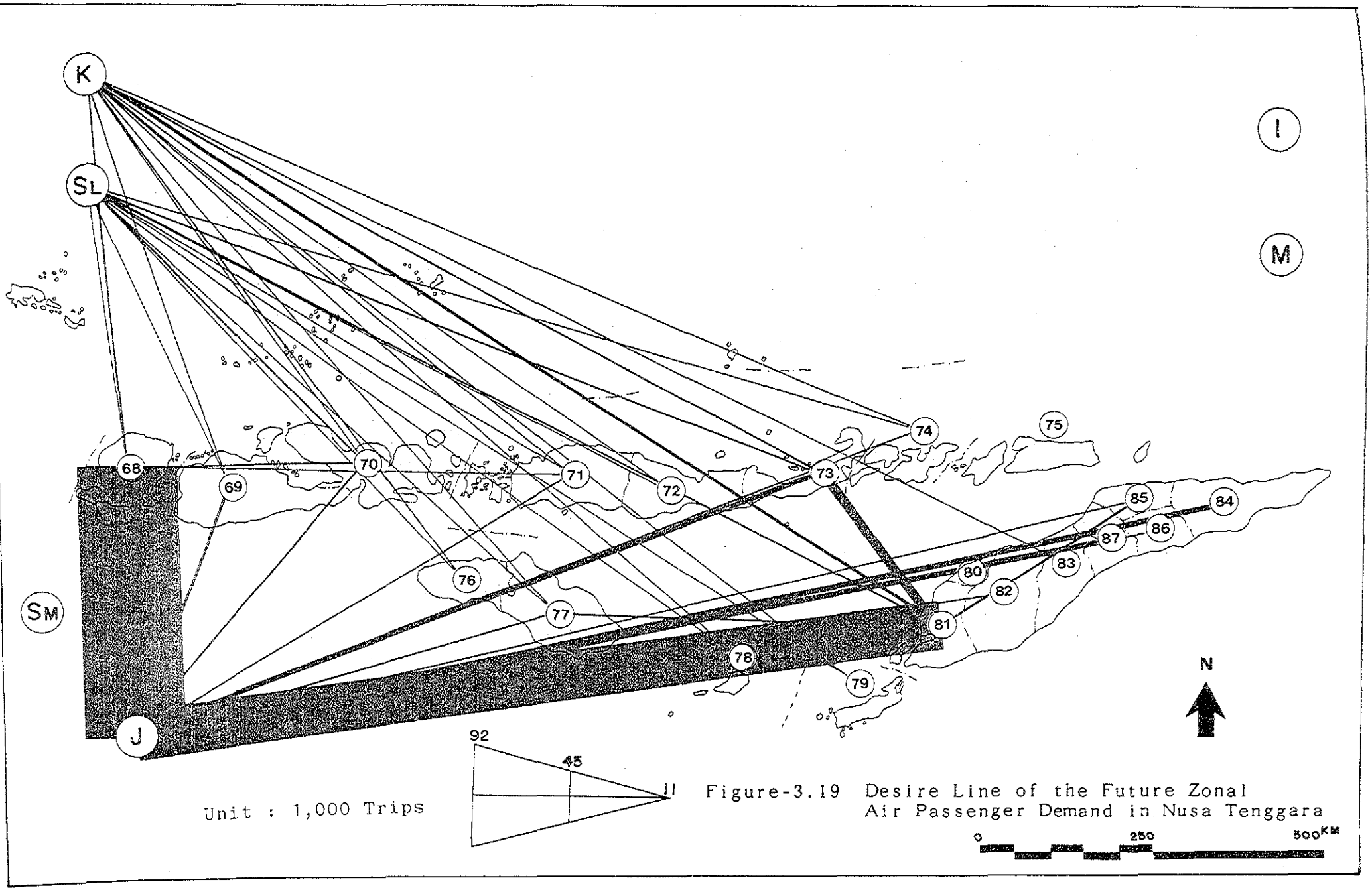


Figure-3.18 Desire Line of the Future Zonal Air Passenger Demand in Jawa/Bali



Unit : 1,000 Trips

Figure-3.19 Desire Line of the Future Zonal Air Passenger Demand in Nusa Tenggara

Figure-3.20 Desire Line of the Future Zonal Air Passenger Demand in Kalimantan

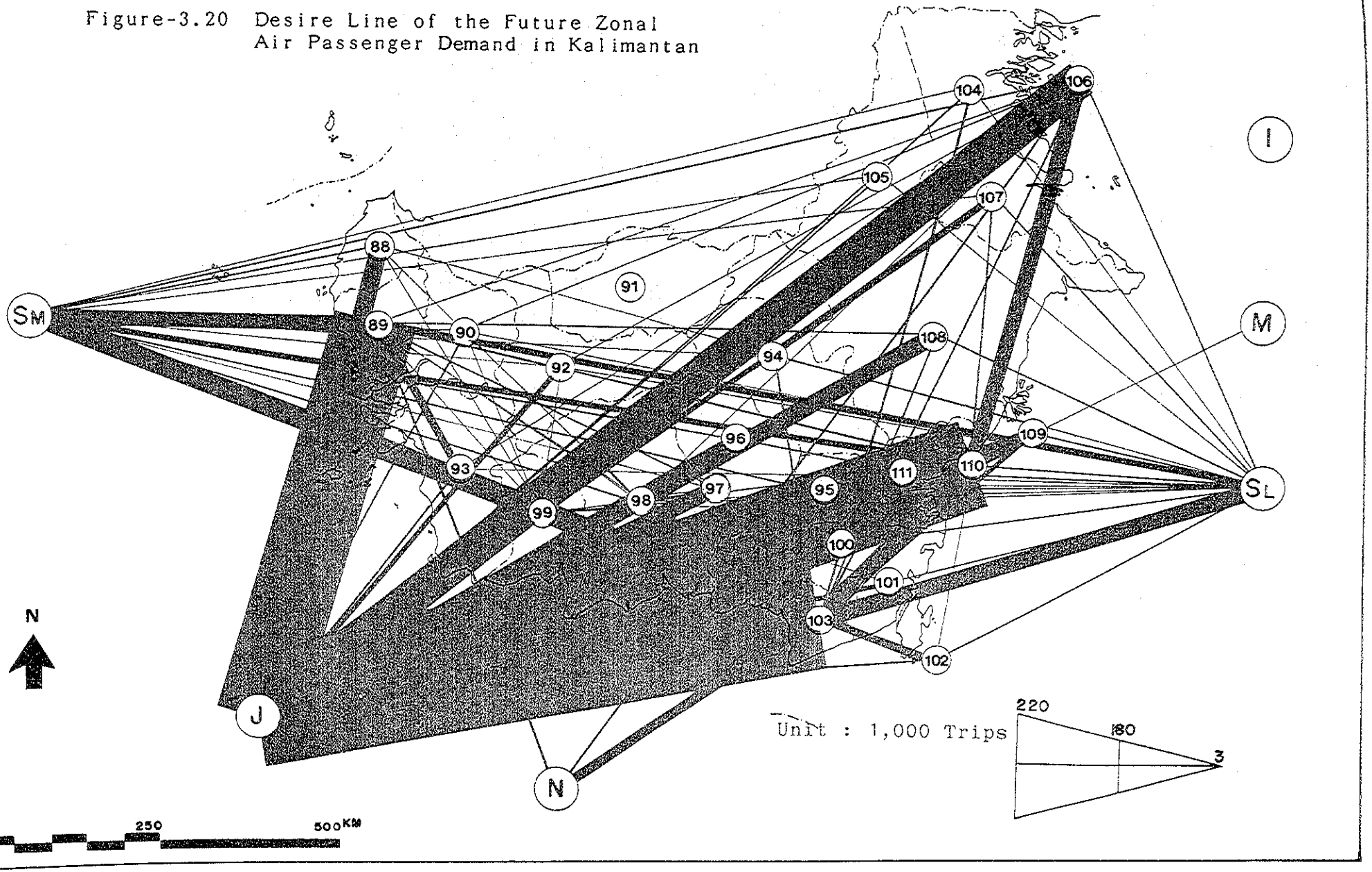


Figure-3.21 Desire Line of the Future Zonal Air Passenger Demand in Sulawesi

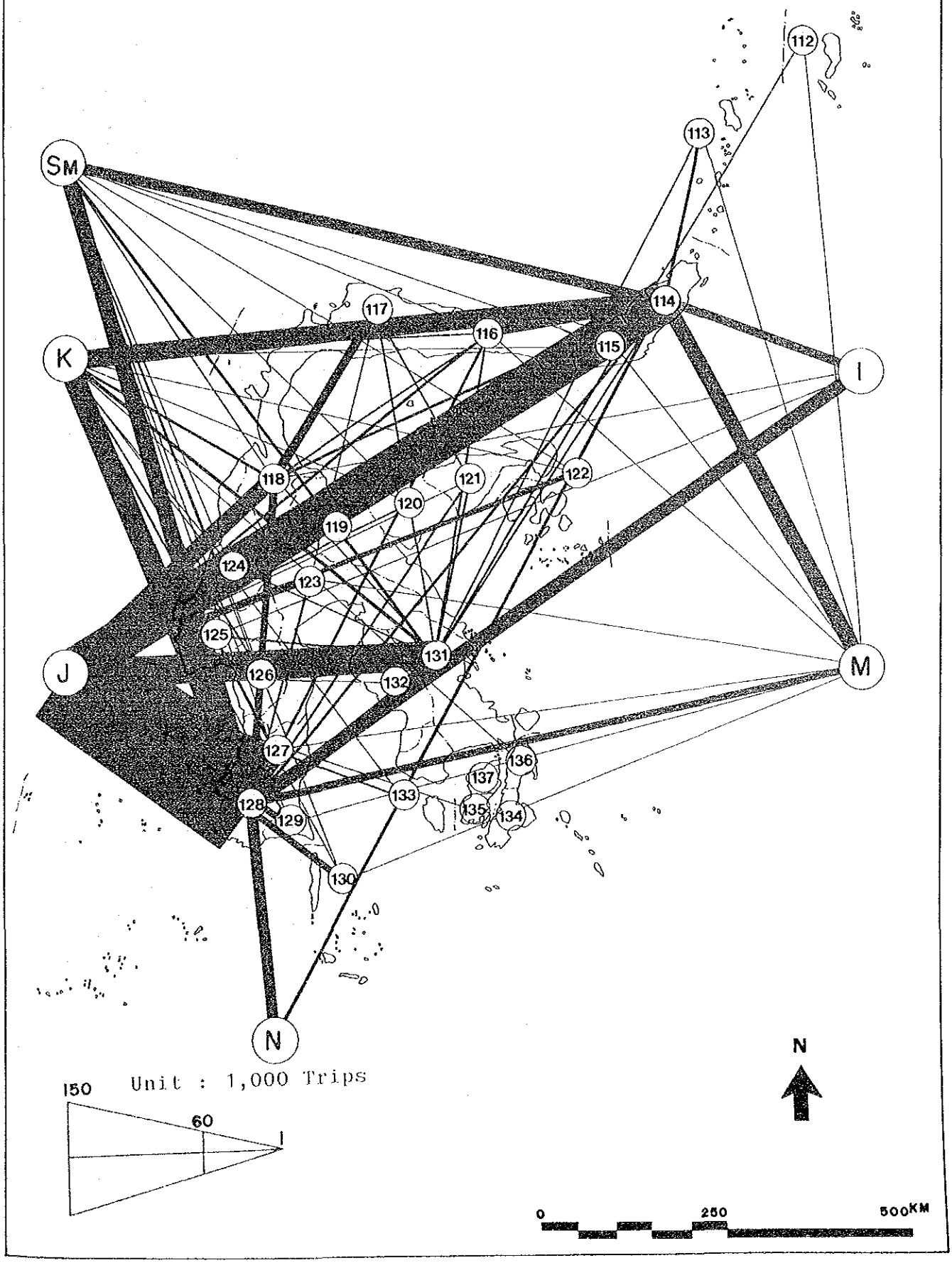


Figure-3.22 Desire Line of the Future Zonal Air Passenger Demand in Maluku

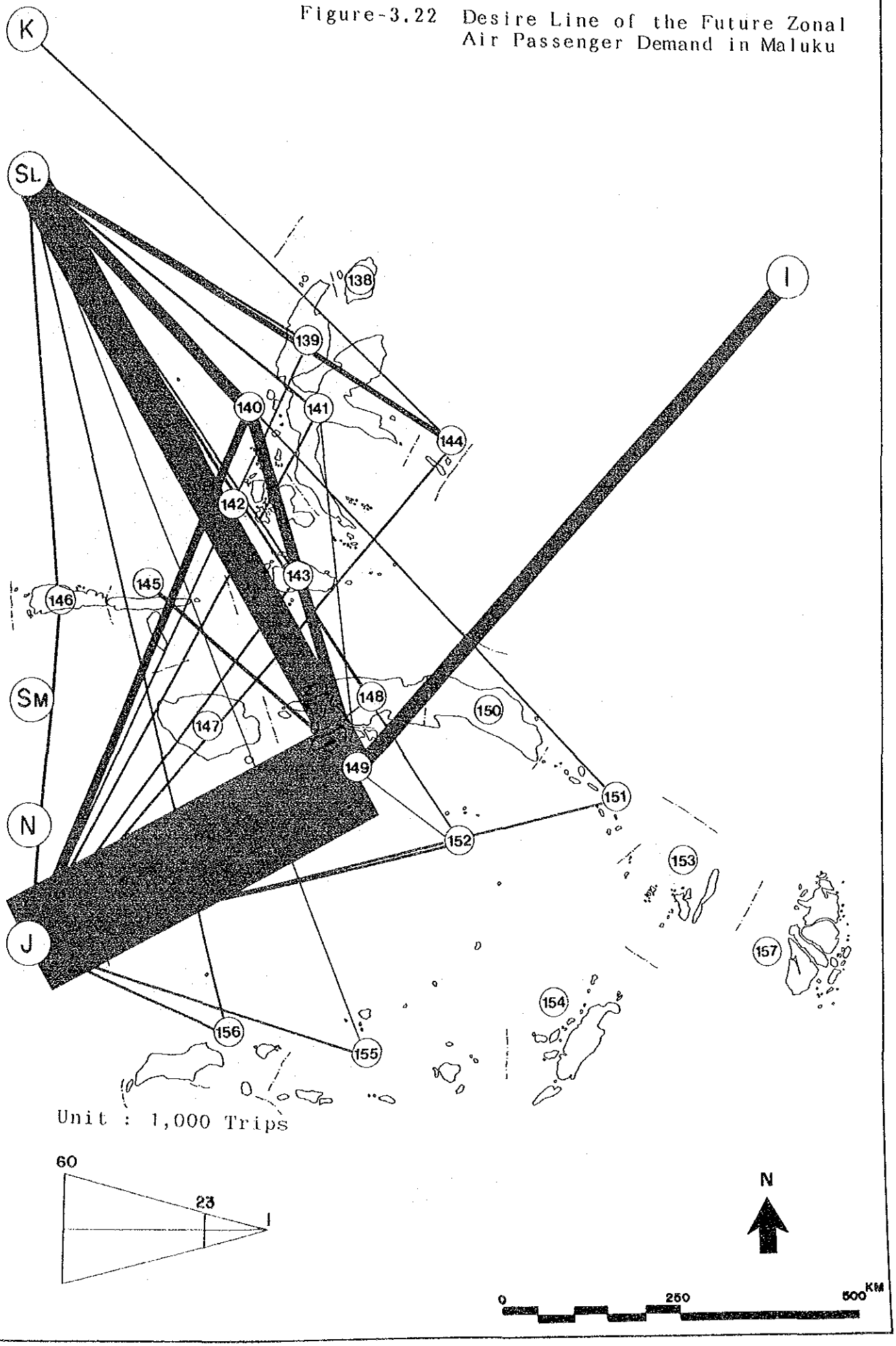
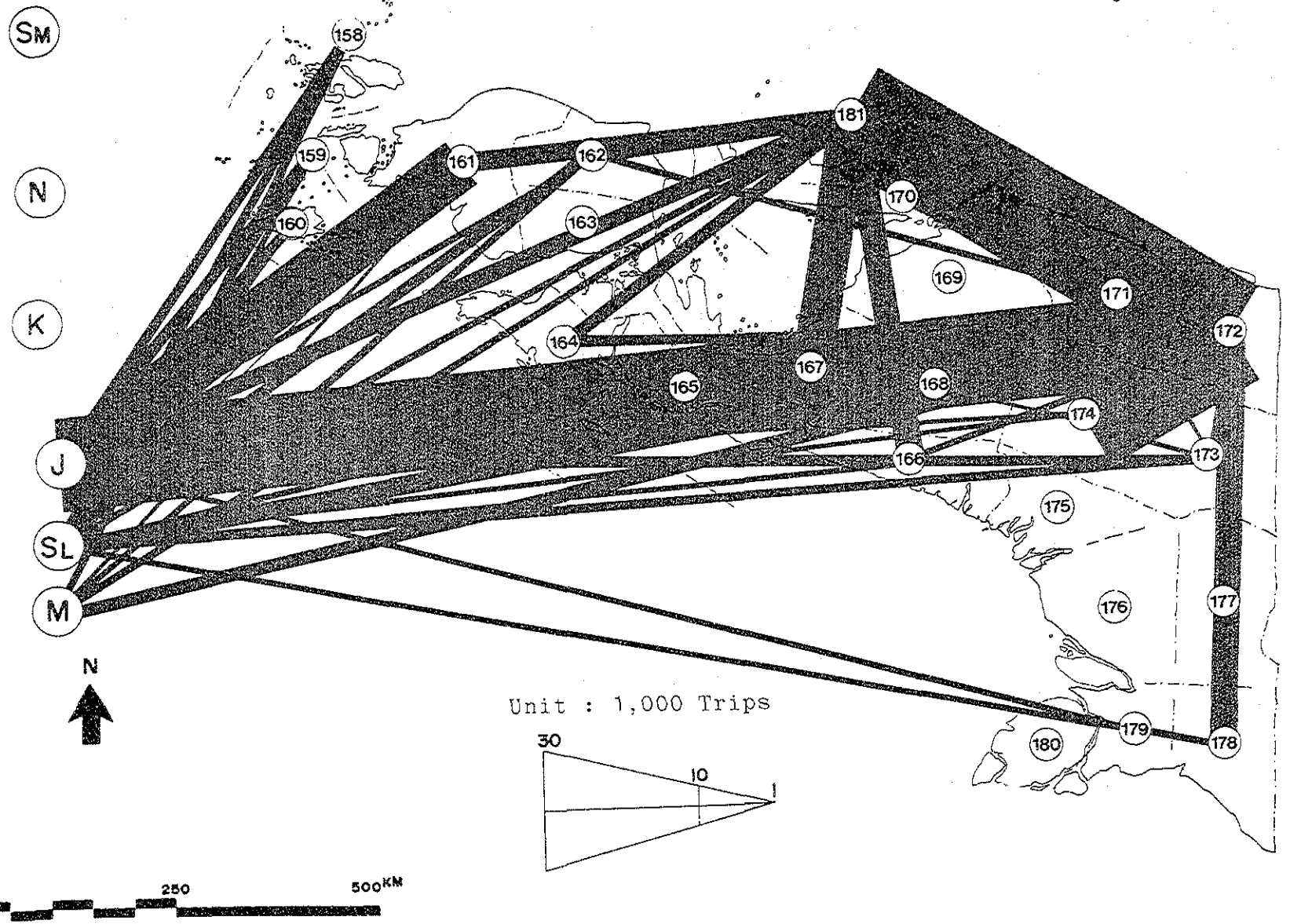


Figure-3.23 Desire Line of the Future Zonal Air Passenger Demand in Irian Jaya



- 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.

3.02.7.3 Assessment of Future Sea Passenger Demands

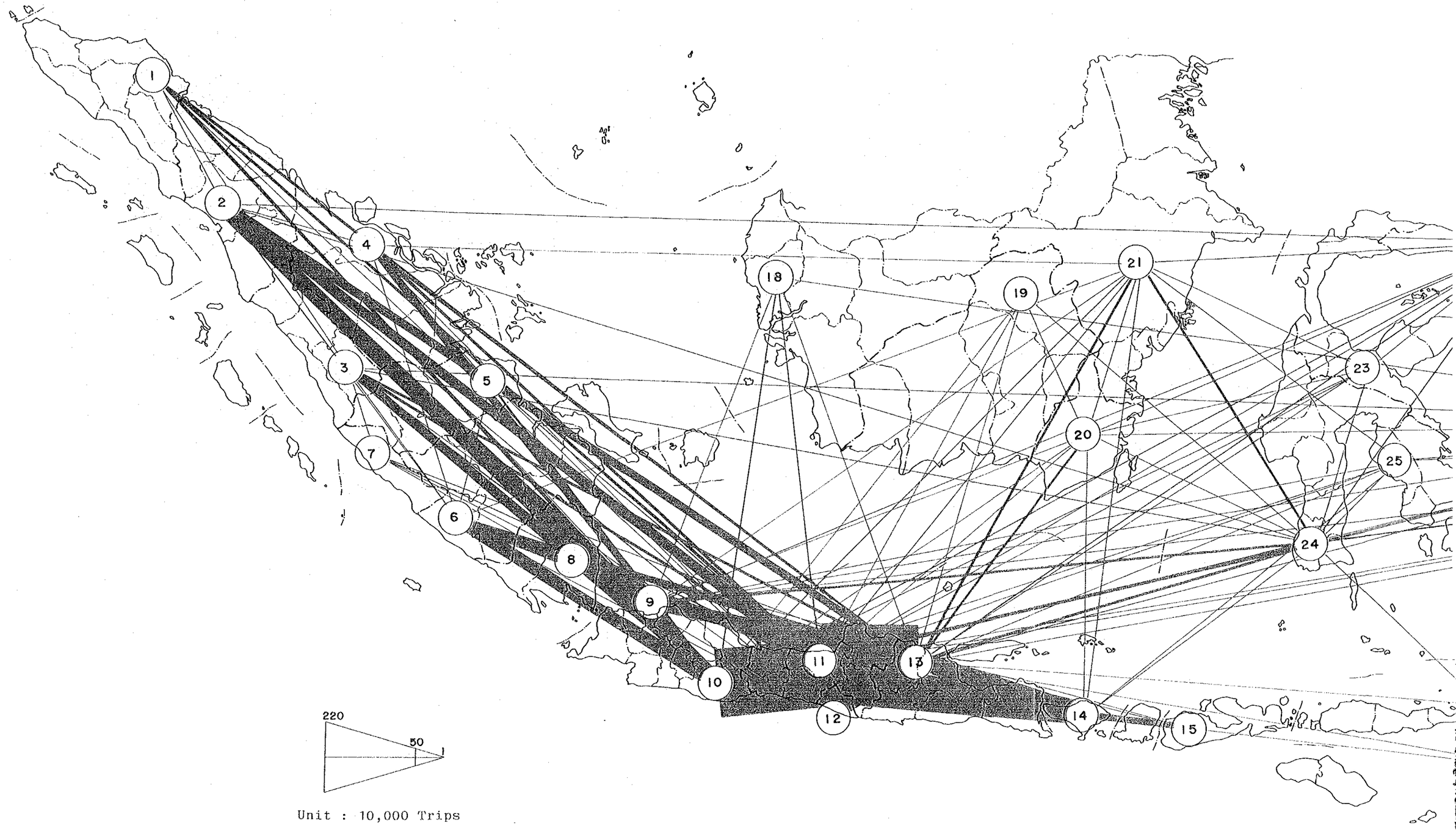
(51) Tables-3.14 and 3.15 show the future sea passenger OD tables between provinces in 1994 and 2004. The future sea passenger OD tables between zones in 1994 and 2004 are attached in the "Data Book", Sections 4 and 6, respectively. In addition, Figure-3.24 illustrates the future desire line of sea passengers 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.

Table-3.14 Future Sea Passenger OD Table Between Provinces - 1994

O / D	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	287707	5411	1768	68	128	0	0	0	17760	88218	59960	6738	63772	0	0	0	0	6	8	98	90	54	113	146	28	21	50	532144
SUM.UTA	5411	44268	5364	10516	356	1399	0	9	87351	344710	192318	20789	205063	31	396	0	0	332	49	518	787	1111	621	1101	157	130	281	923068
SUM.BAR	1768	5364	8789	0	132	2895	1599	0	49604	164410	75397	8228	78276	0	0	0	0	0	13	101	571	161	748	3358	130	673	0	402217
RIAU	68	10516	0	46219	941	5192	0	0	26565	122307	66986	7057	67654	0	2	32	4	450	6	69	5766	6	9	384	25	258	0	360516
JAMBI	128	356	132	941	1426	11130	107	22	15746	67304	42944	4761	43033	20	0	0	0	0	1	10	248	15	50	203	9	46	0	188632
SUM.SEL	0	1399	2895	5192	11130	78710	47	8205	60416	228260	138884	15195	143630	1311	1064	0	0	0	162	0	1947	634	0	165	0	0	94	699340
BENGKUL	0	0	1599	0	107	47	0	0	5978	29679	21132	2362	21024	0	0	0	0	652	0	0	0	0	0	0	0	0	0	82580
LAMPUNG	0	9	0	0	22	8206	0	0	38840	186324	119177	13148	114860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480586
JAKARTA	17760	87351	49604	26565	15746	60416	5978	38840	96	193	398	3	311823	55783	4	87	12	31	472	2429	7818	7506	501	39542	1096	1789	1279	733122
JAW.BAR	88216	344710	164410	122307	67304	228260	29679	186324	193	907	42027	10	1671936	295799	19	308	42	11308	1319	6589	16977	23255	2093	87587	4500	7949	5162	3408792
JAW.TEN	59960	192318	75397	66986	42944	138884	21132	119177	398	42027	487	37	1638226	274518	194	133	16	23875	5975	7322	6857	2276	3489	8756	2037	3473	3230	2740124
YOGYA	6738	20789	8228	7057	4761	15195	2362	13148	3	10	37	0	189879	32054	0	0	0	18181	43	19	0	0	21	3	0	0	0	318528
JAW.TIM	63774	205063	78276	67654	43033	143631	21024	114860	311823	1671936	1638226	189879	4407776	542976	5639	11696	1599	0	10532	60023	62951	18024	13395	56317	8351	18245	15176	9781879
BALI	0	31	0	0	20	1311	0	0	55783	295799	274518	32054	542976	0	134938	14	3	1408	111	1565	2205	0	562	1282	1203	25	3	1345811
NT.BAR	0	396	0	2	0	1064	0	0	4	19	194	0	5639	134938	278210	5826	76	0	78	380	173	0	0	638	18	362	95	428112
NT.TIM	0	0	0	32	0	0	0	0	87	308	133	0	11696	14	5826	13285	392	65	28	25	0	0	0	1650	0	568	46	34355
TIM.TIM	0	0	0	4	0	0	0	0	12	42	16	0	1599	3	76	392	36	41	2	6	0	0	0	581	0	4	8	2822
KAL.BAR	6	332	0	450	0	652	0	31	11308	23875	18181	0	1408	0	65	41	6	6	167	69	33	26	0	16	0	805	0	57477
KAL.TEN	8	49	13	6	1	162	0	0	472	1319	5975	43	10532	111	78	28	2	2854	2271	2781	1125	451	129	1955	62	82	6	30515
KAL.SEL	98	518	101	69	10	0	0	0	2429	6589	7322	19	60023	1565	380	25	6	167	2781	1497	2054	4922	1440	12176	684	1510	52	106437
KAL.TIM	90	787	570	5766	248	1947	0	0	7818	16977	6857	0	62949	2205	173	0	0	69	1125	2054	25745	14414	3554	54869	2189	0	0	210406
SUL.UTA	54	1111	161	6	15	634	0	0	7506	23255	2276	0	18023	0	0	0	0	33	451	4922	14414	14230	6641	16307	766	9145	8938	128888
SUL.TEN	113	621	748	9	50	0	0	0	501	2093	3489	21	13395	562	0	0	0	26	129	1440	3554	6641	1563	9869	404	72	0	41300
SUL.SEL	146	1101	3358	384	203	165	0	0	39542	87587	8756	3	56315	1282	638	1650	581	0	1955	12176	54869	16307	5869	131914	8560	14461	15268	463090
SUL.TGR	28	157	130	25	9	0	0	0	1096	4500	2037	0	8351	1203	18	0	0	16	62	684	2189	766	404	8560	702	15068	3793	49798
MALUKU	21	130	673	258	46	0	0	0	1789	7549	3473	0	18244	25	362	568	4	805	82	1510	0	9145	72	14461	15068	40778	12354	127417
IRIAN	50	281	0	0	0	94	0	0	1279	5162	3230	0	15175	3	95	46	8	0	6	52	0	8938	0	15268	3793	12353	50899	116732
TOTAL	532146	923068	402216	360516	188632	699994	81928	480616	744399	3421359	2734430	300347	9783277	1344403	428177	34131	2787	60325	27828	106339	210373	128882	41274	463108	49782	127417	116734	23794488

Table-3.15 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	360705	7142	2276	91	153	0	0	0	23658	118300	78673	8316	79818	0	0	0	0	9	10	126	121	71	139	189	32	25	64	679918
SUM.UTA	7142	61369	7262	14774	442	2028	0	9	122366	485310	265552	27458	270312	36	501	0	0	447	63	672	1087	1501	802	1487	183	180	370	1270953
SUM.BAR	2276	7262	11618	0	159	4071	1803	0	67857	226315	101497	10427	100976	0	0	0	0	0	18	130	804	213	940	4451	149	870	0	541836
RIAU	91	14374	0	62266	1148	7424	0	0	36688	170093	91052	9031	88142	0	4	45	4	599	9	95	8153	9	16	512	29	340	0	490124
JAMBI	153	442	159	1148	1578	14415	111	25	19709	84835	52901	5521	50817	22	0	0	0	0	1	11	318	20	58	246	10	55	0	232555
SUM.SEL	0	2028	4071	7424	14415	119352	57	11227	88149	336101	200291	20628	198192	1663	1471	0	0	919	218	0	2886	896	0	233	0	0	120	1010347
BENGKUL	0	0	1803	0	111	57	0	0	6979	34890	24280	2555	23152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93827
LAMPUNG	0	9	0	0	25	11227	0	0	51338	247972	155012	16098	143200	0	0	0	0	42	0	0	0	0	0	0	0	0	0	624923
JAKARTA	23658	122366	67857	36688	19709	88149	6979	51338	136	275	554	4	416257	68353	6	118	15	15446	623	3175	11132	10234	653	54112	1233	2080	1699	1002849
JAW.BAR	118300	485310	226315	170093	84835	336101	34890	247972	275	1314	58920	11	2246823	364644	20	350	73	32608	1739	8968	24762	31572	2740	120350	5297	10048	6795	4621125
JAW.TEN	78673	265552	101497	91052	52901	200291	24280	155012	554	58920	668	47	2151588	330909	254	154	28	24444	7738	9815	9676	2913	4472	11790	2281	4569	4223	3594301
YOGYA	8316	27458	10427	9031	5521	20628	2555	16098	4	11	47	0	234788	36378	0	0	0	0	53	23	0	0	21	4	0	0	0	371363
JAW.TIM	79821	270312	100976	88142	50817	198194	23152	143200	416257	2246823	2151588	234788	5549294	560625	7063	14504	1654	1822	13080	76146	84313	23069	16374	72567	8868	22403	18826	12474678
BALI	0	36	0	0	22	1664	0	0	68353	364644	330909	36378	560625	0	155606	14	3	0	127	1792	2676	0	633	1517	1398	30	3	1526430
NT.BAR	0	501	0	4	0	1471	0	0	6	20	254	0	7063	155606	347383	7097	82	87	90	488	233	0	0	826	19	455	121	521806
NT.TIM	0	0	0	45	0	0	0	0	118	350	154	0	14504	14	7097	15856	422	42	28	34	0	0	0	2068	0	690	52	41474
TIM.TIM	0	0	0	4	0	0	0	0	15	73	28	0	1654	3	82	422	36	8	2	6	0	0	0	658	0	4	8	3003
KAL.BAR	9	447	0	599	0	919	0	42	15446	32608	24444	0	1821	0	87	42	6	3760	211	89	48	38	0	22	0	1049	0	81689
KAL.TEN	10	63	18	9	1	218	0	0	623	1739	7738	53	13080	127	90	28	2	211	2773	3515	1452	572	156	2487	67	100	9	35141
KAL.SEL	126	672	130	95	11	0	0	0	3175	8968	9815	23	76146	1792	488	34	6	89	3515	1969	2860	6244	1803	15851	774	1943	62	136591
KAL.TIM	121	1087	804	8153	318	2886	0	0	11132	24762	9676	0	84311	2676	233	0	0	48	1452	2860	40378	20064	4736	77091	2635	0	0	295423
SUL.UTA	71	1501	213	9	20	896	0	0	10234	31572	2913	0	23068	0	0	0	0	38	573	6244	20064	18684	8318	21487	867	10617	11437	168826
SUL.TEN	139	802	940	16	58	0	0	0	653	2740	4472	21	16374	633	0	0	0	0	156	1803	4736	8318	1868	7385	436	103	0	51653
SUL.SEL	189	1486	4451	512	246	233	0	0	54112	120350	11790	4	72563	1517	826	2068	658	22	2487	15851	77091	21487	7385	174474	9727	18568	19586	617683
SUL.TGR	32	183	149	29	10	0	0	0	1233	5297	2281	0	8868	1398	19	0	0	0	67	774	2635	867	436	9727	683	16724	4176	55988
MALUKU	25	180	870	340	55	0	0	0	2080	10048	4569	0	22401	30	455	690	4	1049	100	1943	0	10617	103	18568	16724	51267	15508	157626
IRIAN	64	370	0	0	0	120	0	0	1699	6795	4223	0	18825	3	121	52	8	0	9	62	0	11437	0	19586	4176	15507	63473	146530
TOTAL	679921	1270952	541836	490124	232555	1010344	93827	624923	1002849	4621125	3594301	371363	12474662	1526429	521806	41474	3003	81690	35142	136591	295425	168826	51653	617688	55588	157627	146532	30848256



Unit : 10,000 Trips

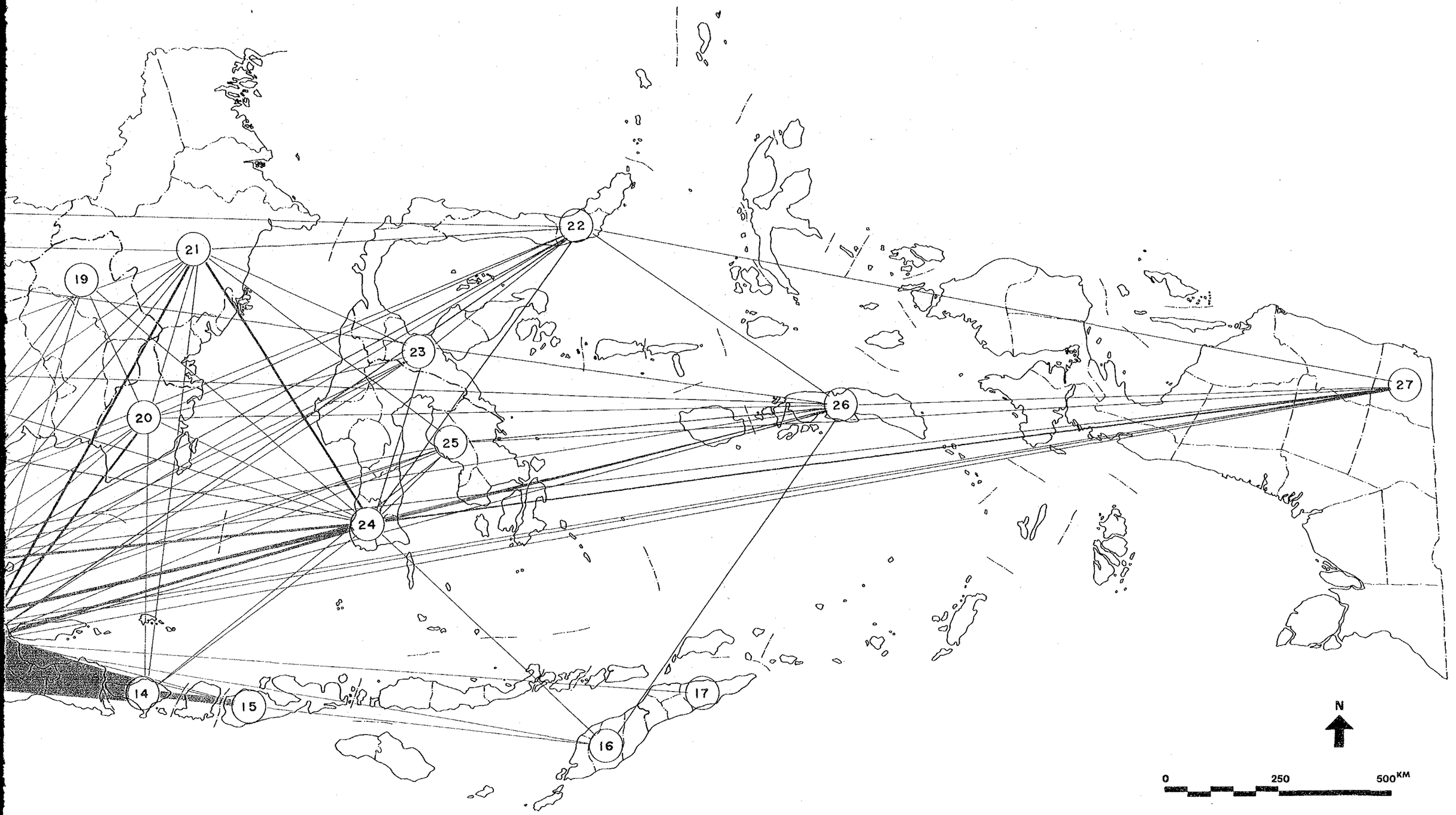


Figure-3.24 Future Desire Line of Sea Passenger Demand Between Provinces - 2004

3.02.8 Sensitivity Analysis

3.02.8.1 Change of GDP Growth Rate

(52) The future traffic demand forecast described in the previous sections was based on a moderate annual GDP growth rate of 5%. 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.

(53) Table-3.16 and Figure-3.25 show differences in forecasts of future passenger volume for each GDP growth rate. This table 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.

Table-3.16 Fluctuation of Forecast Air Passenger Demand by Changing GDP Growth Rate

Unit : 1,000 Trips

Year	GDP Growth Rate		
	4%	5%	6%
1994	8,836 (-1.3%)	8,953	9,078 (+1.4%)
2004	11,601 (-3.8%)	12,060	12,590 (+4.4%)

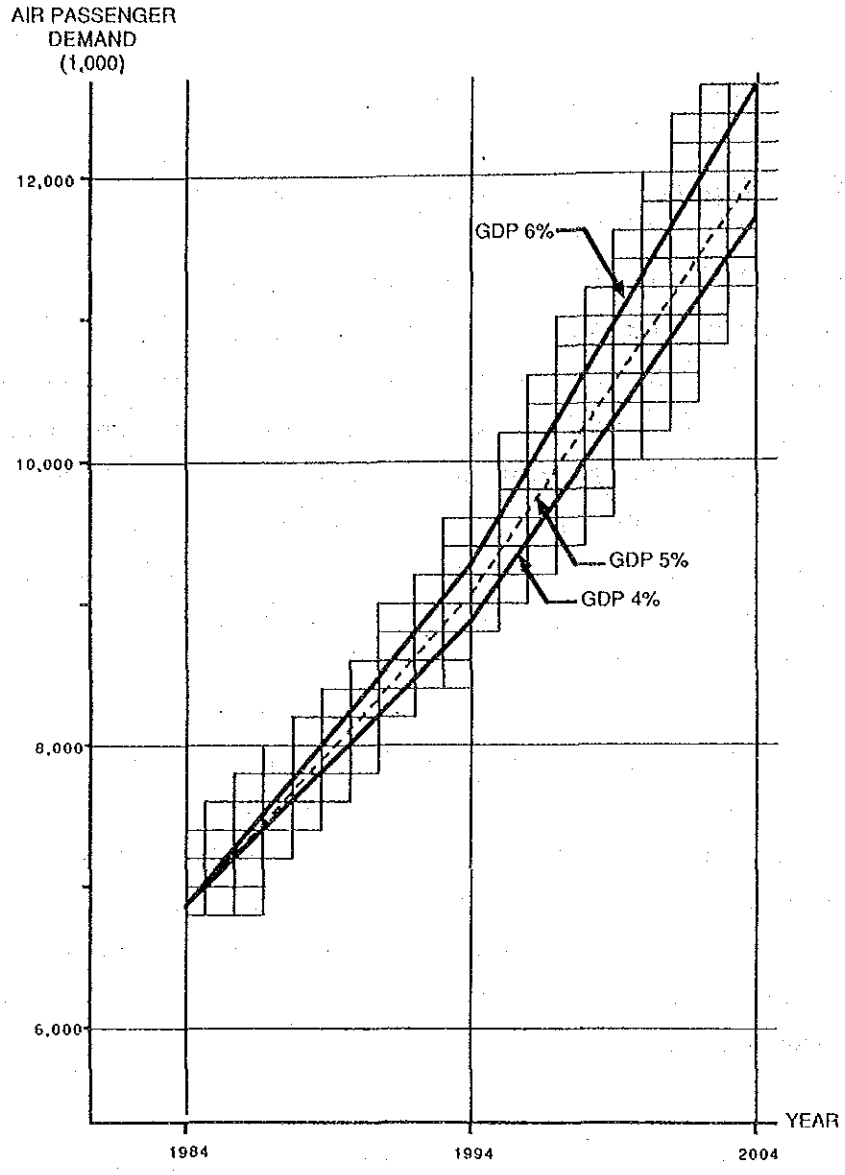


Figure-3.25 Fluctuation of Forecast Air Passenger Demand by Changing GDP Growth Rate

3.02.8.2 Change of Time Value

(54) Based on the socioeconomic indices projected in the Study, GDP per capita in 2004 is estimated to be 1.6 times that of 1984. 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 25.5% more than the case projected using present time values. The share of air transport in 2004 is estimated to reach 35.2%.

3.02.9 Preparation of Present and Future Air Cargo Demand

(55) Preparation 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 (shown in Table-3.17): 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. Table-3.18 shows the present air cargo demand between provinces, while Tables-3.19 and 3.20 respectively show the forecast future air cargo demands between provinces in 1994 and 2004.

Table-3.17 Unit Cargo Volume Per Passenger

Unit : Kg

Item	Whole Indonesia Excluding Inter-Regional Trips in Irian Jaya	Inter-Regional Trips in Irian Jaya
Cargo	9.37	54.00
Baggage	9.42	10.70
Mail	1.23	1.09

Table-3.18 Present Air Cargo OD Table Between Provinces - 1984

Unit : Ton

O \ D	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	68	263	100	284	61	212	62	231	714	113	31	0	78	84	0	0	0	46	0	72	4	5	0	6	0	0	0	2435
SUM.UTA	263	102	199	481	49	217	38	133	2523	403	91	291	154	247	6	0	0	129	50	93	87	52	32	91	58	0	0	5789
SUM.BAR	100	199	38	167	33	150	21	101	1749	106	33	145	63	85	0	0	0	73	49	52	55	6	15	90	2	4	0	3335
RIAU	284	481	167	23	45	287	50	139	2439	124	20	49	68	98	0	0	0	31	33	64	13	24	0	41	0	0	0	4481
JAMBI	61	49	33	45	0	182	0	58	1114	24	17	0	46	36	0	0	0	29	0	31	0	6	0	20	0	0	0	1749
SUM.SEL	212	217	150	287	182	873	135	57	4115	342	98	41	226	75	0	0	0	111	66	91	75	44	29	101	64	0	7	7598
BENGKUL	62	38	21	50	0	135	0	20	189	59	0	0	12	12	0	0	0	9	0	10	0	0	0	7	0	0	0	624
LAMPUNG	231	133	101	139	58	57	20	0	777	80	0	0	77	40	0	0	0	18	0	21	0	11	0	13	0	0	0	1775
JAKARTA	714	2523	1749	2439	1114	4115	189	777	202	435	2770	1514	4119	1505	338	218	82	1785	370	700	1087	412	205	1005	156	644	294	31461
JAW.BAR	113	403	106	124	24	342	59	80	435	55	239	129	477	387	42	35	6	230	43	221	207	98	33	171	142	102	75	4375
JAW.TEN	31	91	33	20	17	98	0	0	2770	239	17	0	275	138	33	39	31	108	71	187	240	75	0	75	142	47	63	4860
YOGYA	0	291	145	49	0	41	0	0	1514	129	0	0	94	450	33	20	131	47	5	28	161	8	6	45	0	8	71	3277
JAW.TIM	78	154	63	68	46	226	12	77	4119	477	275	94	35	824	246	422	31	194	416	1117	1554	100	177	993	270	278	193	12541
BALI	84	247	85	98	36	75	12	40	1505	387	138	450	824	357	580	413	166	48	82	56	89	13	86	893	107	136	119	7127
NT.BAR	0	6	0	0	0	0	0	0	338	42	33	33	246	580	298	213	42	22	0	44	0	20	0	42	0	0	4	1963
NT.TIM	0	0	0	0	0	0	0	0	218	35	39	20	422	413	213	1070	230	73	7	133	62	93	0	219	0	34	0	3279
TIM.TIM	0	0	0	0	0	0	0	0	82	6	51	131	31	166	42	230	0	17	0	30	8	25	0	38	0	0	0	858
KAL.BAR	46	129	73	31	29	111	9	18	1785	230	108	47	194	48	22	73	17	433	271	99	254	50	32	115	69	0	0	4294
KAL.TEN	0	50	49	33	0	66	0	0	370	43	71	5	416	82	0	7	0	271	105	419	237	48	0	65	0	0	7	2342
KAL.SEL	72	93	52	64	31	91	10	21	700	221	187	28	1117	56	44	133	30	99	419	239	502	92	80	172	101	0	0	4653
KAL.TIM	4	87	55	13	0	75	0	0	1087	207	240	161	1554	89	0	62	8	254	237	502	992	151	55	230	0	17	0	6080
SUL.UTA	5	52	6	24	6	44	0	11	412	98	75	8	100	13	20	93	25	50	48	92	151	445	171	231	225	326	176	2907
SUL.TEN	0	32	15	0	0	29	0	0	205	33	0	6	177	86	0	0	0	32	0	80	55	171	431	391	238	72	23	2076
SUL.SEL	6	91	90	41	20	101	7	13	1005	171	75	45	993	893	42	219	38	115	65	172	230	231	391	163	348	389	493	6446
SUL.TGR	0	58	2	0	0	64	0	0	156	142	142	0	270	107	0	0	0	69	0	101	0	225	238	348	0	85	7	2015
MALUKU	0	0	4	0	0	0	0	0	644	102	47	8	278	136	0	34	0	0	0	0	17	326	72	389	85	901	214	3257
IRIAN	0	0	0	0	0	7	0	0	294	75	63	71	193	119	4	0	0	0	7	0	0	176	23	493	7	214	13712	15458
TOTAL	2435	5789	3335	4481	1749	7598	624	1775	31461	4375	4860	3277	12541	7127	1963	3279	858	4294	2342	4653	6080	2907	2076	6446	2015	3257	15458	147053

Table-3.19 Future Air Cargo OD Table Between Provinces - 1994

Unit : Ton

O 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	83	341	126	362	71	288	68	287	991	151	40	0	100	93	0	0	0	54	0	100	5	7	0	6	0	0	0	3171
SUM.UTA	341	140	266	647	60	312	43	174	3734	554	124	405	222	290	8	0	0	161	62	136	124	72	38	105	66	0	0	8084
SUM.BAR	126	266	48	217	39	209	23	129	2473	142	44	184	85	97	0	0	0	88	57	73	76	7	17	101	2	5	0	4507
RIAU	362	647	217	31	56	447	56	179	3672	168	26	65	95	113	0	0	0	38	40	92	19	32	0	47	0	0	0	6402
JAMBI	71	60	39	56	0	247	0	68	1476	28	21	0	65	38	0	0	0	33	0	40	0	7	0	22	0	0	0	2269
SUM.SEL	288	312	209	447	247	1319	162	78	6324	495	137	54	314	93	0	0	0	147	85	139	112	63	37	122	78	0	9	11269
BENGKUL	68	43	23	56	0	162	0	22	231	65	0	0	13	12	0	0	0	10	0	13	0	0	0	7	0	0	0	725
LAMPUNG	287	174	129	179	68	78	22	0	1102	107	0	0	104	45	0	0	0	21	0	29	0	14	0	15	0	0	0	2374
JAKARTA	991	3734	2473	3672	1476	6324	231	1102	314	637	4008	2056	5819	1879	461	231	64	2395	482	1092	1664	607	261	1240	190	833	394	44630
JAW.BAR	151	554	142	168	28	495	65	107	637	74	327	165	637	474	54	33	4	294	52	324	299	193	39	200	163	127	94	5857
JAW.TEN	40	124	44	26	21	137	0	0	4008	327	22	0	362	160	42	38	37	134	86	274	339	97	0	84	161	55	77	6696
YOGYA	0	405	184	65	0	54	0	0	2056	165	0	0	117	492	40	19	90	54	6	38	214	10	7	48	0	9	83	4154
JAW.TIM	100	222	85	95	65	314	13	104	5819	637	362	117	45	999	306	405	22	239	495	1588	2159	132	204	1133	305	322	242	16526
BALI	93	290	97	113	38	93	12	45	1879	474	160	492	999	358	637	352	104	51	86	70	109	15	88	887	105	140	128	7914
NT.BAR	0	8	0	0	0	0	0	0	461	54	42	40	306	637	357	198	29	26	0	60	0	24	0	45	0	0	4	2291
NT.TIM	0	0	0	0	0	0	0	0	231	33	38	19	405	352	198	770	122	66	6	142	65	89	0	184	0	29	0	2749
TIM.TIM	0	0	0	0	0	0	0	0	64	4	37	90	22	104	29	122	0	12	0	24	6	18	0	23	0	0	0	554
KAL.BAR	54	161	88	38	33	147	10	21	2395	294	134	54	239	51	26	66	12	492	302	132	329	60	34	121	72	0	0	5366
KAL.TEN	0	62	57	40	0	85	0	0	482	52	86	6	495	86	0	6	0	302	114	548	301	56	0	67	0	0	8	2852
KAL.SEL	100	136	73	92	40	139	13	29	1092	324	274	38	1588	70	60	142	24	132	548	373	764	130	102	213	124	0	0	6618
KAL.TIM	5	124	76	19	0	112	0	0	1664	299	339	214	2159	109	0	65	6	329	301	764	1470	208	68	276	0	21	0	8628
SUL.UTA	7	72	7	32	7	63	0	14	607	153	97	10	132	15	24	89	18	60	56	130	208	565	197	257	249	379	210	3657
SUL.TEN	0	38	17	0	0	37	0	0	261	39	0	7	204	88	0	0	0	34	0	102	68	197	449	393	239	75	25	2273
SUL.SEL	6	105	101	47	22	122	7	15	1240	200	84	48	1133	887	45	184	23	121	67	213	276	257	393	160	337	397	520	7011
SUL.TGR	0	66	2	0	0	78	0	0	190	163	161	0	305	105	0	0	0	72	0	124	0	249	239	337	0	86	8	2185
MALUKU	0	0	5	0	0	0	0	0	833	127	55	9	322	140	0	29	0	0	0	0	21	379	75	397	86	955	236	3668
IRIAN	0	0	0	0	0	9	0	0	394	94	77	83	242	128	4	0	0	0	8	0	0	210	25	520	8	236	15693	17731
TOTAL	3171	8084	4507	6402	2269	11269	725	2374	44630	5857	6696	4154	16526	7914	2291	2749	554	5366	2852	6618	8628	3657	2273	7011	2185	3668	17731	190161

Table-3.20 Future Air Cargo OD Table Between Provinces - 2004

Unit : Ton

O \ D	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	104	449	162	471	83	397	74	357	1320	202	51	0	131	108	0	0	0	70	0	128	6	9	0	8	0	0	0	4129
SUM.UTA	449	194	360	885	74	452	50	228	5230	799	163	516	307	352	11	0	0	218	80	184	179	97	49	142	77	0	0	11096
SUM.BAR	162	360	64	290	47	297	26	164	3383	199	59	233	110	115	0	0	0	116	73	96	106	9	21	134	3	6	0	6072
RIAU	471	885	290	42	69	639	64	231	5071	234	36	83	124	135	0	0	0	51	51	122	26	42	0	63	0	0	0	8726
JAMBI	83	74	47	69	0	320	0	80	1847	35	25	0	77	41	0	0	0	39	0	49	0	8	0	26	0	0	0	2820
SUM.SEL	397	452	297	639	320	1999	196	107	9273	745	197	74	441	118	0	0	0	208	115	197	168	89	49	174	95	0	12	16361
BENGKUL	74	50	26	64	0	196	0	25	270	77	0	0	15	12	0	0	0	11	0	14	0	0	0	8	0	0	0	841
LAMPUNG	357	228	164	231	80	107	25	0	1457	143	0	0	129	51	0	0	0	27	0	37	0	17	0	19	0	0	0	3071
JAKARTA	1320	5230	3383	5071	1847	9273	270	1457	445	907	5582	2695	7768	2303	615	301	75	3272	635	1490	2418	828	339	1696	225	1121	524	61090
JAW.BAR	202	799	199	234	35	745	77	143	907	106	458	218	857	589	72	43	5	409	68	445	437	216	51	281	193	173	129	8091
JAW.TEN	51	163	59	36	25	197	0	0	5582	458	31	0	476	193	55	48	42	180	111	367	486	133	0	113	188	72	100	9168
YOGYA	0	516	233	83	0	74	0	0	2695	218	0	0	144	558	49	23	97	69	7	48	288	12	8	61	0	11	102	5296
JAW.TIM	131	307	110	124	77	441	15	129	7768	857	476	144	56	2491	385	495	26	307	614	2060	2990	172	252	1464	345	418	307	22961
BALI	108	352	115	135	41	118	12	51	2303	589	193	558	2491	380	734	397	106	61	98	84	138	18	99	1050	103	162	147	10642
NT.BAR	0	11	0	0	0	0	0	0	615	72	55	49	385	734	446	242	31	33	0	77	0	31	0	58	0	0	5	2845
NT.TIM	0	0	0	0	0	0	0	0	301	43	48	23	495	397	242	919	131	84	7	178	86	112	0	232	0	36	0	3332
TIM.TIM	0	0	0	0	0	0	0	0	75	5	42	97	26	106	31	131	0	13	0	27	7	20	0	26	0	0	0	607
KAL.BAR	70	218	116	51	39	208	11	27	3272	409	180	69	307	61	33	84	13	649	384	174	461	79	43	160	82	0	0	7199
KAL.TEN	0	80	73	51	0	115	0	0	635	68	111	7	614	98	0	7	0	384	140	694	407	71	0	85	0	0	10	3653
KAL.SEL	128	184	96	122	49	197	14	37	1490	445	367	48	2060	84	77	178	27	174	694	490	1066	175	128	284	140	0	0	8752
KAL.TIM	6	179	106	26	0	168	0	0	2418	437	486	288	2990	138	0	86	7	461	407	1066	2143	292	91	384	0	29	0	12209
SUL.UTA	9	97	9	42	8	89	0	17	828	216	133	12	172	18	31	112	20	79	71	175	292	742	247	339	282	512	269	4820
SUL.TEN	0	49	21	0	0	49	0	0	339	51	0	8	252	99	0	0	0	43	0	128	91	247	537	494	258	92	31	2790
SUL.SEL	8	142	134	63	26	174	8	19	1696	281	113	61	1464	1050	58	232	26	160	85	284	384	339	494	211	383	516	669	9081
SUL.TGR	0	77	3	0	0	95	0	0	225	193	188	0	345	103	0	0	0	82	0	140	0	282	258	383	0	95	8	2478
MALUKU	0	0	6	0	0	0	0	0	1121	173	72	11	418	162	0	36	0	0	0	0	29	512	92	516	95	1211	296	4750
IRIAN	0	0	0	0	0	12	0	0	524	129	100	102	307	147	5	0	0	0	10	0	0	269	31	669	8	296	19551	22160
TOTAL	4129	11096	6072	8726	2820	16361	841	3071	61090	8091	9168	5296	22961	10642	2845	3332	607	7199	3653	8752	12209	4820	2790	9081	2478	4750	22160	255041

3.03 INTER-REGIONAL TRAFFIC DEMAND FORECAST

3.03.1 Objective of the Inter-Regional Traffic Demand Forecast

(56) 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.

3.03.2 Study Method

(57) The basic study method of the inter-regional traffic demand forecast is shown in Figure-3.26. The Phase-1 study projected present and future traffic demands for passengers and cargo according to each transport mode between regions (primary zones). 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

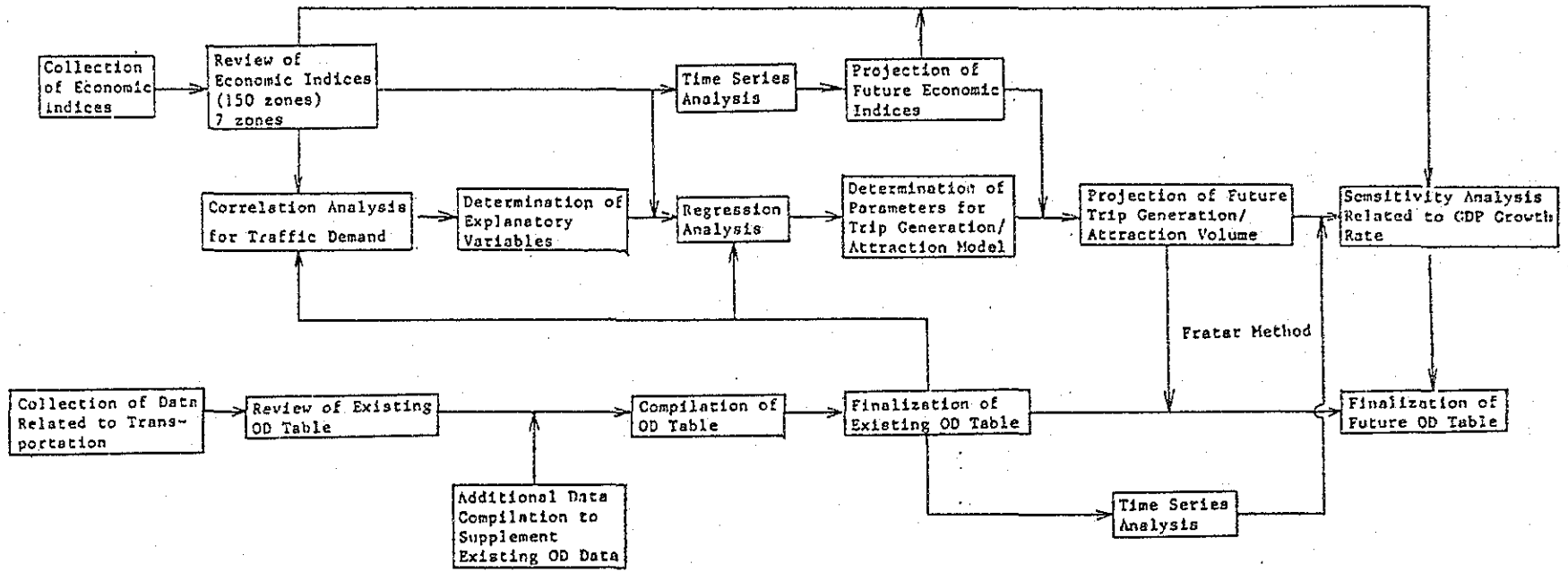


Figure-3.26 Flowchart of Inter-Regional Traffic Demand Forecast

3.03.3 Zoning

(58) 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-3.21 shows details of primary zones.

Table-3.21 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.

3.03.4 Collection and Review of Existing Traffic Data

(59) Prior to the collection of traffic data, the results of various past studies were carefully reviewed. The data, as described in Para-(08), were collected from the agencies concerned and were compiled by computer for use in the traffic demand forecast.

(60) Most of the data obtained during the course of the Phase-1 study were OD data of each transport mode, and thus were based on the gross movements. However, under the category of gross movements, most trips can be considered as access trips to/from terminals of the main modes of transport within the movement from an origin to a destination. Therefore, types of movements can be identified as either gross movements or net movements depending on the zone size, which includes terminals of the main modes of transport. In this case, all intra-zone trips can be considered as gross movements.

(61) Based on the concept mentioned above, since primary zones covered regions and were sufficiently large in size, the obtained OD data related to each transport mode were assumed to be net movements for the forecasts of inter-regional traffic demands.

3.03.5 Supplementary Arrangement for Collected Data

(62) During the course of data compilation, collected data were examined from the following points of view and several problems were found. This sub-section primarily discusses these problems relating to collected traffic data and supplementary arrangements for these data.

- Whether collected data cover all of Indonesia.
- Whether collected data cover all major modes of transport and their routes.
- Whether collected data cover annual movements of passengers and cargo.
- Whether collected data can be utilized as the OD data for forecasting traffic demands.

3.03.5.1 Air Transport Data

(63) The air transport passenger/cargo OD have been com-

piled yearly by the Central Bureau of Statistics, however, there are some problems to be solved and some arrangements for these data were required as described below.

- There are many cases where destinations are only identified as "Others (Lain lain)". These OD pairs were assumed to be intra-region OD pairs.
- There are no baggage data between 1976 and 1980. The following unit volume was used to estimate baggage volume by number of passengers.
  * Domestic flight : 9.26 kg/person
- There are many cases where OD volumes differ greatly from their complementary volumes. In order to solve this problem, each OD volume was assumed to be the average of the OD volume and its complementary volume, ((OD+DO)/2).
- The statistics revealed that origin airports numbered about 80 (mostly primary and secondary airports), while destination airports numbered almost 600 (including small scale aerodromes). This implies that there were no OD data from about 520 airports. In this case, complementary volumes were assumed to be equivalent to OD volumes from the origin airports.
- There was no OD data for movements between about 520 small scale aerodromes. These OD volumes, however, were assumed to be quite limited, and were therefore neglected in the data compilation.

3.03.5.2 Sea Transport Data

(64) Regarding passengers/cargo carried by sea transport, the DGSC has compiled OD data related to 47 ports in Indonesia for 1984 and 1985. However, since these data do not cover all shipping sectors, some supplemental arrangements were required for these OD data.

- Passenger/cargo volumes carried by the pioneer fleets were supplemented by OD data between ports obtained from PT. PELNI.

- Numbers of passengers carried by passenger fleets were supplemented by OD data between ports obtained from PT. PELNI.
- Passenger/cargo volumes carried by ferry boats were supplemented by passenger/cargo volume data on each ferry route compiled by the DGLC.
- Regarding passengers carried by the Local and Rakyat fleets, only the total number of passengers were available. Therefore, passenger OD carried by these fleet types were estimated from the cargo distribution pattern of each fleet type.
- The original OD data treated every cargo movement related to the Sabang port under the classification of foreign trade, because the Sabang port is a free port. In the Study, however, cargo movements between the Sabang port and other Indonesian ports were considered as domestic trade from the traffic demand forecast point of view.

3.03.5.3 Land Transport Data

(65) Every 5 years since 1972, the Department of Transport, Communications and Tourism has carried out a comprehensive OD survey for road transport and the 1982 OD data were employed. However, this data required some arrangements.

- Since this OD data was prepared from the OD survey carried out in 1982, it was necessary to convert the data to 1984 figures. The OD data were converted by using the growth rate of traffic volume at certain links in each region, which has been tallied by the BINA MARGA every year.
- Since seasonal fluctuations in vehicle traffic were not available, this OD data was converted from daily movements to yearly movements simply by using 365 days as the conversion factor.

- Maluku and Irian Jaya were excluded from the OD survey, hence there were no OD data for these regions. Furthermore, there was no traffic volume data on road links in Irian Jaya. In order to estimate OD volume in these regions, correlation factors between OD volume and number of registered vehicles in Kalimantan were utilized.

(66) PJKA has compiled passenger/cargo volumes between railway stations every year and it was possible to utilize this data as the railway OD data in the Study.

(67) DGLC has compiled the total volume of passengers and cargo, but not OD data, carried by inland waterway transport systems in each region every year. Since the inland waterway transport systems only carry intra-region passengers and cargo, these total volume were added to the intra-region OD volume.

3.03.6 Finalization of Present OD Table

(68) The present passenger and cargo OD tables for each transport mode were finalized after the completion of supplemental data arrangements for collected traffic data. OD tables for each transport mode were prepared for different durations, depending on the availability of traffic data; i.e., 10 years (1976-1985) for air transport, 2 years (1983 and 1984) for sea transport, and 1 year (1984) for land transport. Passenger movements to/from other foreign countries by sea transport were excluded from this OD table, because these data were not available. Finalized present OD tables for each transport mode are presented in Appendix-3.2.

3.03.7 Collection and Review of Economic Indices

(69) In order to determine explanatory variables and parameters in the trip generation/attraction models, it was necessary to carry out correlational analyses on traffic demand. For this purpose, basic economic indices in each province were collected and reviewed, as shown below. These economic indices can directly reflect the governmental development policy, which was a very important factor in the construction of the trip attraction/generation models in the Study. Furthermore, these indices are the basis for the projection of other economic indices, hence it is reasonable to utilize these indices for the forecast of traffic demand.

- Population.
- Number of employees by type of industry.
- GRDP by type of industry.

3.03.8 Construction of Trip Generation/Attraction Models

3.03.8.1 Selection of Explanatory Variables

(70) The present and past traffic demands and economic indices in each region were used to perform correlational analyses to select suitable explanatory variables in the trip generation/attraction models for forecasting passenger and cargo movements by each transport mode. The following indices were selected as explanatory variables for trip attraction/generation models.

- Air passenger : 1) Number of employees in tertiary industry.
  2) Total GRDP.
- Air cargo : 1) Total number of employees.
  2) Total GRDP.
- Sea passenger : 1) Population.
  2) Total GRDP.
- Sea cargo : 1) Population.

2) Number of employees in primary industry.

- Land passenger : 1) Population.
  2) Total GRDP.
- Land cargo : 1) Population.
  2) Total GRDP.

3.03.8.2 Determination of Trip Generation/Attraction Models

(71) In order to determine parameters in the trip generation/attraction models, multiple regression analyses were carried out. Parameters of models were determined from the results of multiple regression analyses with selected explanatory variables in several types of formulae. The reliability of these developed models were later confirmed by the results of traffic demand forecasts.

- Air Transport
  * Air passenger demand

    $Y = 300625 + 0.120\ X1 + 0.111\ X2 \quad (R = 0.980)$

    where Y : Passenger demand in each region (unit : person)
    X1 : Number of employees in tertiary industry in each region (unit : person)
    X2 : Total GRDP in each region (unit : mill. Rp)

  * Air cargo demand

    $Y = 0.4924\ X1 + 3633.68\ X2 \quad (R = 0.928)$

    where Y : Cargo demand in each region (unit : kg)
    X1 : Total number of employees in each region (unit : person)
    X2 : Total GRDP in each region (unit : mill. Rp)

- Sea Transport
  * Sea passenger demand

    $Y = EXP\ (0.402) * X1 \quad * X2 \quad (R = 0.983)$

where Y : Passenger demand in each region
(unit : person)
X1 : Population in each region
(unit : person)
X2 : Number of employees in tertiary industry in each region
(unit : person)

* Sea cargo demand

Y = EXP (-5.9048) * X1 * X2 (R = 0.942)

where Y : Cargo demand in each region
(unit : 100 tons)
X1 : Population in each region
(unit : 1,000 persons)
X2 : Number of employees in primary industry in each region
(unit : 1,000 persons)

- Land Transport

* Land passenger demand

$Y = EXP (-8.6563) \times X1^{0.9908} \times X2^{0.5530}$ (R = 0.929)

where Y : Passenger demand in each region
(unit : 1,000 persons)
X1 : Population in each region
(unit : 1,000 persons)
X2 : Total GRDP in each region
(unit : mill. Rp)

* Land cargo demand

Y = EXP (-8.6563) * X1 * X2 (R = 0.929)

where Y : Cargo demand in each region
(unit : 1,000 tons)
X1 : Population in each region
(unit : 1,000 persons)
X2 : Total GRDP in each region
(unit : mill. Rp)

3.03.9 Projection of Future Economic Indices

(72) The procedure described in Para-(34) was used to project future economic indices, which are only indices selected as explanatory variables.

3.03.10 Forecast of Future Trip Attraction/Generation Volume

(73) The developed trip attraction/generation models and projected future economic indices in each region were used to forecast future trip generation/attraction volume of passenger and cargo movements for each transport mode.

3.03.11 Finalization of Future OD Table

(74) Following the forecast of future trip generation and attraction volume, two types of analyses were conducted to finalize the future OD tables for each transport sector: the Frater method to predict the future OD table, and time series analysis to obtain the present OD table. Finalized future OD tables for each transport mode are presented in Appendix-3.3.

(75) Table-3.22 summarizes the present and future traffic demands of passenger movements for each transport mode and the expected modal split, while the present and future cargo movements for each transport mode are summarized in Table-3.23.

Table-3.22 Present and Future Traffic Demand of Passengers

Unit : Million Persons

Transport Mode	1984	1994	2004	Annual Growth Rate (1984/2004)
Air Transport Passenger No. Share	7.0 (0.4%)	9.4 (0.4%)	13.0 (0.5%)	3.1%
Sea Transport Passenger No. Share	18.6 (1.2%)	25.3 (1.2%)	33.2 (1.1%)	2.9%
Land Transport Passenger No. Share	1,536.0 (98.4%)	2,092.0 (98.4%)	2,844.0 (98.4%)	2.8%
Total Passenger No.	1,561.6	2,126.7	2,890.2	3.1%

Table-3.23 Present and Future Traffic Demand of Cargo

Unit : Million Tons

Transport Mode	1984	1994	2004	Annual Growth Rate (1984/2004)
Air Transport Cargo Volume Share	0.2 (0.4%)	0.2 (0.4%)	0.3 (0.5%)	3.0%
Sea Transport Cargo Volume Share	37.6 (1.2%)	47.3 (1.2%)	65.3 (1.1%)	2.8%
Land Transport Cargo Volume Share	187.4 (98.4%)	279.2 (98.4%)	440.2 (98.4%)	4.4%
Total Cargo Volume	225.2	326.7	505.8	4.1%

SECTION 4

POTENTIAL NEW AIR ROUTES AND FUTURE AIR NETWORK

SECTION 4
POTENTIAL NEW AIR ROUTES AND FUTURE AIR NETWORK

4.01 CONCEPT OF IDENTIFICATION OF POTENTIAL NEW AIR ROUTES

(01) 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.

4.02 BASIC METHOD FOR SELECTION OF NEW AIR ROUTES

(02) 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-4.1. 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.

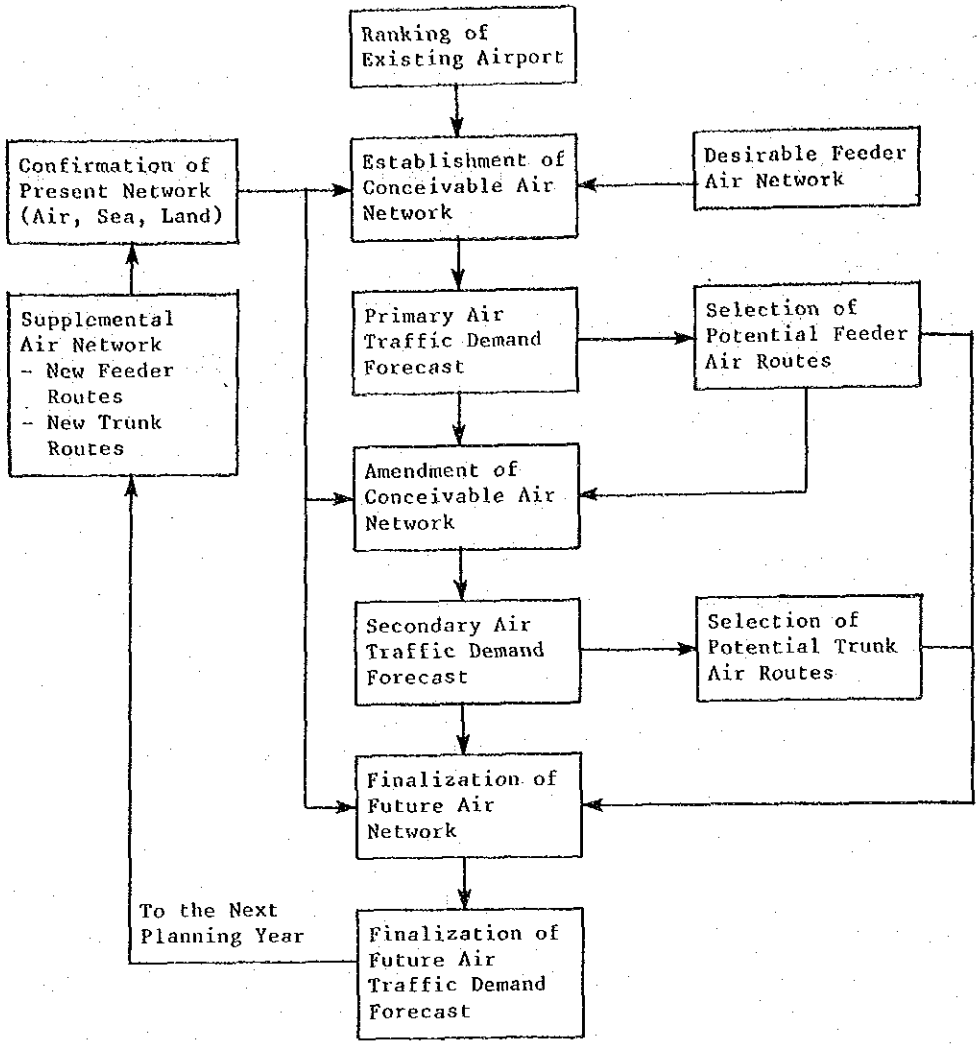


Figure-4.1 Process for the Selection of Potential New Air Routes

(03) 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) 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) 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) 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) 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 described in Section 3, Paras-(36)-(39). Then, OD volumes of both air and sea transport are obtained on the basis of these results and developed modal split models, described in Section 3 Para-(43). 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) 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.

4.03 SELECTED POTENTIAL NEW AIR ROUTES

(09) Tables-4.1 and 4.2 show the selected potential new feeder routes and trunk routes, respectively. Potential new air routes for years 1994 and 2004 are illustrated in Figures-4.2 and 4.3, 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).

Table-4.1 Potential New Feeder Air Routes

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-4.2 Potential New Trunk Air Routes

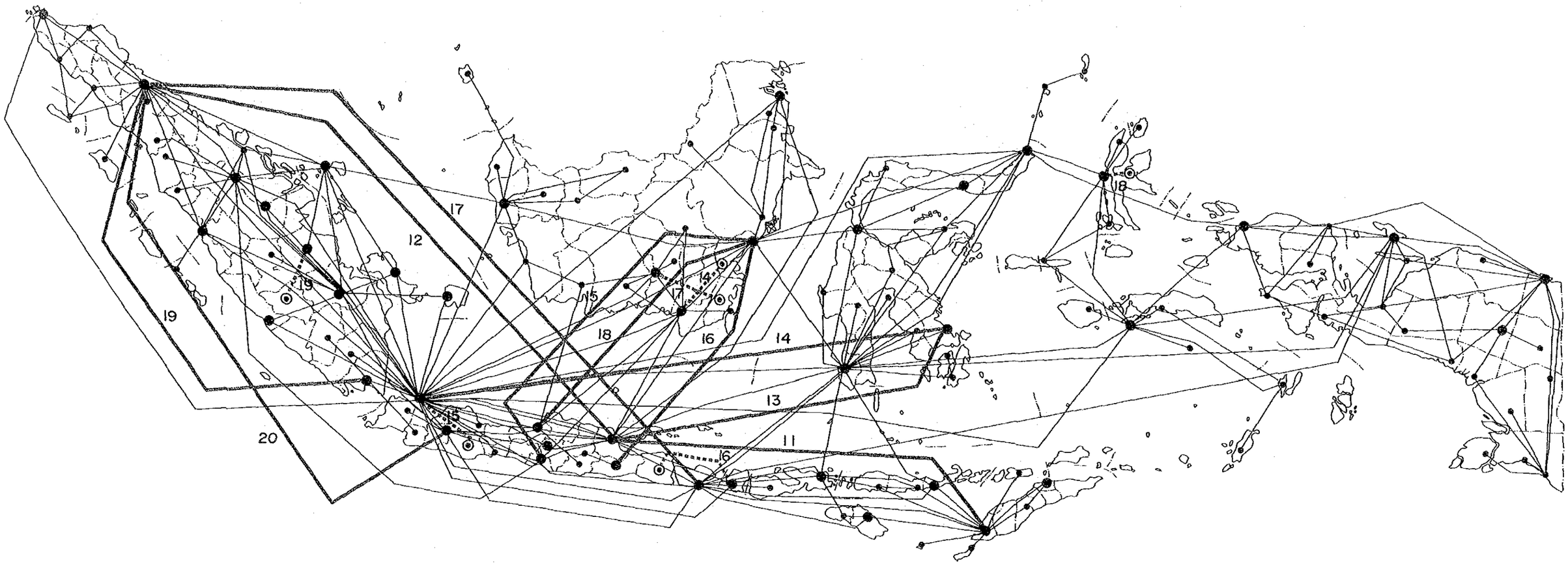
Year	New Trunk Air Routes				Distance	Passenger Demand **
	No. *	City Name (Airport Name)	Zone No.	City Name (Airport Name)	Zone No.	(Km)	(Trips)
1994	1	Banda Aceh (Blang Bintang)	2	Jakarta (Soekarno Hatta)	43	1,803	124,584 156,618
	2	Jakarta (Soekarno Hatta)	43	Ambon (Patimura)	149	2,414	119,894 160,614
	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-4.2 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-4.3 Potential New Air Routes for 2004

(10) In addition, as shown in Table-4.3, 5 feeder routes and 8 trunk routes were highlighted by passengers during the air passenger survey and concerned officials during the hearings.

4.04 FORMATION OF THE FUTURE AIR NETWORK

(11) 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 described in the following Section 5 of this report.

Table-4.3 Potential New Air Routes Highlighted by Passengers/Officials

Year	New Feeder Routes				Distance	Passenger Demand **
	No. * City Name (Airport Name)	Zone No.	City Name	Zone No.	(Km)	(Trips)
1994	2 Pontianak (Supadio)	89	Singkawang	88	123	61,990 83,498
	12 Pontianak (Supadio)	89	Batang Tarang	90	240	23,320 30,866
2004	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
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
	3 Jakarta (Soekarno Hatta)	43	Manado (Sam Ratulangi)	114	2,208	106,160 142,794
	9 Jakarta (Soekarno Hatta)	43	Mataram (Selaparang)	68	1,075	41,372 81,910
2004	12 Medan (Polonia)	10	Surabaya (Juanda)	63	1,954	66,356
	15 Yogyakarta (Adi Sucipto)	60	Balikpapan (Sepinggan)	110	1,023	50,528
	16 Malang (Malang)	65	Balikpapan (Sepinggan)	110	890	46,200
	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.

SECTION 5

STUDY ON AIRCRAFT

SECTION 5

STUDY ON AIRCRAFT

5.01 MODEL FOR PREPARATION OF AIRCRAFT SPECIFICATIONS

(01) Input and output data for preparation of aircraft specifications will be;

- Air route stage length and airport facilities' data (input)
- Air traffic demand of an air route (input)
- Standard number of passenger seats (output)
- Maximum cruising speed (output)
- Maximum range (output)
- Takeoff distance (output)
- Landing distance (output)

The actual calculation of the above items is to be executed by using a computer program of TCHART. The program also provides the following data required for aircraft operating cost estimation;

- Type of aircraft, such as conventional airplane, short takeoff and landing (STOL) airplane , helicopter and amphibian.
- Number of aircraft required.
- Parameters relating to aircraft operation such as passenger load factor, utilization and frequency.

Aircraft operating cost including direct and indirect costs is similarly to be estimated based on a computer program TCHART.

(02) The aircraft specifications are to be studied based on a computer program of TCHART. The program covers the uestions listed below.

- Maximum range with maximum payload
- Number of Passenger seats
- Takeoff field length at maximum takeoff weight
- Landing distance at maximum landing weight
- Type of aircraft
- Maximum cruising speed at maximum takeoff weight
- Passenger load factor
- Flight frequency and adjusted passenger load factor
- Flight frequency check
- Number of aircraft
- Annual utilization of aircraft

(03) Once an air route is selected, the stage length of air route, that is; the distance between the airports at both ends of the air route, be given by the equation in section 3.03 of Report Part II.
The equation gives the distance of a great circle route calculated on longitude and latitude of airports concerned.

(04) Location of airports, longitude and latitude, is available in Section 5.04. Given the stage length of a selected air route, the required range performance of an aircraft to be allocated to the specific air route be calculated by the following equation.

Maximum range with maximum payload
$\geq$ 2.0 * air route stage length

(05) Once the maximum range with maximum payload is provided as stated before, the standard number of passenger seats can be calculated as below.

1) $0 \leq SN < 100$

Maximum Range (km) = 40 * SN

Where,

SN : Number of passenger seats

2) $100 \leq SN$

Maximum Range (km) = (155 * SN + 20,500)/9

Similarly, the equations are expressed as follows.

1) $0 \leq MR < 4{,}000$ km, at maximum payload

SN = MR / 40

Where,

SN ; Number of passenger seats

MR : Maximum range in km

2) 4,000 km $\leq$ MR, at maximum payload

SN =(9 * MR - 20,500)/155

(06) In relation with the above, the aircraft is classified by the maximum number of seats available.

Aircraft	Maximum Number of Seats
1	10
2	20
3	35
4	50
5	70
6	100
7	150
8	225
9	340
10	510

These 10 types of aircraft with number of seats available