SECTION 3

AIRCRAFT

SECTION 3

AIRCRAFT

3.01 PRESENT SITUATIONS

(01) The civil air transportation covers domestic and international air routes, including the scheduled flight, the non-scheduled flight, the general aviation flight, Haji flight and transmigration flight. The major airlines serving the civil air scheduled transport are ;

- GARUDA INDONESIA
- MERPATI NUSANTARA AIRLINES
- BOURAQ INDONESIA AIRLINES
- MANDARTA AIRLINES

In addition to the above airlines, some 20 airlines operate the non-scheduled flight.

(02) The civil air services are classified into Scheduled Operation, Non-scheduled Operation, Supplementary Airline Operation, Airial Work and General Aviation.
The major four airlines stated-above serves the scheduled flights. The aircraft operated in each mode of operation are tabulated below.

Table - 3.1 Numbers of Aircraft in 1984

Mode of Operation	Owners	Aircraft	M.T.O.W (LBS)
Scheduled Operation	4	161	21,818,339
Non-scheduled Operation	20	193	3,001,382
Supplementary Operation	5	61	449,436
Airial Works	3	10	33,881
General Aviation	50	351	4,342,168
Total	78	788	29,645,206

M.T.O.W: Max. Takeoff Weight in lb.

In terms of the maximum takeoff weight, the aircraft assigned to the scheduled operation occupies about 74 percent of total aircraft takeoff weight.

(03) Air Transport Statistics for 1985 show that the passengers carried by the Government airlines including the domestic and international passengers come up to 5.5

millions and those transported by the private airlines correspond to 1.1 millions approximately in 1984. The Table-3.2 below depicts the historical trend of the air transport activities in Indonesia.

Table-3.2 (1) Production of Government Airline Services for Domestic and International Flight.

Description	Unit	1981	1982	1983	1984
Aircraft - km	000	117,604	126,559	114,989	122,886
Aircraft Departure	Number	144,018	144,300	142,963	146,223
Pax. Carried	000	6,073	5,918	5,561	5,531
Pax. Load Factor	%	54.6	49.8	52.5	52.0

Table-3.2 (2) Production of Private Airline Services for Domestic Flight.

Discription	Unit	1981	1982	1983	1984
Aircraft - km	000	15,683	15,128	14,674	19,155
Aircraft Departure	Number	22,895	24,949	29,833	36,784
Pax. Carried	000	653	597	644	1,163
Pax. Load Factor	%	74.8	68.7	69.9	65.5

(04) The domestic air freights are counted at about 74.7 thousands tons for the Government airlines and 5.5 thousands tons for the private airlines in 1984. The historical trend of the cargo movement does not show any significant fluctuation.

(05) The aircraft employed for the civil aviation from the year of 1977 to 1985 are tabulated below.

Table - 3.3 Number of Civil Air Craft Registered

FIXED WING, M.T.O.W

YEAR	above 10,000 Kg	below 10,000 Kg	Helicopter	Total Fleet
1977	157	276	165	598
1978	162	290	158	610
1979	166	288	166	620
1980	187	300	169	656
1981	202	335	178	715
1982	223	357	182	762
1983	229	365	187	781
1984	218	364	206	788
1985	215	356	201	772

Source : Statistic Angkutan Udara 1985

The percentage increase of the numbers of aircraft is 40 % for the aircraft above 10,000 Kg, 29 % for the aircraft below 10,000 Kg and 20 % for the helicopter, and about 30 % on an average of the total numbers of aircraft, during the above 8 - years.

(06) In the light of the maximum take off weight (M.T.O.W), the fixed wing aircraft above 30,000 lbs or 13,600 kg occupies about 90 % of the total, corresponding to 27,846,967 lbs or 12,631,161 kg. The next follows the aircraft of the size of 10,000 to 15,000 lbs class which contributes to about 4.5 %.
While, in the light of the available number of the fixed wing aircraft, those below 50,000 or 2,270 kg in M.T.O.W. are counted up 161 numbers or 28 % which are ranked at the second, next to the aircraft above 30,000 lbs class. The latter is registered 188 numbers or 33 % of the total of the civil aviation aircraft.

(07) The aggregate M.T.O.W. of the helicopter corresponds to 1,596,906 lbs or 724,343 kg. Adding that of the fixed wing, 27,846,967 lbs stated-above, the total M.T.O.W. of the civil aviation aircraft amounts to 29,443,873 lbs or 13,355,502 kg, which can be broken down by classification of operation as follows.

Table - 3.4 Number of Aircraft and M.T.O.W.

OPERATION	NUMBERS	M.T.O.W.
Scheduled Operation	183	21,775,339
Non-Scheduled Operation	169	2,936,107
Supplementary Operation	59	440,836
Aerial Works	10	33,881
General Aviation	351	4,257,710
Total	772	29,443,873

M.T.W.T. in lbs Source : Statistic Angkutan Udara 1985

Out of 183 aircraft of the scheduled operation, 84 numbers or 46 % owned by Garuda, 53 numbers or 29 % by Merpati, 25 numbers or 14 % by Bouraq and 11 numbers or 6 % by Mandala. The remaining 5 % are owned by Others.

(08) The Scheduled Airline Fleets consist of the following aircraft type.

Table - 3.5 Scheduled Airline Fleet by Airline and Aircraft Type

AIRCRAFT TYPE	GARUDA	MERPATI	BOURAQ	OTHERS
B - 747	6			
DC-10-30	6			
A300-B4	9			
B-707		1		
DC-8	2			
VC-9		3		
L-188				6
DC-9-32	21			
F-28	34			
VC-8		2	4	5
HS-748		2	16	
CV-500				3
F-27	6	8		
DHC-6		19		
DC-3		1	2	8
CN-212		16	3	
GA-21A		1		
Total	84	53	25	22

Source : Audit of Civil Aviation Structure

As is clear in the above Table, the main fleets are DC-9-32 and F-28 for GARUDA, DHC-6 and CN-212 for MERPATI and HS-748 for BOURAQ.

(09) Indonesia National Air Carrier Association (I.N.A.C.A.) has been formed by the private companies to represent the collective interest of the member companies and to coordinate the services among them to provide all facets of the air transport to the public.
The members of the said Association are :

- PT. BOURAQ INDONESIA AIRLINES
- PT. MANDALA AIRLINES
- Non-scheduled airlines

(10) The records of number of personnel working in the airlines, including directors, managers, pilots, co-pilots, engineers, ground man and others have been collected from 8 airlines through direct interview to the personnel in charge.

- PT. GARUDA INDONESIA
- PT. MERPATI NUSANTARA AIRLINES
- PT. BOURAQ INDONESIA AIRLINES
- PT. DIRGANTARA AIR SERVICE
- PT. DERAYA
- PT. GATARI HUTAMA AIR SERVICES

- PT. SEMPATI AIR TRANSPORT
- PT. JAKARTA AIRCRAFT ENGINEERING AND MAINTENANCE CORPORATION (JAEMCO)

Table-3.6 shows the summary of the records collected. From the size of the numbers in this Table, it can be understood that the scheduled airlines have been playing the most important role in civil aviation in Indonesia.

Table-3.6 Number of Personnel in Airlines

Airline Type	Scheduled			Non Scheduled & General Aviation				
Airline Name	GARUDA	MERPATI	BOURAQ *1	DAS	DERAYA	GATARI	SEMPATI	JAEMCO
Director Manager	23	16	5	3	9	9	3	3
Pilot (Co-Pilot)	524	192	95 (15)	35	19	45	16	18
Engineer	70	355	170		20	57	26	1
Ground Staff	5,725	985	730	65	8	84	34	3
Others	1,140	124			4	0	106	6
Total	7,482	1,672	1,000	N.A.	60	195	185	31

Note : *1 Including personnel of Bali International Air Service
Source : Based on hearings from airline officials

(11) The records of the aircraft utilization in terms of flight hours per day, which are indispensable for preparation of specifications for assigning appropriate aircraft to a particular air route, have also been collected from 5 airlines below.

- PT. GARUDA INDONESIA
- PT. MERPATI NUSANTARA AIRLINES
- PT. BOURAQ INDONESIA AIRLINES
- PT. DIRGANTARA AIR SERVICE
- PT. DERAYA

These records are summarized in Table-3.7 and analyzed in relation to the number of passenger seats and utilization (flight hours per day) as illustrated in Figure-3.1. Figure-3.1 suggests that :

- Utilization of B-747 shows more than 4,000 hours per year, the highest figure, including both international and domestic flights.
- Utilization of jet airplanes and turbo-prop airplanes between 50 and 300 passenger seats falls within between 1,900 and 2,700 hours per year.

- Utilization of airplanes with no more than 50 passenger seats, decrease sharply as seats number becomes less.

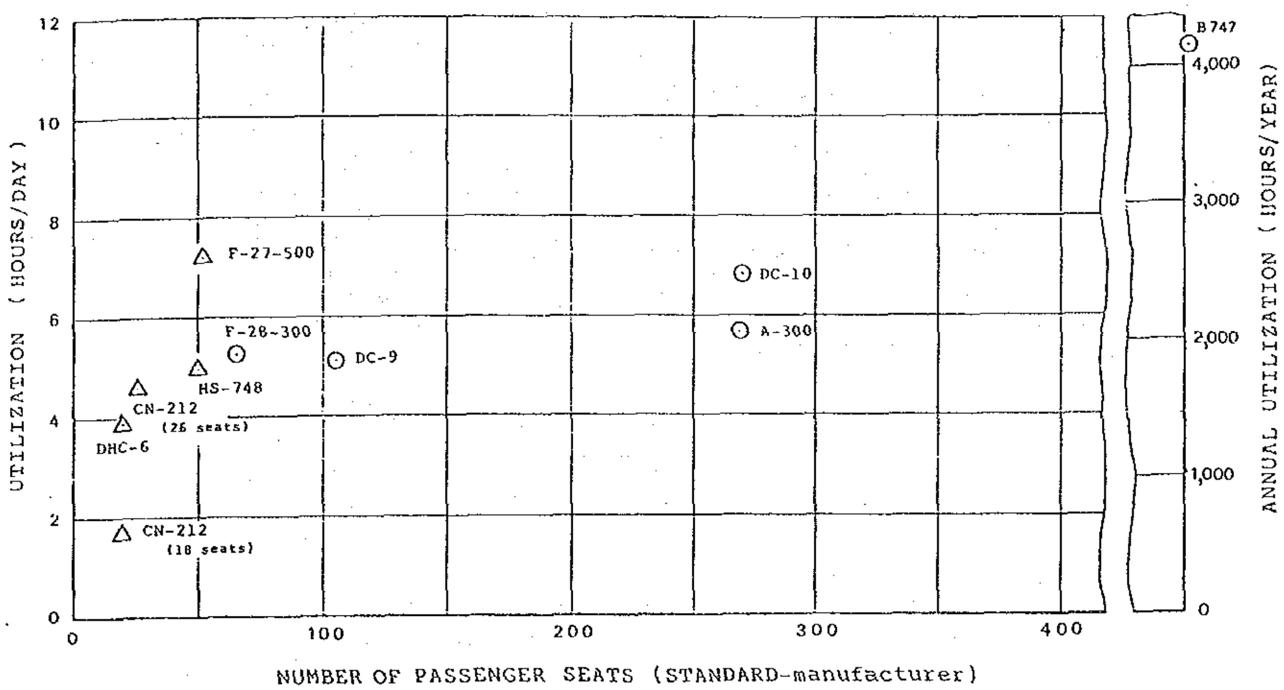
The ratio of the actual number of flights to the number of flights scheduled in timetables is to about 98%, according to the airlines. This ratio will be taken into account in working out the specification of the aircraft.

Table-3.7 Utilization Hour of Aircraft

Airline	Aircraft Model	Utilization Hour/Day
PT. GARUDA INDONESIA	Boeing 747	11.4
	Douglas DC-10	6.84
	Douglas DC-9	5.13
	Airbus A-300	5.69
	Fokker F-28-3000	5.24
	Fokker F-28-4000	5.83
PT. MERPATI NUSANTARA AIRLINES	Vickers Viscount VC-8	7.7
	Fokker F-27-200/400	6.5
	Fokker F-27-500	7.2
	Hawker Siddeley HS-748	5.0
	Twin Otter DHC-6	3.9
	Casa CN-212 18 seats	1.7
	Casa CN-212 26 seats	4.6
PT. BOURAQ INDONESIA AIRLINES	Hawker Siddeley HS-748	7.0
	Vickers Viscount VC-8	~7.5
PT. DIRGANTARA AIR SERVICE	BN-2A, CASA CN-212	3.3
	Douglas DC-3	2.2
	(at Irian Jaya)	1.6
PT. DERAYA	Casa CN-212-100	2.3
	Short Skyvan	2.3
	Cessna 402	1.0
	Bell 206	2.0

Source : Based on hearings from airline officials

Figure-3.1 UTILIZATION VS. NUMBER OF PASSENGER SEATS



(12) Availability of refueling services in an airport is one of the factors restricting aircraft operation including utilization, i.e. flight hours per day or per year. In Indonesia the number of airports equipped with refueling facilities comes to about 40, which is scarce in comparison with the total number of airports. Soekarno-Hatta Airport is the sole airport, which can provide 24 hours refueling service.

(13) Length of airport operation hours is another factor restricting aircraft operation including frequency, i.e. number of flights per day or per week.The majority of airports are operational in daytime only due to deficiency of navaids, personnel and some other reasons.

At present, the 7 airports listed below are under 24-hour operation.

- SOEKARNO-HATTA, JAKARTA
- JUANDA, SURABAYA
- NGURAH RAI, DENPASAR
- HASANUDDIN, UJUNG PANDANG
- POLONIA, MEDAN
- TALANGBETUTU, PALEMBANG
- FRANS KAISIEPO, BIAK

The runway length and the air traffic demand in 1984 of these major airports are tabulated in Table-3.8.

Table-3.8 List of 24-Hours Operation Airports

No.	City (Airport)	Runway Length (m)	Number of Passengers in 1984 (1000 Pax)
1	Jakarta (Soekarno-Hatta)	3,660	3,534.8
2	Surabaya (Juanda)	3,000	1,310.9
3	Denpasar (Ngurah Rai)	2,700	705.1
4	Ujung Pandang (Hasanuddin)	2,495	666.1
5	Medan (Polonia)	2,900	561.1
6	Palembang (Talangbetutu)	2,200	440.9
7	Biak (Frans Kaisiepo)	3,570	192.2

Source : * STATISTIK ANGKUTAN UDARA, 1984
* AERONAUTICAL INFORMATION PUBLICATION INDONESIA AERONAUTICAL INFORMATION SERVICE D.G.A.C.

(14) As shown in this Table, these 24-hour operation airports recorded a great deal of air traffic demand more than 440,000 in 1984, except BIAK which is a transit airport of a PT. GARUDA INDONESIA international air route (Denpasar - Biak - Guam - Honolulu) . These figures suggest that, at the time when the annual passenger numbers reach 440,000 or more, it might be reasonable for an airport to operate for 24-hour a day with the provision of proper facilities and personnel necessary for the safe night operation. It may also be said that runway length has no direct relation with length of an airport operation hours, so far as the runway length is long enough to accommodate aircraft with a certain number of passenger seats to meet the air traffic demand at the airport.

3.02 AIRCRAFT MAINTENANCE

(15) Importance of aircraft maintenance can not be over-emphasized. It directly effects efficiency of aircraft operation. Currently, there are 8 aircraft maintenance facilities available in Indonesia. The location and owner's name of these maintenance facilities are shown in Table-3.9 and in Figure-3.2.
As is clear in Figure-3.2, all of these facilities are located in the west half of the country. As the air traffic demand grows in the future, such maintenance facilities should be provided intensively in the east half of the country. The following airlines have their own aircraft maintenance facilities.

- PT. GARUDA INDONESIA
- PT. MERPATI NUSANTARA AIRLINES
- PT. BOURAQ INDONESIA AIRLINES
- PT. DIRGANTARA AIR SERVICE

Table- 3.8 Maintenance Bases

No.	City (Airport)	Company
A	Jakarta (Soekarno-Hatta) Jakarta (Pondokcabe)	GARUDA PERITA (JAEMCO can use)
B	Ujung Pandang (Hasanuddin)	MERPATI
C	Balikpapan (Sepinggan)	BOURAQ
D	Banjarmasin (Sjamsuddin)	DAS
E	Surabaya (Juanda)	JAEMCO
F	Medan (Polonia)	JAEMCO
G	Bandung (Husain Sastranegara)	IPTN

Source : Based on hearings from airline officials

Figure-3.2 THE LOCATION OF MAINTENANCE BASES

(16) PT. JAKARTA AIRCRAFT ENGINEERING AND MAINTENANCE CORPORATION (JAEMCO) owns maintenance facilities in Surabaya and Medan, and in Jakarta JAEMCO provides maintenance services by using the facilities of Perita Air Service. With the aid of these facilities, JAEMCO has mainly been conducting the maintenance of small civil aircraft and aircraft belonging to the Marines of the Republic of Indonesia. PT. IPTN (Indonesia Aircraft Industries) in Bandung has been maintaining of CN-212 and BO-105 aircraft.

(17) Information on the maintenance methods for aircraft were gathered from the following airlines through interview.

- PT. BOURAQ INDONESIA AIRLINES
- PT. DIRGANTARA AIR SERVICE
- PT. DERAYA
- PT. GATARI HUTAMI AIR SERVICES
- PT. PENAS SURVEY UDARA
- JAEMCO APRISINDO
- PT. SEMPATI AIR TRANSPORT

Table-3.10 summarizes this information .

Table-3.10 Maintenance Items and Places of Airlines

Airlines	Maintenance Items	and Places
PT. BOURAQ INDONESIA AIRLINES	* Airframe	: Own Factory
	* Engine Landing Gear Propeller Other Component	: Hong Kong, Taipei Manila, Singapore
PT. DIRGANTARA AIR SERVICE	* Airframe	: Own Factory
	* Engine Landing Gear	: Singapore
	(DC-3 Engine	: Miami, USA)
	(CN-212	: IPTN)
PT. DERAYA	* CN-212 Airframe	: IPTN, MNA
	* Engine	: Garret-Singapore
	* Propeller Landing Gear Hyd. System	: MNA
	* Indicator	: Singapore
PT. GATARI HUTAMA AIR SERVICE	* Spare Parts of Bell Helicopter	: Singapore
	* Engine	: USA, Singapore
PT. PENAS SURVEY UDARA	* Camera Navigation System	: Own Factory
JAEMCO APRISINDO	* Camera for mapping Survey	: Own Factory
PT. SEMPATI AIR TRANSPORT	* Airframe	: Netherland, New Zealand, Singapore
	* Engine	: UK, Hong Kong, New Zealand
	* Propellers	: Singapore, UK, Hong Kong, New Zealand
	* Gear Box	: Malaysia, New Zealand, Singapore

Source : Based on hearings from airline officials

(18) Airframe can be maintained in the domestic factory. Major functional parts such as engines, propellers, gear boxes, landing gear and component parts of hydraulic-systems shall be repaired and maintained outside Indonesia, in for example Singapore, Manila, Hongkong, Taipei, U.S.A, U.K, Netherlands, New Zealand and Malaysia.

3.03 AIR ROUTES AND AIRCRAFT ALLOCATION

(19) Macroscopic investigation of existing aircraft allocation in Indonesia has been performed in connection with :

- What range performance is required for an air route
- How long it takes to fly an air route
- What kinds of aircraft are used

Such macroscopic investigation has been analyzed and summarized in respect of the items below.

- Relation between air route stage length and aircraft range performance
- Relation between air route stage length and block time
- Types of aircraft in service

These three items are discussed in sequence below.

(20) The data on air route stage length is plotted against the data on maximum range with maximum payload as presented in Figure-3.3. The data on maximum range with maximum payload is given in Table-3.11.
The calculation method of air route stage is as follows.

$$SL = 1.852 * R * (pi/180) * \cos^{-1}\{\sin(HA) * \sin(HB) + \cos(TB - TA) * \cos(HA) * \cos(HB)\}$$

Where,

SL : Stage length in km (distance along a great-circle route)
HA : Latitude of an airport A in degree
HB : Latitude of an airport B in degree
TA : Longitude of an airport A in degree
TB : Longitude of an airport B in degree
R : Radius of the earth, 3,438.16 NM

Referring to Figure-3.3, it can be understood that the maximum range with maximum payload of an aircraft allocated to an air route corresponds to at least twice the air route stage length. Hence, the relation between air route stage length and aircraft range performance can be expressed in

Figure-3.3 STAGE LENGHT VS. RANGE WITH MAX. PAYLOAD

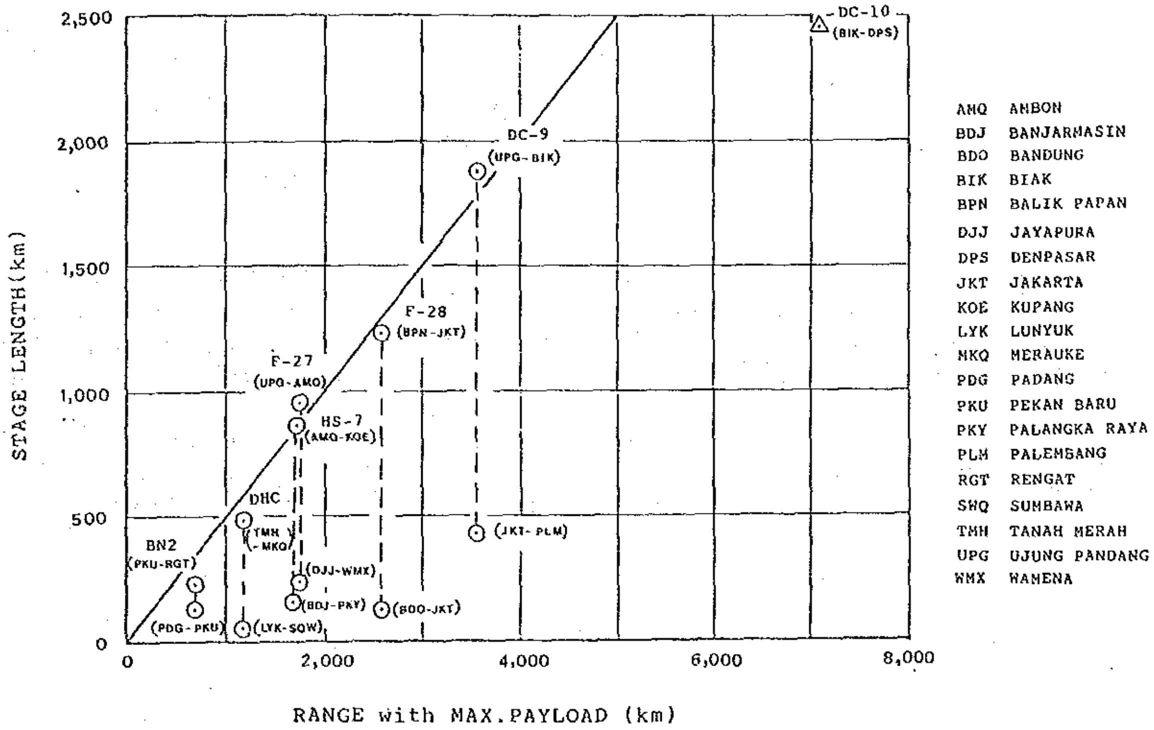


Table-3.11 Maximum Range with Maximum Payload

Aircraft Model	Engine Type	No. of Passenger Seats (Standard, Manufacturer)	Maximum Range with Maximum Payload (Km)
BN-2 ISLANDER	Reciprocating	10	670
BN-2 TRISLANDER	Reciprocating	18	
CASA 212-5	Turbo-Prop	19	480
DHC-6-300	Turbo-Prop	20	1,198
F-27 (MK500)	Turbo-Prop	52	1,741
HS-748-2B	Turbo-Prop	50	1,714
L-188 ELECTRA	Turbo-Prop	74	4,458
A-300 (AIRBUS B4-220)	Turbo-Fan	269	5,375 (269 passengers)
B-747-200B	Turbo-Fan	452	10,562
DC-9-30	Turbo-Fan	105	2,775
DC-10-30	Turbo-Fan	270	7,040
F-28 (MK3000)	Turbo-Fan	65	3,169

Source : JANE'S ALL THE WORLD'S AIRCRAFT

the following equation.

$$MR \geq 2 * SL$$

where,

MR : Aircraft maximum range with maximum payload

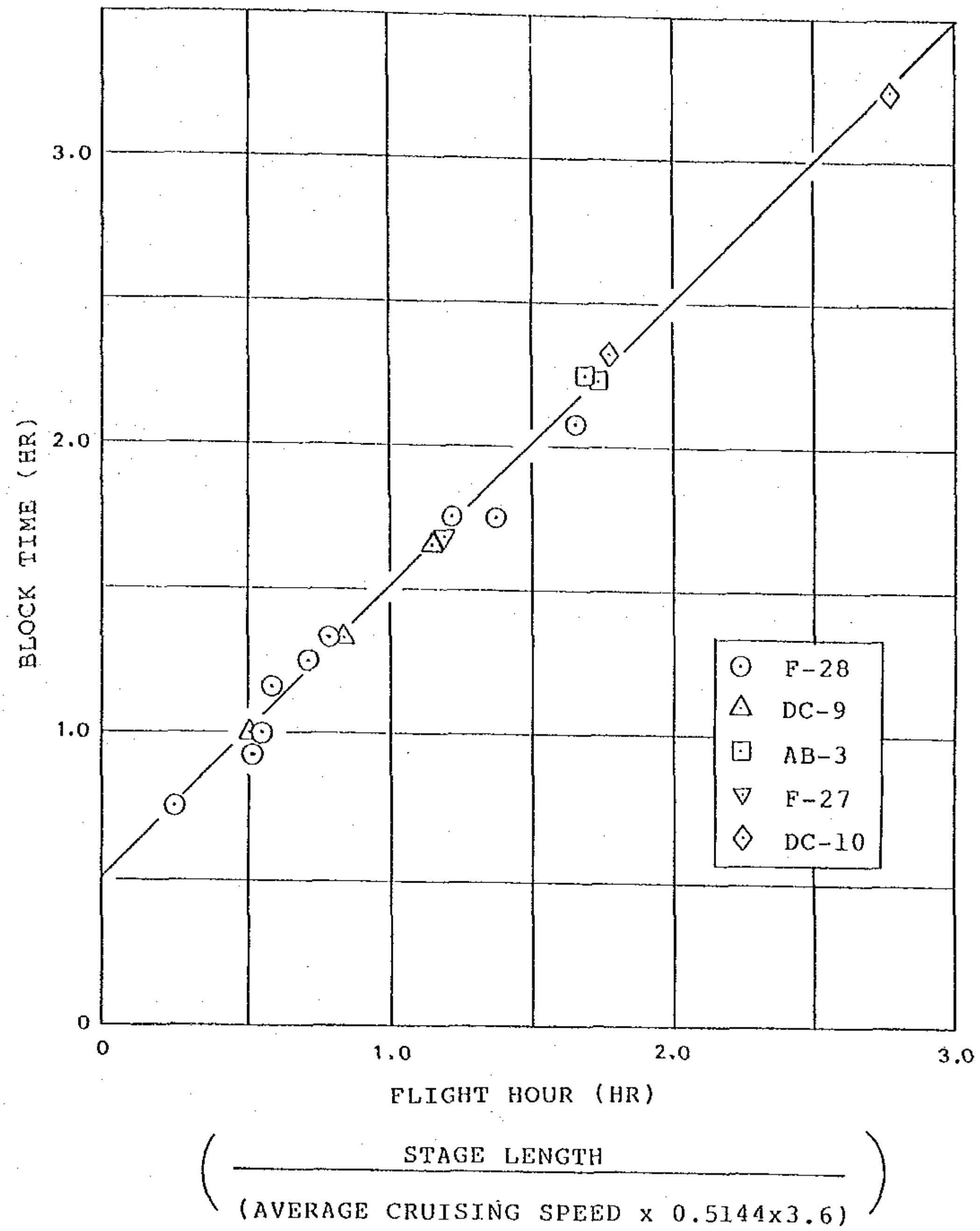
SL : Air route stage length

(21) Block time is defined as the time required for travelling from departure airport to arrival airport on airlines timetables. Flight hour is the function of air route stage length given by the equation described in para.(20) and average cruising speed shown in Table-3.12. Flight hour thus calculated and the corresponding block time excerpted mainly from the timetable of PT. GARUDA INDONESIA are tabulated in Table-3.12 and illustrated graphically in Figure-3.4.

Table-3.12 Block Time

Aircraft	① Vcrav. (KTAS)	Air Route		② Stage Length (Km)	② / ①X0.5144X3.6 (hr)	Block Time (from Timetable) (hr-min)	Block Time (from Timetable) (hr)
F-28 (MK-3000)	409.5	Padang	Jakarta	1,047.2	1.38	1-45	1.75
		Bandar Lampung	Jakarta	189.6	0.25	0-45	0.75
		Banda Ache	Medan	420.2	0.55	1-00	1.00
		Jambi	Jakarta	600.6	0.79	1-20	1.33
		Bengkulu	Jakarta	540.2	0.71	1-15	1.25
		Pekanbaru	Jakarta	933.1	1.23	1-45	1.75
		Tanjung Pandan	Jakarta	395.3	0.52	0-55	0.92
		Pangkal Pinang	Jakarta	444.5	0.59	1-10	1.16
		Balikpapan	Jakarta	1,258.5	1.66	3-05	3.08
A-300 (AIRBUS B4-220)	445.5	Medan	Jakarta	1,395.3	1.69	2-15	2.25
		Ujung Pandang	Jakarta	1,431.6	1.74	3-15	3.25
DC-9-30	441.9	Medan	Banda Ache	420.2	0.51	1-00	1.00
		Surabaya	Jakarta	688.8	0.84	1-20	1.33
		Banjarmasin	Jakarta	945.2	1.16	2-40	2.66
DC-10-30	477.0	Biak	Denpasar	2,464.9	2.79	3-15	3.25
		Manado	Denpasar	1,572.3	1.78	2-20	2.33
F-27 (Mk 500)	233.1	Tarakan	Balikpapan	516.5	1.20	1-40	1.66

Figure-3.4 BLOCK TIME VS. FLIGHT HOUR



(22) From Figure-3.4 , the following relation between air route stage length and block time is obtained.

BT = SL / ACS * 0.5144 * 3.6 + 0.5

where,
- BT : Block time (hr)
- SL : Air Route Stage Length (km)
- ACS : Average Cruising Speed (KTAS) or 0.9 times max. cruising speed at max. take off weight KTAS stands for knot true air speed.

This relation is applied in the estimation of aircraft operating cost.

(23) At present, all the airliners for passenger transport used by airlines in Indonesia are fixed wing and land planes. There are no helicopters and amphibians. It is said that helicopters and amphibians are not being employed as airliners due to their higher operating cost.

3.04 DATA FOR PREPARATION OF AIRCRAFT SPECIFICATIONS

(24) The basic specifications for aircraft to be prepared in Stage-5 will specify aircraft in respect to the following items.

- Standard number of passenger seats
- Maximum cruising speed
- Maximum range
- Takeoff distance
- Landing distance

(25) The aircraft to be studied in preparation of the specifications are as defined tentatively below.

- Boeing 747
- McDonnell Douglas DC-10
- Airbus A-300
- McDonnell Douglas DC-9
- Fokker F28 FELLOWSHIP
- Lockheed L-188 ELECTRA
- Vickers VC-8 VISCOUNT
- Hawker Siddeley 748
- Fokker F27 FRIENDSHIP
- CASA 212
- De Havilland Canada DHC-6 TWIN OTTER
- Britten Norman ISLANDER
- Britten Norman TRISLANDER

(26) The above aircraft are selected taking the following points into account.

- These aircraft are typical aircraft currently used in the world. Therefore, the performance of these aircraft is typical for the respective type and category of aircraft, such like as jet plane, propeller airplane, large airplane and small airplane.

- The manufacturers have been maintaining a high reputation in the world market. This means that the performance of these aircraft represents the current international aircraft industry technological level.
- It is considered that these types of aircraft are likely to be in service in Indonesia for next decade or so, or until replaced by new types of aircraft.
- Due to the popularity of these types of aircraft, it is reasonable to work out the specifications based on the historical records or statistics of these aircraft.

Furthermore, statistical analysis of these aircraft will provide valuable information to understand the present status of airline operation in Indonesia, since the major airlines have assigned these aircraft over long periods, depending on their sizes and performance, air traffic demand and air route stage length. The major airlines using a part or several parts of these aircraft are listed below.

- PT. GARUDA INDONESIA
- PT. MERPATI NUSANTARA AIRLINES
- PT. BOURAQ INDONESIA AIRLINES
- PT. MANDALA AIRLINES
- PT. DERAYA
- PT. DIRGANTARA AIR SERVICE
- PT. AIRFAST INDONESIA
- PT. SEMPATI AIR TRANSPORT

(27) Number of passenger seats number is used as a parameter to represent the size of airliners in this study. Most aircraft manufacturers publish the standard number of passenger seats for each type of aircraft they manufacture. The Actual number of passenger seats for a particular aircraft is not always equal to the standard number of passenger seats published by the aircraft manufacturer. Before procurement each airline company specifies the number of passenger seats of each type of aircraftas desired for its actual operation .
A comparison of these two number of seats , standard andactual, is shown by Table-3.13 and Figure-3.5.
For Indonesia, the actual number of seats corresponds to 90% of thatof the standard number.

Table-3.13 Number of Passenger Seats by Aircraft Model

Aircraft Model	Engine Type	No. of Passenger Seats (Standard, Manufacturer)	No. of Passenger Seats - Airline GARUDA	MERPATI	BOURAQ
BN-2 ISLANDER	Reciprocating	10			8 *
BN-2 TRISLANDER	Reciprocating	18			16 *
CASA 212-5	Turbo-Prop	19		18	19 *
DHC-6-300	Turbo-Prop	20		18	
F-27 (MK200,600) (MK500)	Turbo-Prop	44 52		44 56	
HS-748-2B	Turbo-Prop	50		44	47
A-300 (AIRBUS B4-220)	Turbo-Fan	269	244		
B-747-200B	Turbo-Fan	452	390		
DC-9-30	Turbo-Fan	105	102		
DC-10-30	Turbo-Fan	270	226		
F-28 (MK3000) (MK4000)	Turbo-Fan	65 85	65 85		

Note : * Aircrafts owned by PT. Bali International Air Service
Source : JANE'S ALL THE WORLD'S AIRCRAFT

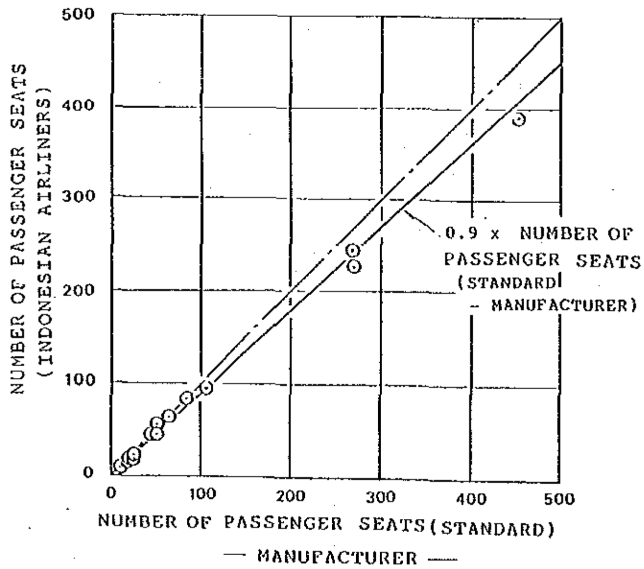


Figure-3.5 NUMBER OF PASSENGER SEATS (INDONESIAN AIRLINER) VS. NUMBER OF PASSENGER SEATS (STANDARD)

(28) The maximum cruising speed and the number of seats for each type of aircraft are presented in Table-3.14 andFigure-3.6. The relation between these two technical indicesis obtained as follows.

1) 0 < SN < 100, at MTOW

MCS = 4.15 * SN + 100

Where,
MCS : Max. cruising speed (KTAS)
SN : number of Passenger seats
MTOW : Maximum takeoff weight

2) 100 ≤ SN, at MTOW

MCS = 515 (constant)

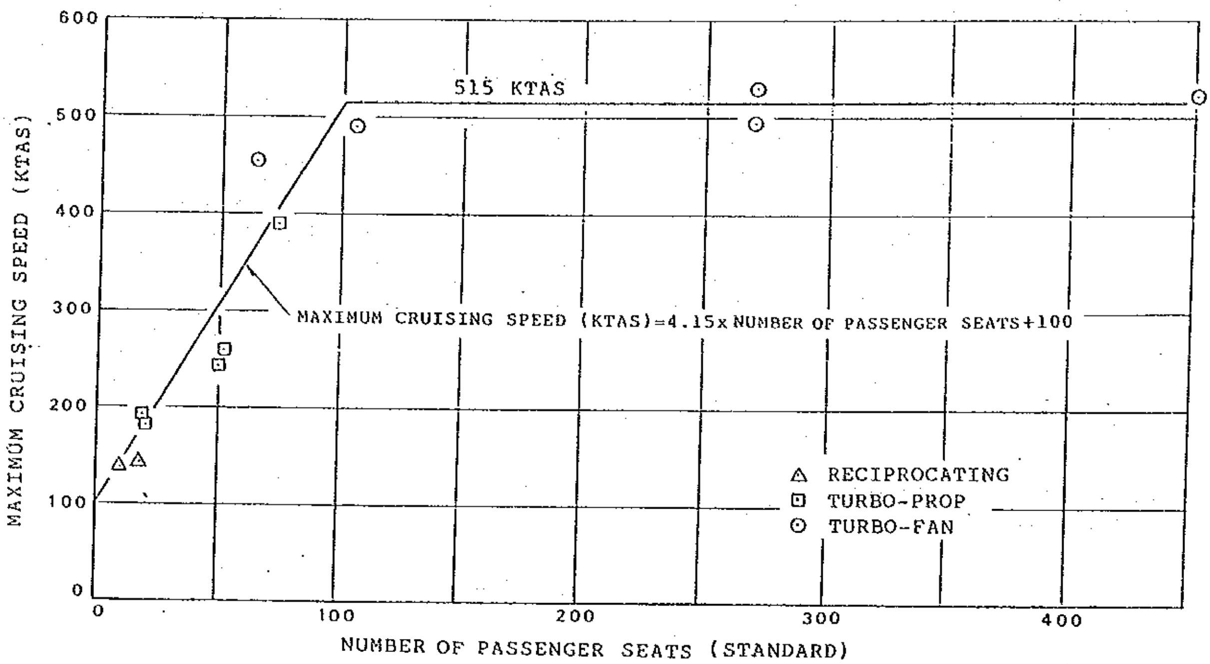
Maximum cruising speed is given by the equation above, once numberof passenger seats is defined, and vice versa.

Table- 3.14 Maximum Cruising Speed and Average Cruising Speed

Aircraft Model	Engine Type	No. of Passenger Seats (Standard, Manufacturer)	Maximum Cruising Speed at Maximum Takeoff Weight (KTAS)	Average Cruising Speed (KTAS,from Brochure of MERPATI)
BN-2 ISLANDER	Reciprocating	10	139	
BN-2 TRISLANDER	Reciprocating	18	144	
CASA 212-5	Turbo-Prop	19	194	175 (324 Km/h)
DHC-6-300	Turbo-Prop	20	182	165 (306 Km/h)
F-27 (MK500)	Turbo-Prop	52	259	225 (417 Km/h)
HS-748-2B	Turbo-Prop	50	244	210 (389 Km/h)
L-188 ELECTRA	Turbo-Prop	74	390	
VC-8 VISCOUNT	Turbo-Prop			245 (454 Km/h)
A-300 (AIRBUS B4-220)	Turbo-Fan	269	495	
B-747-200B	Turbo-Fan	452	523	
DC-9-30	Turbo-Fan	105	491	
DC-10-30	Turbo-Fan	270	530	
F-28 (MK3000)	Turbo-Fan	65	455	

Source : JANE'S ALL THE WORLD'S AIRCRAFT

Figure-3.6 MAXIMUM CRUISING SPEED VS. NUMBER OF PASSENGER SEATS



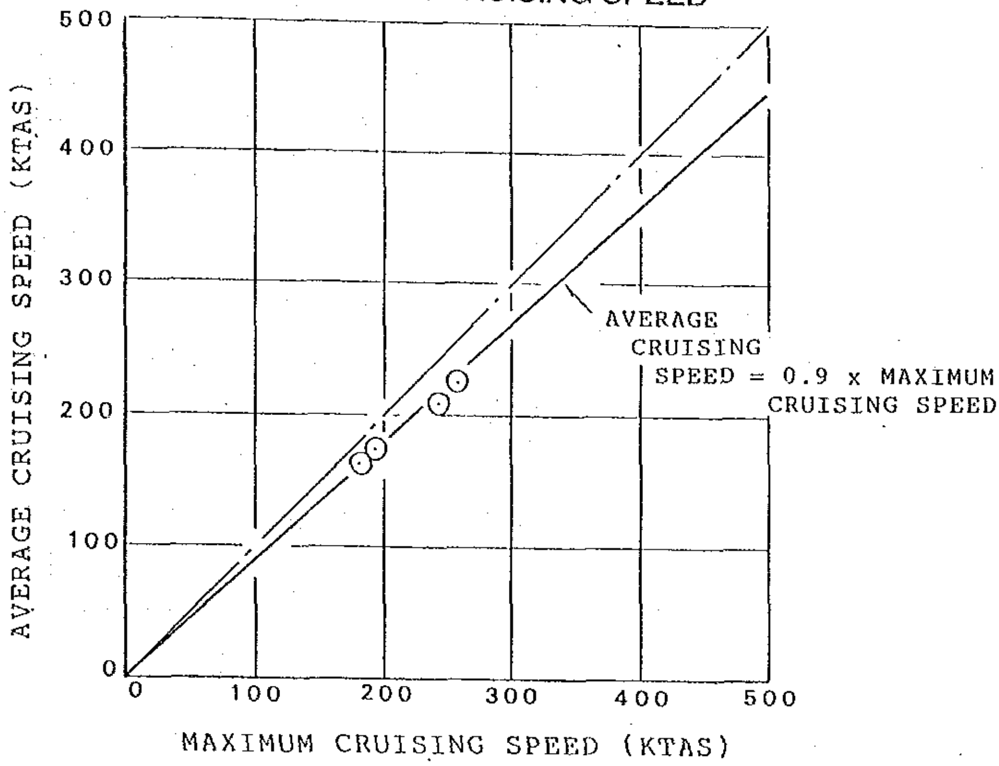
(29) The relation between average cruising speed and maximum cruising speed has been examined to calculate the flight hour for an aircraft. Average cruising speed is quotedfrom the record of PT. MERPATI NUSANTARA AIRLINES and shown in Table-3.14 and Figure-3.7. The relation under question may be defined as follows.

$$ACS = 0.9 * MCS$$

Where,

ACS : Average cruising speed (KTAS)
MCS : Maximum cruising speed (KTAS)

Figure-3.7 AVERAGE CRUISING SPEED VS. MAXIMUM CRUISING SPEED



(30) The maximum range at a condition of maximum payload of each type of aircraft and the number of passenger seats given by the manufacturers are shown on the Table-3.11 andFigure-3.8. The relation may be expressed as below.

1) $0 < SN < 100$, at Max. Payload

$$MR = 40 * SN$$

Where,
MR : Maximum range (km)
SN : Number of Passenger seats

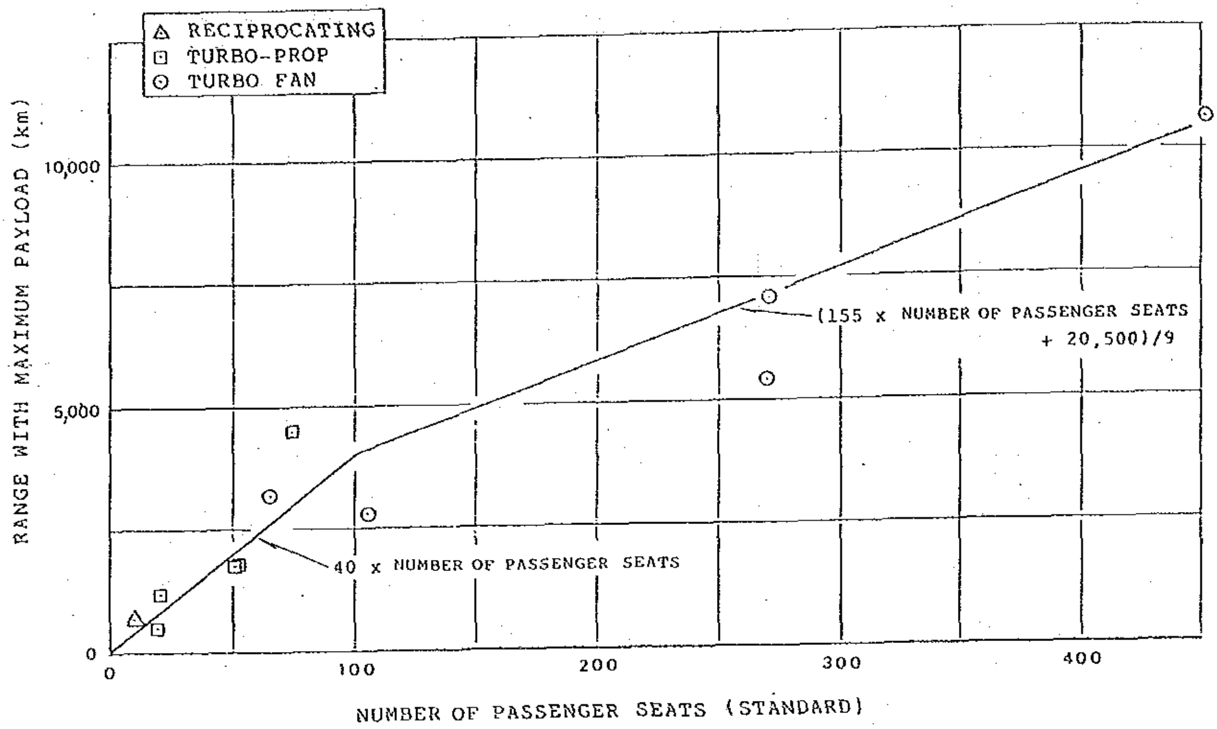
2) $100 \leq SN$, at Max. Payload

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

The maximum range under the maximum payload is given by the above equation, once the number of passenger seats is defined,and vice versa.

(31) The manufacturer's takeoff field length of each type of aircraft, number of passenger seats and maximum

Figure-3.8 MAXIMUM RANGE WITH MAXIMUM PAYLOAD VS. NUMBER OF PASSENGER SEATS



(32) The takeoff field length under maximum takeoff weight versus number of passenger seats is tabulated in Table-3.15, and illustrated in Figure-3.9. The relation between takeoff field length and number of passenger seats isdelineated as below.

1) 0 < SN < 80, at maximum takeoff weight

TOL = 25 * SN

Where,
TOL : Takeoff field length (m)
SN : Passenger seats number

2) 80 ≤ SN < 225, at maximum takeoff weight

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

3) 225 ≤ SN , at maximum takeoff weight

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

Takeoff field length at maximum takeoff weight can be specified, once the number of passenger seats is given, and viceversa, from the above equation.

takeoff weight are tabulated in Table-3.15. These manufacturer's takeoff field length is under maximum takeoff weight for each type of aircraft except F-27 and L-188, for which takeoff weights are shown in parenthesis in the column of " Published takeoff field length (m) " in Table-3.15.

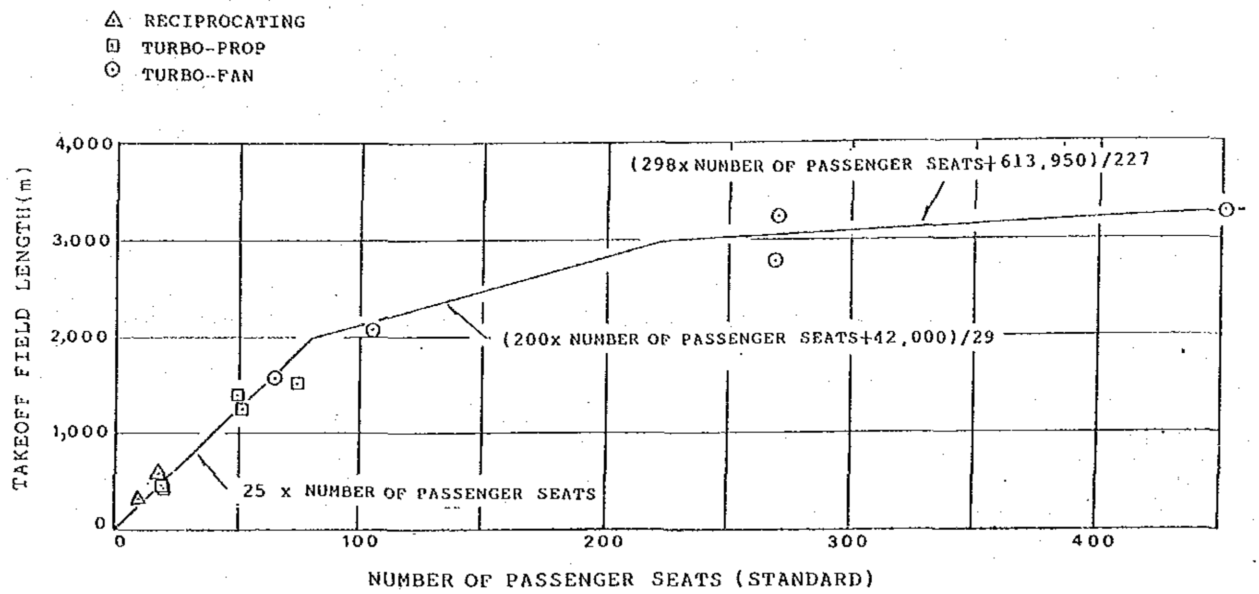
Table-3.15 Takeoff Field Length (ISA. SEA LEVEL)

Aircraft Model	Engine Type	No. of Passenger Seats (Standard, Manufacturer)	Maximum Takeoff Weight (kg)	Published Takeoff Field Length (m)	Takeoff Field Length with Maximum Takeoff Weight (m)
BN-2 ISLANDER	Reciprocating	10	2,857	332	332
BN-2 TRISLANDER	Reciprocating	18	4,536	594	594
CASA 212-5	Turbo-Prop	19	6,500	484	484
DHC-6-300	Turbo-Prop	20	5,670	457	457
F-27 (MK500)	Turbo-Prop	52	20,410	988 (18,143kg)	1,250
HS-748-2B	Turbo-Prop	50	21,092	1,393	1,393
L-188 ELECTRA	Turbo-Prop	74	52,664	1,440 (51,256kg)	1,520
VC-8 VISCOUNT	Turbo-Prop		(32,954)		
A-300 (AIRBUS B4-220)	Turbo-Fan	269	165,000	2,774	2,774
B-747-200B	Turbo-Fan	452	377,840	3,298	3,298
DC-9-30	Turbo-Fan	105	44,450	2,075	2,075
DC-10-30	Turbo-Fan	270	251,744	3,240	3,240
F-28 (MK-3000)	Turbo-Fan	65	32,200	1,585	1,585

Source : JANE'S ALL THE WORLD'S AIRCRAFT

Figure-3.9 TAKEOFF FIELD LENGHT VS. NUMBER OF PASSENGER SEATS

(AT MAXIMUM TAKEOFF WEIGHT)



(33) The landing performance and passenger seats number of each type of aircraft are tabulated in Table-3.16. These landing performance figures are those under the maximum landingweight of each type of aircraft except F-27 and L-188, of which landing weights are parenthesized in the column of" published landing performance (m) " in Table-3.16.

Table-3.16 Landing Distance (ISA. SEA LEVEL)

Aircraft Model	Engine Type	No. of Passenger Seats (Standard Manufacturer)	Published Landing Performance (m)	Correction of Published Performance (with Max.Landing Weight) (m)	Landing Distance from 50 ft Height (m)
BN-2 ISLANDER	Reciprocating	10	293	293	293
BN-2 TRISLANDER	Reciprocating	18	440	440	440
CASA 212-5	Turbo-Prop	19	518	518	311
DHC-6-300	Turbo-Prop	20	591	591	591
F-27 (MK500)	Turbo-Prop	52	1,003 (16,329kg)	1,365 (19,050kg)	819
HS-748-2B	Turbo-Prop	50	567	567	567
L-188 ELECTRA	Turbo-Prop	74	1,310 (38,782kg)	1,639 (43,385kg)	983
A-300 (AIRBUS B4-220)	Turbo-Fan	269			
B-747-200B	Turbo-Fan	452	2,109	2,109	2,109
DC-9-30	Turbo-Fan	105	1,500	1,500	1,500
DC-10-30	Turbo-Fan	270	1,817	1,817	1,817
F-28 (MK-3000)	Turbo-Fan	65	1,065	1,065	1,065

Source : JANE'S ALL THE WORLD'S AIRCRAFT

(34) The landing distance under the maximum landing weight of each type of aircraft is given in Table-3.16 and thecorrelation with the number of passenger seats is shown in Figure-3.10 . In these table and figure, landing distances of F-27, L-188 and CASA-212 have been corrected to maximum landing weight and/or from landing filed length to landing distance. The relation between landing distance and number of passenger seats is described below.

1) 0 < SN < 100, at maximum landing weight

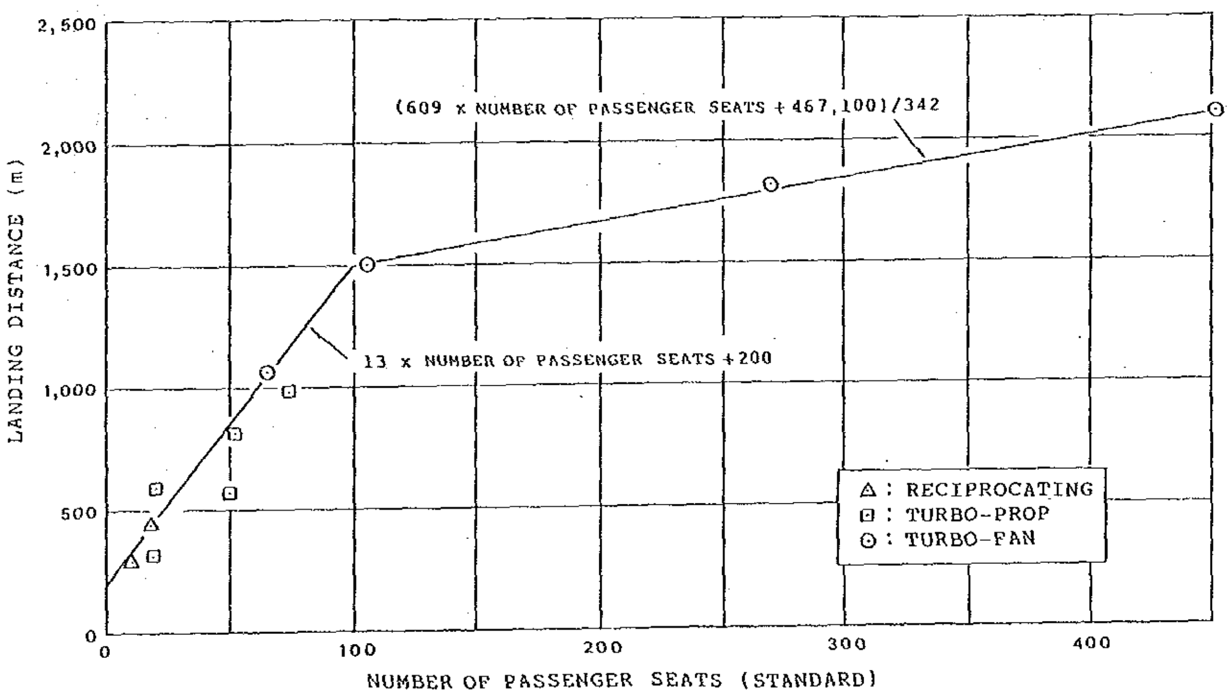
LD = 13 * SN + 200

Where,
LD : Landing distance (m)
SN : Passenger seats number

2) 100 ≤ SN, at maximum landing weight

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

Figure-3.10 LANDING DISTANCE VS. NUMBER OF PASSENGER SEATS
(AT MAXIMUM LANDING WEIGHT)



(35) In order to have the average values of maximum cruising speed and maximum range, data for helicopters currently operated in the world are collected and shown in Table-3.17.
The data comprise ;

- Helicopter model
- Engine type and number of engines
- Maximum number of passenger seats
- Maximum takeoff weight
- Maximum cruising speed
- Range with seats full

Table-3.17 (1) Data of Helicopters

Helicopter Model	Type and No. of Engine	No. of Passenger Seat (max.)	Maximum Takeoff Weight (kg)	Maximum Cruising Speed (KTAS)	Range with Full Seating (km)
ROBINSON R22 BETA	Reciprocating X 1	1	621	96	315
HYNES H2	- do -	1	758	87	350
SCHWEIZER-HUGHES 300C	- do -	2	930	83	387
ROGERSON-HILLER UH-12E	- do -	3	1,406	78	293
HYNES H5	- do -	4	1,315	90	311
ENSTROM F-28F FALCON	- do -	2	1,179	97	176
ENSTROM 280FX SHARK	- do -	2	1,179	110	194
SIKORSKY S-58	- do -	12	5,900	85	
McDONNELL DOUGLAS MD500E	Turbo-Shaft X 1	6	1,361	136	193
BELL 206B	- do -	4	1,452	113	572
AEROSPATIALE AS 350D	- do -	6	1,950	122	565
ROGERSON-HILLER RH-1100	- do -	4	1,111	118	194
McDONNELL DOUGLAS MD530F	- do -	4	1,406	135	232
BELL 206L-3	- do -	6	1,882	114	393
BELL 204B	- do -	8	3,856	120	370
AEROSPATIALE SA 316B	- do -	6	2,200	100	540
AEROSPATIALE SA 319B	- do -	6	2,250	106	605

/conti.

Source : BUSINESS AND COMMERCIAL AVIATION/ April, 1986

Table-3.17 (2) Data of Helicopters

Helicopter Model	Type and No. of Engine	No. of Passenger Seat (max.)	Maximum Takeoff Weight (kg)	Maximum Cruising Speed (KTAS)	Range with Full Seating (km)
AEROSPATIALE AS 355F-2	Turbo-Shaft X 2	5	2,540	123	372
MBB BO-105CBS	- do -	5	2,500	126	519
AGUSTA 109A	- do -	7	2,600	142	269
BELL 222UT	- do -	8	3,742	138	500
MBB BK 117-A3	- do -	9	3,200	134	494
BELL 222B	- do -	8	3,742	146	393
AEROSPATIALE SA 365N	- do -	12	4,000	155	746
BELL 212	- do -	13	5,080	109	317
BELL 412	- do -	13	5,400	128	557
SIKORSKY S-76A	- do -	12	4,763	139	674
SIKORSKY S-76B	- do -	12	5,171	145	737
WESTLAND 30 100-60	- do -	17	5,806	144	676
BELL 214ST	- do -	18	7,938	146	639
SIKORSKY S-70C	- do -	19	7,387	145	
WESTLAND 300	- do -	17	7,258	150	541
BOEING VERTOL 234	- do -	44	22,000	135	1,052
EH INDUSTRIES EH 101	Turbo-Shaft X 3	30	14,288	160	969

Source : BUSINESS AND COMMERCIAL AVIATION/ April, 1986

(36) Correlation between maximum cruising speed and maximum number of passenger seats is shown in Figure-3.11. The maximum cruising speed of helicopters with no more than 10passenger seats is 120 KTAS.
Range with seats full is plotted against maximum number of passengerseats number in Figure-3.12. The average range with seats full of helicopters with no more than 10 passenger seats is around 350 km.

Figure-3.11 MAXIMUM CRUISING SPEED VS. MAXIMUM NUMBER OF PASSENGER SEATS

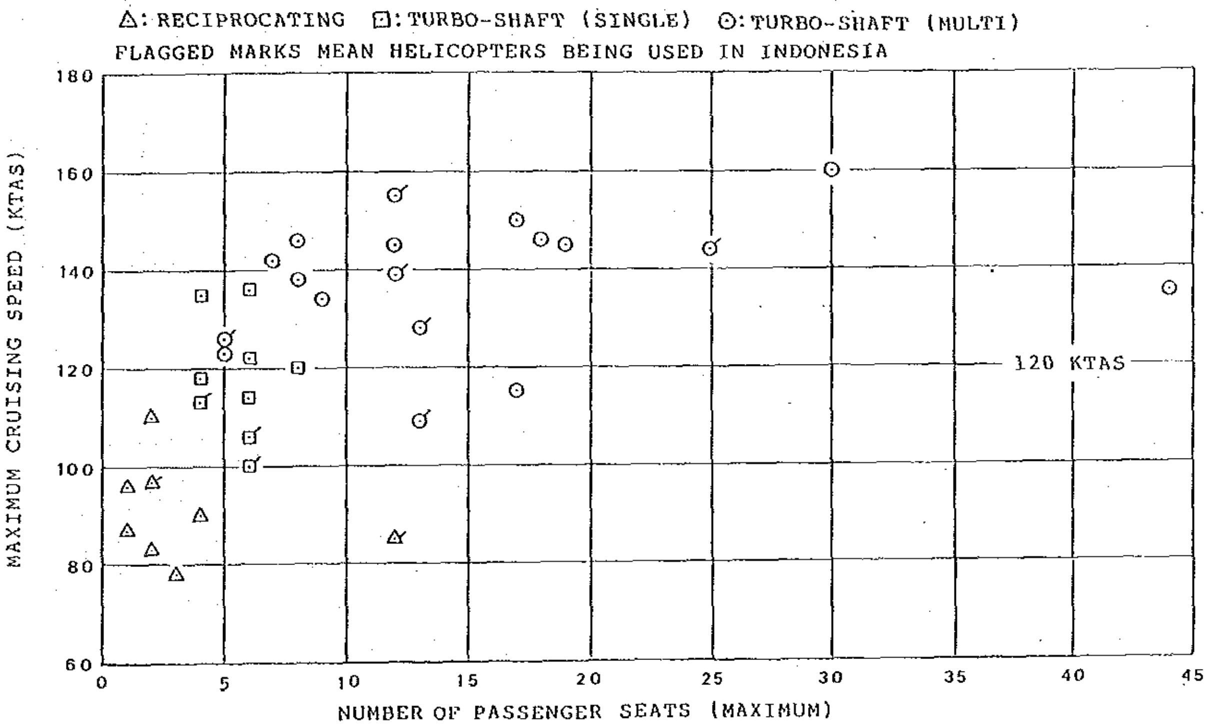
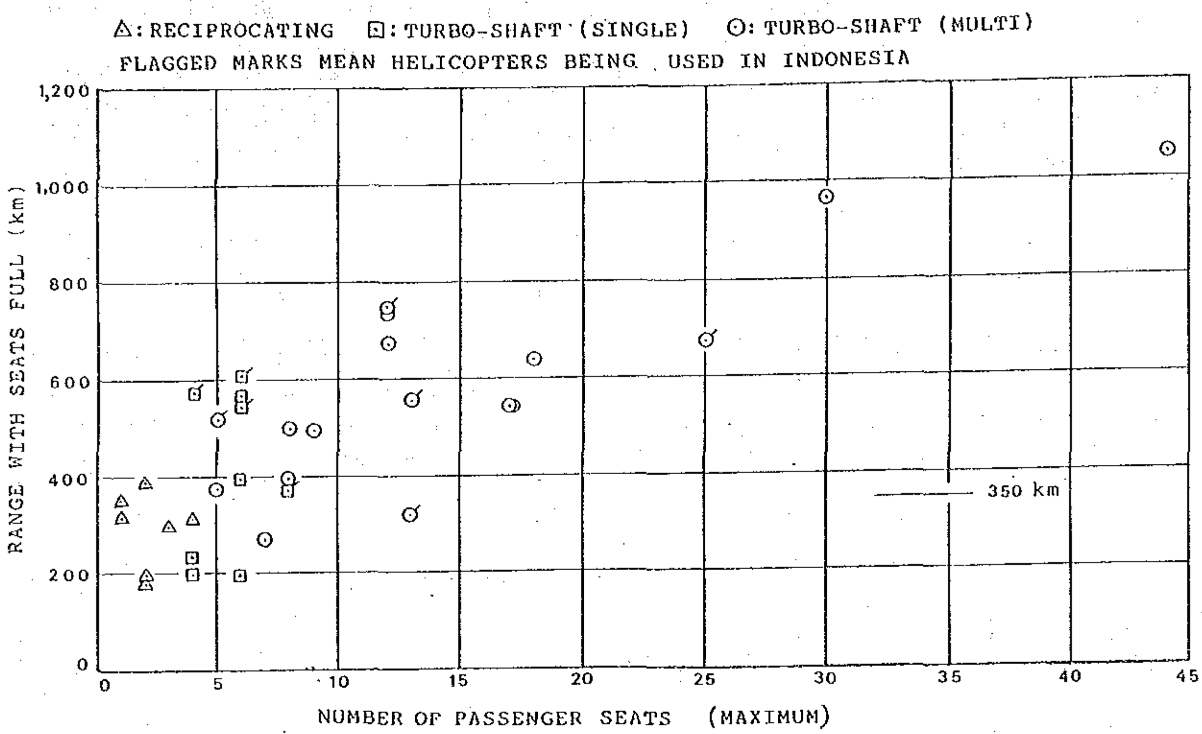


Figure-3.12 RANGE WITH SEATS FULL
VS. MAXIMUM NUMBER OF PASSENGER SEATS



(37) There are few STOL's which are allocated to regular air lines at present. In this study, STOL planes having USB (Upper Surface Blowing system) type engines are assumed. STOL planes having the minimum DOC have been designed for different required fields length. The DOC's of these planes are given in Figure-3.13 (130 seats) and Figure-3.14 (50 seats), with abscissa of figures representing the required fields length (RFL).

Figure-3.13 DOC_{min} vs RFL (130 SEATS)

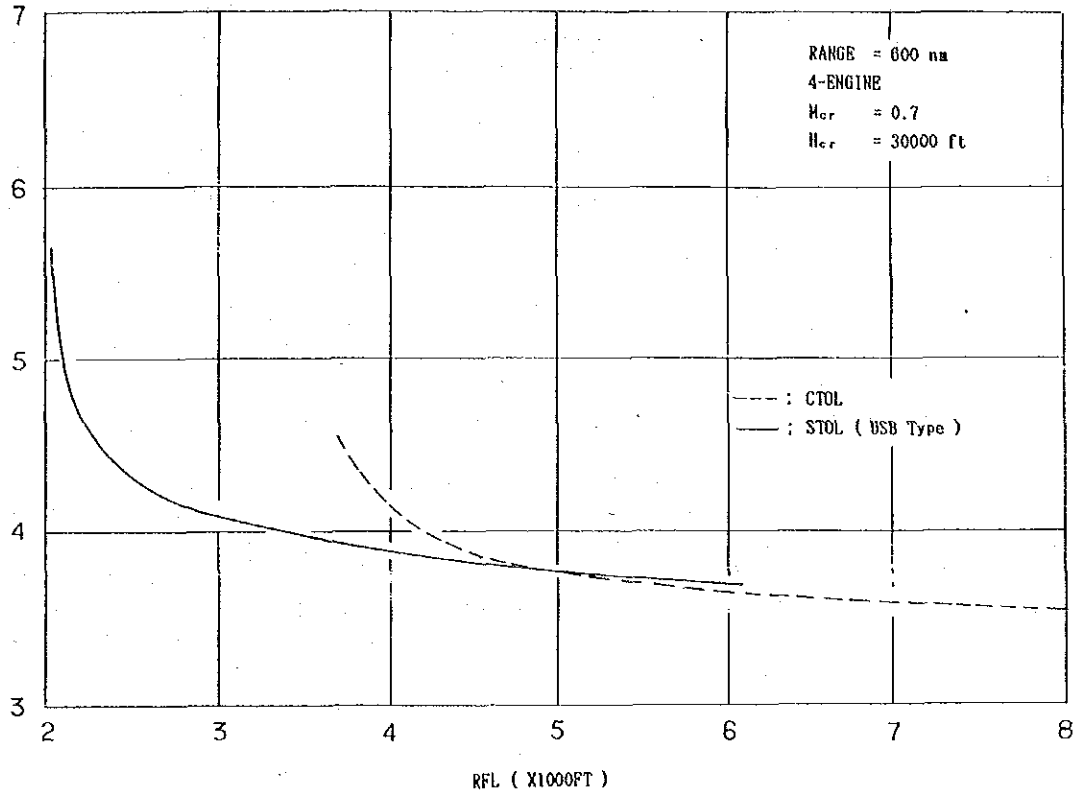
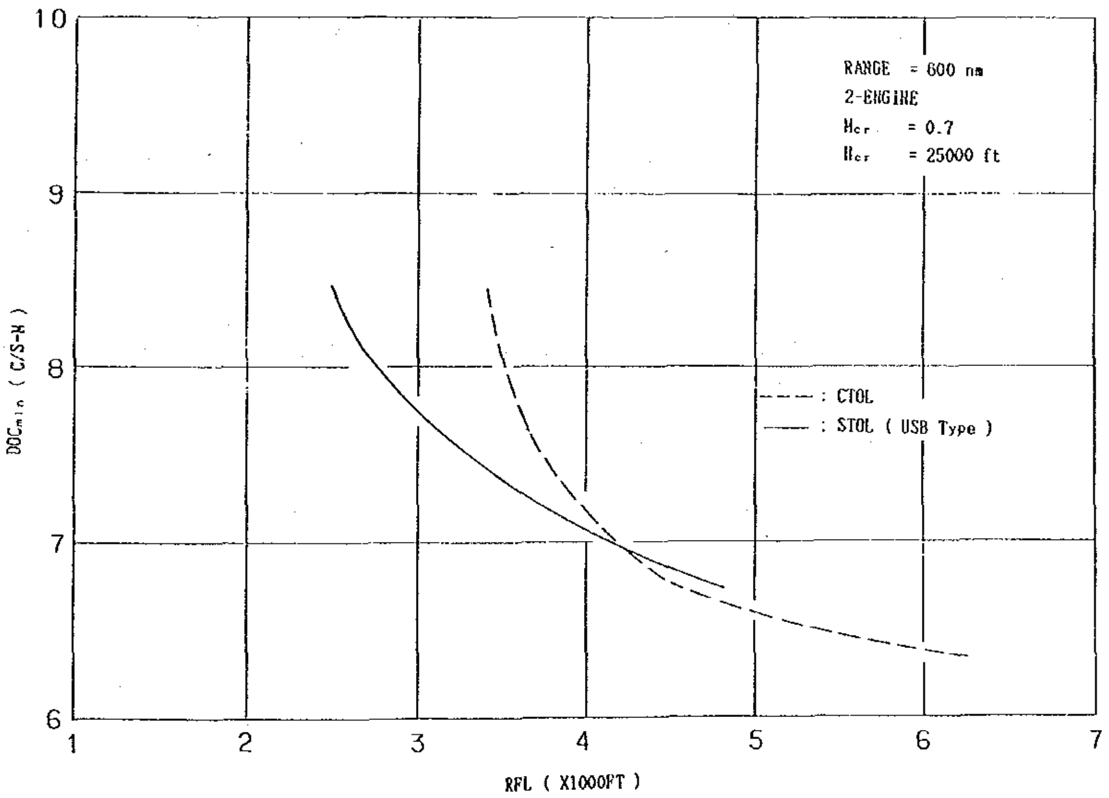


Figure-3.14 DOC_{min} vs RFL (50 SEATS)



(38) In both figures, DOC increases rapidy in the range of RFL≤3000 ft. Therefore, a field length of 3000 ft (914m) will be required for operating a STOL. The field length which gives equal minimum DOC's for both conventional planes and STOL's is approximately in the range from 4200 ft to 5000 ft.
As a conventional aircraft of 70 seats can operate for runways having this length, it is reasonable to use a STOL plane having less than 70 seats. In this study, a STOL plane having 50 seats has been selected.
The performance of this plane is as below.

Maximum cruising speed	;	464 KTAS
Cruising speed	;	422 KTAS
Maximum range	;	600 km
Required field length	;	914 m

(39) Considering that amphibians are handicapped by additional weight, such as hull or floats, as against conventional planes, 3 types of turbo-prop amphibians, having 50, 35, and 20 seats each, have been assumed in this study. As few data is available for amphibians as with STOL's the following performance has been assumed for each class.

Seats	50	35	20
Maximum cruising speed	287 KTAS	229 KTAS	170 KTAS
Cruise speed	258 KTAS	206 KTAS	153 KTAS
Maximum range	2000 km	1400 km	800 km
Required field length	1400 m	1100 m	800 m

3.05 DATA FOR ESTIMATION OF OPERATING COST

(40) A great deal of data are needed for calculation/estimation of operating cost of aircraft. The majority of this data is provided by the computer program TCHART. TCHART is utilized for preparation of aircraft specifications and introduced for estimation of operating cost of aircraft.

(41) The additional data necessary for estimation of aircraft operating cost are as follows.

- Aircraft maximum takeoff weight
- Aircraft empty weight (equipped)
- Number of crew and cabin attendants for a flight
- Maximum takeoff thrust and power
- Fuel burn during flight
- Aircraft price.
- Engine price
- Fuel price
- Oil price

- Insurance rate
- Depreciation years
- Labour rate
- Crew and cabin attendant rates

(42) Maximum takeoff weight in relation with the number of passenger seats is presented graphically in Figure-3.15 , which is prepared based on Tables-3.18 and - 3.19. As is clear in Figure-3.15, the correlation between maximum takeoff weight and number of passenger seats is expressed by the mathematical formula as below.

1) $0 < SN < 100$

$$MTW = 400 * SN$$

Where,

MTW : Maximum takeoff weight (kg)

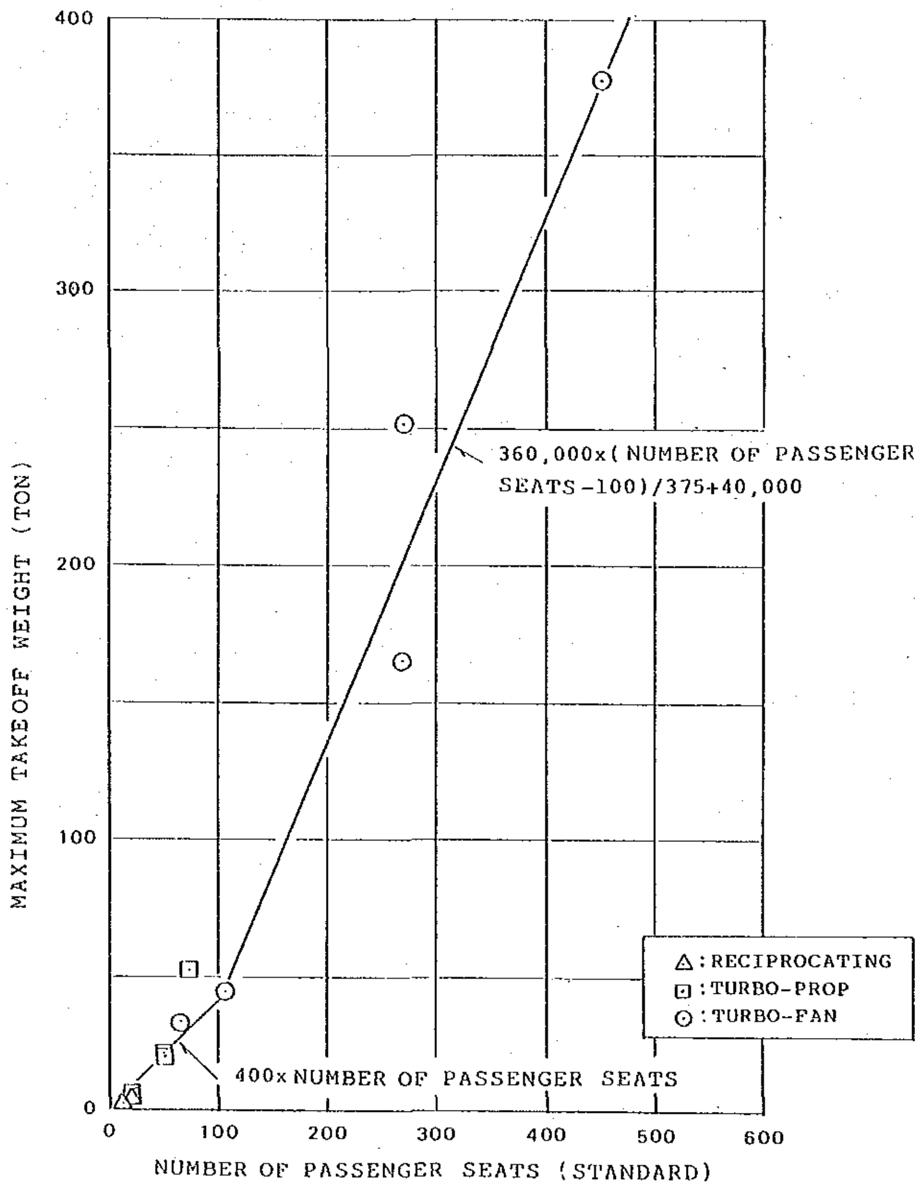
SN : Number of passenger seats

2) $100 \leq SN$

$$MTW = 360{,}000 * (SN - 100) / 375 + 40{,}000$$

Maximum takeoff weight is a variable for estimating aircraft empty weight, maximum takeoff thrust, maximum takeoff power and fuel burn during flight as discussed below.

Figure-3.15 MAXIMUM TAKEOFF WEIGHT
VS. NUMBER OF PASSENGER SEATS



(43) Aircraft empty weight is introduced to evaluate the airframe weight, which reflects the labour cost to conduct airframe maintenance. Aircraft empty weight and maximum takeoff weight are plotted in Figure-3.16 , based on the " Jane's All The World's Aircraft " yearbook.

From the above Figure, the following formula is obtained.

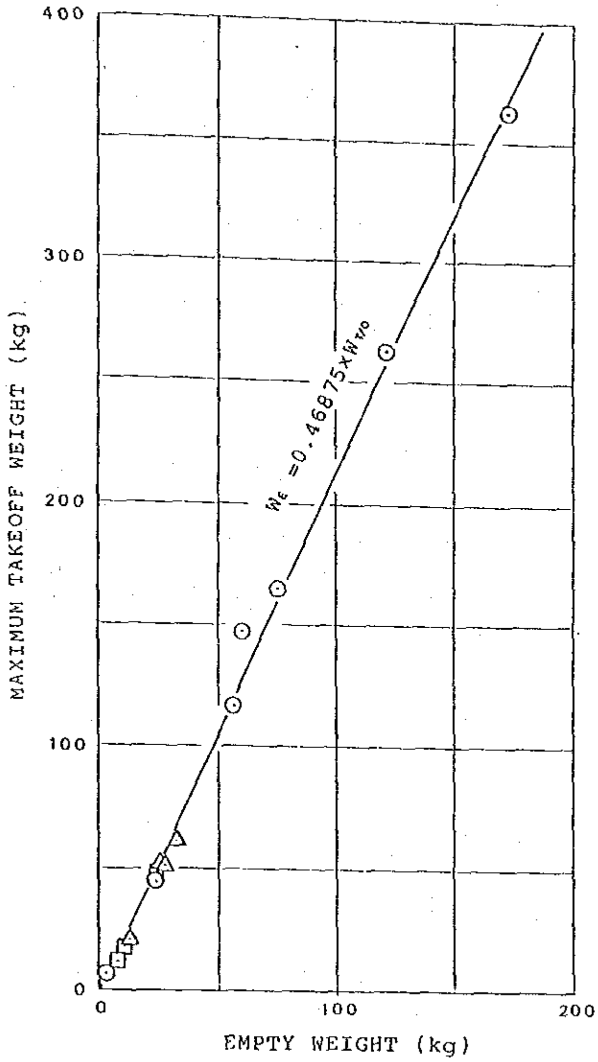
EW = 0.46875 * MTW

Where,

EW = Aircraft empty weight (kg)

MTW = Maximum takeoff weight (kg)

Figure-3.16 MAXIMUM TAKEOFF WEIGHT VS. EMPTY WEIGHT



(44) Number of crew and cabin attendants for a flight is an important factor to estimate the direct operating cost. In this regard, the data is collected from several airlines operating in the country, and tabulated in Table-3.20, together with corresponding number of passenger seats.

(45) Number of crew is assumed as follows.

1) SN < 40

Number of crew = 2

2) $40 \leq SN$

Number of crew = 4

Where,
SN = number of passenger seats defined by airlines.

The minimum crew number required by airworthiness of the airplanes listed in Table-3.20 is 2 or 3. However, for long range airliner being operated in Indonesia, 1 or 2 additional crew is/are on board to meet the requirements of Civil Aviation Safety Regulations, which limit the working hours of each crew number within 7 hours in any 24 hour period.

(46) The minimum number of crew required by airworthiness of a large airplane such class as A-300, DC-10 and B-747 will be 2 crew only in future. However, it is assumed in this study that an airplane with more than 40 passenger seats should have 4 crew on board due to the " 7 Hours Restriction ". In fact, now DC-9 and HS-748, for example, have 4 crew on board instead of 2 crews required for airworthiness.

(47) Number of cabin attendants is assumed as follows.

- Less than 20 passenger seats ;

  cabin attendants = 0

- 20 or more Passenger seats ;

  One cabin attendant should take care of no more than 26 passengers or less.

Wherein, the number of passenger seats is the standard number of seats published by aircraft manufacturers. The average figure of " Number of Passengers per cabin attendant " as given in Table-3.20 ,is 26.5 passengers. Hence, it is assumed that a single cabin attendant takes care of no more 26 passengers in airplanes having no less than 20 passenger seats.

(48) Engine price is estimated based on the maximum takeoff thrust or power. The relation between maximum takeoff weight and maximum cruising speed, and the relation between maximum takeoff thrust and maximum cruising speed are analyzed. The results are shown on Table-3.18 and Figure-3.17.

Table- 3.18 Maximum Takeoff Thrust Vs. Maximum Takeoff Weight

Aircraft Model	S : Wing Area (m2)	W : Maximum Takeoff Weight (kg)	T : Takeoff Thrust X No. of Engine (0 KT. Sea Level. ISA) (kg)	$(W/S)^{1/2}$ $(kg/m2)^{1/2}$	$(T/S)^{1/2}$ $(kg/m2)^{1/2}$	Vmax : Maximum Cruising Speed with Maximum Takeoff weight (KTAS)
B-747-200B	511	377,840	24.835 X 4	27.2	13.9	523
DC-10-30	367.7	251,744	23.134 X 3	26.2	13.7	530
A-300 (AIRBUS B4-220)	260	165,000	24,041 X 2	25.2	13.6	495
DC-9-30	92.97	44,450	6,350 X 2	21.9	11.7	491
F-28 (Mk-3000)	79	29,000 (not max. takeoff weight)	4,491 X 2	19.2	10.7	455

Source : JANE'S ALL THE WORLD'S AIRCRAFT

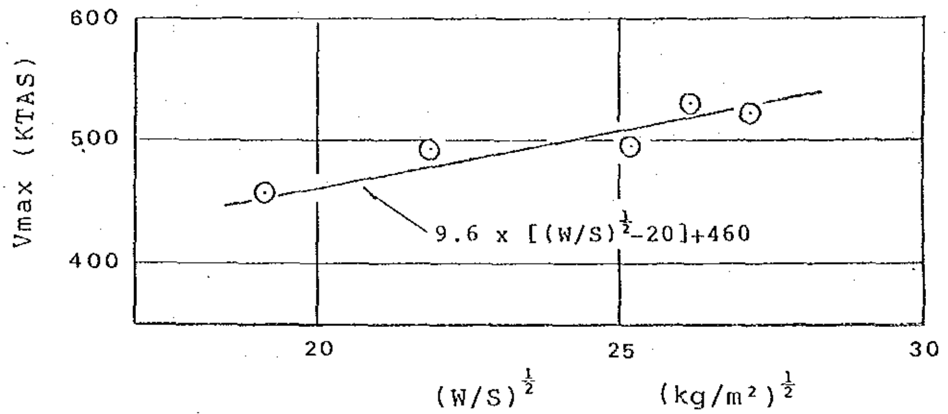
Figure-3.17 MAXIMUM TAKEOFF THRUST VS. MAXIMUM TAKEOFF WEIGHT

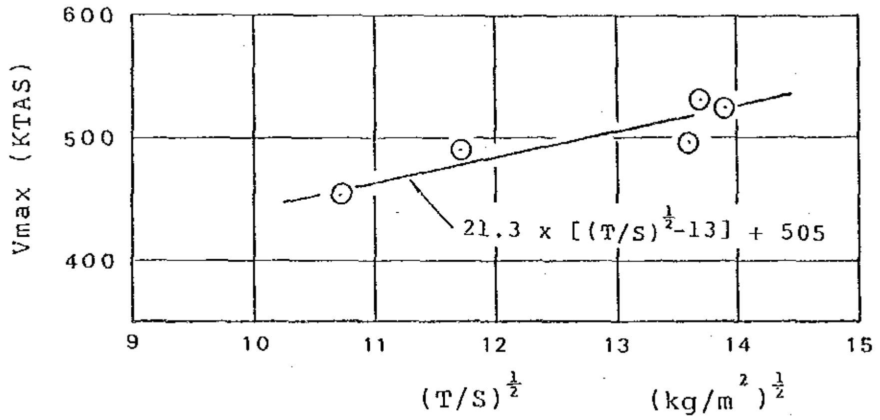
Vmax. : MAXIMUM CRUISING SPEED AT MAXIMUM TAKE OFF WEIGHT

W : MAXIMUM TAKEOFF WEIGHT

T : TAKEOFF THRUST x NUMBER OF ENGINE (AT STATIC SEA LEVEL AND ISA CONDITION)

S : WING AREA





(49) Maximum takeoff thrust and maximum takeoff weight are related as expressed in the following formula.

$$Vmax = 9.6\ \tfrac{1}{4}\ (W/S)^{0.5} - 20\ \P + 460$$

$$Vmax = 21.3\ \tfrac{1}{4}\ (T/S)^{0.5} - 13\ \P + 505$$

Where,
Vmax : Maximum cruising speed (KTAS)
W : Maximum takeoff weight (kg)
T : Takeoff thrust (kg) * number of engines
S : Wing area (m^2)

(50) The relations between maximum takeoff weight and maximum cruising speed, and between maximum takeoff power and maximum cruising speed have been studied as shown in Table-3.19 and Figure-3.18 .
The relation is given in formula as under.

$$Vmax = 23.8 * \tfrac{1}{4}\ (W/S)^{0.5} - 9.5\ \P + 110$$

$$Vmax = 105 * \tfrac{1}{4}\ (P/S)^{1/3} - 3\ \P + 167$$

Where,
Vmax : Maximum cruising speed (KTAS)
W : Maximum takeoff weight (kg)
P : Takeoff power (HP) * number of engines
S : Wing area (m^2)

Maximum takeoff thrust or maximum takeoff power can be obtained by the formula, once the number of passenger seats is given, since maximum takeoff weight and maximum cruising speed be defined by the number of passenger seats as stated above.

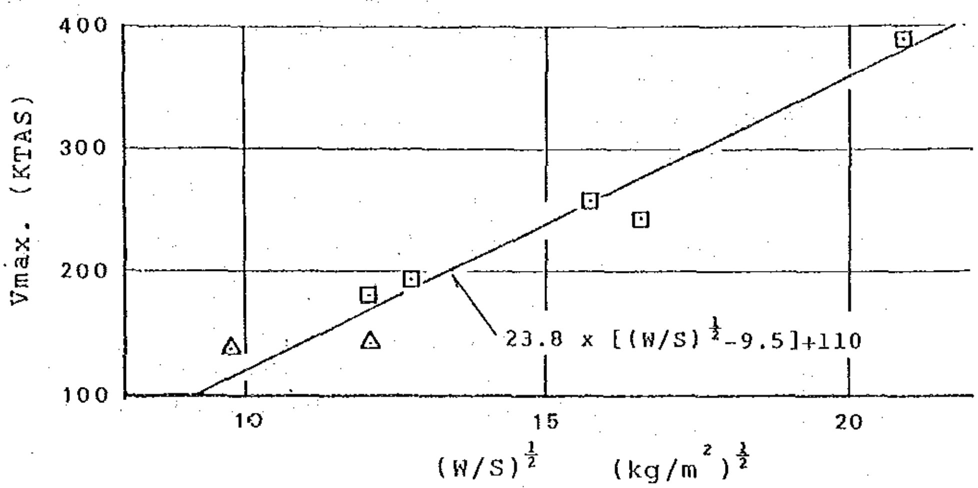
Table-3.19 Maximum Takeoff Power Vs. Maximum Takeoff Weight

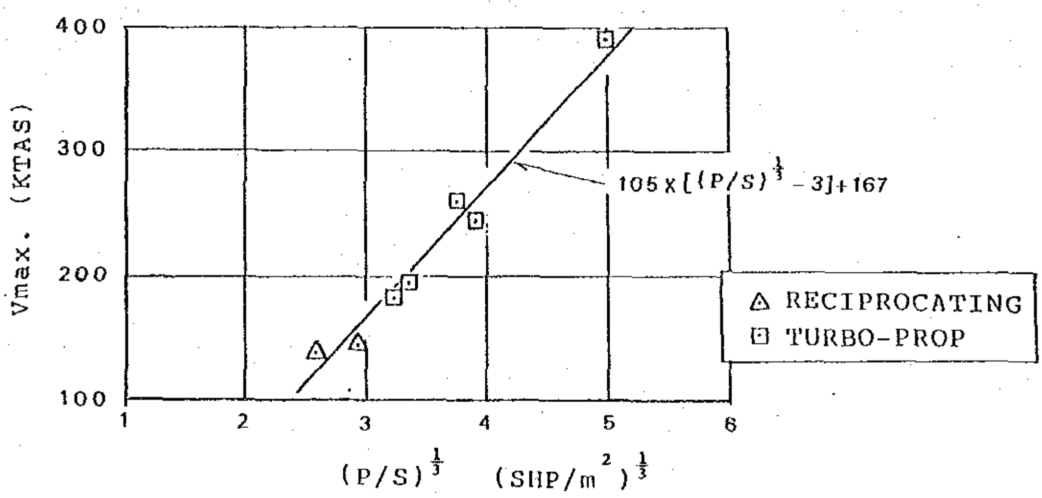
Aircraft Model	S : Wing Area (m2)	W : Maximum Takeoff Weight (kg)	P : Takeoff Power X No. of Engine (0 KT. Sea Level. ISA) (shp)	$(W/S)^{1/2}$ $(kg/m2)^{1/2}$	$(P/S)^{1/3}$ $(shp/m2)^{1/3}$	Vmax : Maximum Cruising Speed with Maximum Takeoff weight (KTAS)
BN-2 ISLANDER	30.2	2,857	260 X 2	9.73	2.58	139
BN-2 TRISLANDER	31.25	4,536	260 X 3	12.05	2.92	144
CASA 212-5	40.0	6,500	750 X 2	12.75	3.35	194
DHC-6-300	39.02	5,670	652 X 2	12.05	3.22	182
F-27 (Mk500)	70.0	17,237 (not max. takeoff weight)	eshp 1,846 X 2	15.69	3.75 *1	259
HS-748-2B	77.0	21,092	eshp 2,280 X 2	16.55	3.90 *1	244
L-188 ELECTRA	120.77	52,664	eshp 3,750 X 4	20.88	4.99 *1	390

Note : *1 $(eshp/m2)^{1/3}$
Source : JANE'S ALL THE WORLD'S AIRCRAFT

Figure-3.18 MAXIMUM TAKEOFF POWER VS. MAXIMUM TAKEOFF WEIGHT

Vmax : MAXIMUM CRUISING SPEED AT MAXIMUM TAKEOFF WEIGHT
W : MAXIMUM TAKEOFF WEIGHT
P : TAKEOFF POWER x NUMBER OF ENGINE (AT STAIC, SEA LEVEL AND ISA CONDITION)
S : WING AREA





(51) Table-3.21 shows the available engine classes of jet engines and turbo-prop engines. The jet engine having output thrust not less than 10,000 lbs is taken into consideration in the study. It is assumed that the future, commuter aircraft will be equipped with a turbo-prop engines instead of the present reciprocating engines. Based on the calculated maximum takeoff thrust or maximum takeoff power as discussed before, the required number of engines is specified as shown on Table-3.21.

Table-3.20 Number of Crew and Cabin Attendant

Aircraft Model	Airline	No. of Passenger Seat	No. of Crew	No. of Cabin Attendants	No. of Passengers per One Cabin Attendant
B-747-200B	GARUDA	390	4	16	24.4
DC-10-30	GARUDA	226	4	10	22.6
A-300-B4-220	GARUDA	244	4	9	27.1
DC-9-30	GARUDA	97	4	4	24.3
F-28 Mk-3000 (Mk-4000)	GARUDA	65 (85)	4	2	32.5 (42.5)
HS-748-2B	BOURAQ	47	4	3	15.7
VC-8 VISCOUNT	BOURAQ	69	4	3	23.0
BN-2 TRISLANDER	BOURAQ	16	2	0	-
BN-2 ISLANDER	BOURAQ	8	2	0	-

Source : Based on hearings from airline officials

Table-3.21 Available Engine Class and Number of Engine

1. Turbo-Jet, Turbo-Fan Engine
   (1) Available Engine Class
   T1 = 10,000 LBS, T2 = 20,000 LBS
   T3 = 30,000 LBS, T4 = 40,000 LBS
   T5 = 50,000 LBS, (T6 = 60,000 LBS)
   (2) Number of Engine
   T/Tn = 2, 3 or 4
   T : Total Required Thrust (static, sea level, ISA)
   Tn : n = 1, 2, 3, 4, 5 or 6; Refer to the item 1.(1).

2. Turbo-Prop Engine
   (1) Available Engine Class
   T1 = 300 SHP, T2 = 400 SHP, T3 = 500 SHP
   T4 = 600 SHP, T5 = 700 SHP, T6 = 800 SHP
   T7 = 900 SHP, T8 =1,000 SHP, T9 =1,100 SHP
   T10=1,200 SHP, T11=1,400 SHP, T12=1,600 SHP
   T13=1,800 SHP, T14=2,000 SHP, T15=3,000 SHP
   T16=4,000 SHP, T17=5,000 SHP, (T18=66,000 SHP)
   (2) Number of Engine
   P/Pn = 2, 3 or 4
   P : Total Required Power (static, sea level, ISA)
   Pn : n = 1 16 ; Refer to the item 2.(1).

(52) The data for fuel burn during flight is required to estimate fuel cost, which is an element of the aircraft operating cost. The relation between maximum takeoff weight, fuel consumption and range has been calculated as presented in Table-3.22 and Figure-3.19.
The following relation is obtained.

1) Jet airplane ;

$$\text{Fuel consumption}/(\text{maximum takeoff weight})^{2/3}$$

$$= 856 * (\text{Range} - 3{,}000)/10^6 + 2.5$$

2) Propeller airplane;

$$\text{Fuel consumption}/(\text{maximum takeoff weight})^{2/3}$$

$$= 7 * (\text{Range} - 520)/10^4 + 0.45$$

Fuel consumption (fuel burn during flight) can be given by the above equations, once range and the number of passenger seats are defined, because maximum takeoff weight can be specified using the number of passenger seats as explained in the preceding paragraphs.

Table-3.22 (1) Fuel Consumption Vs. Range (1/2)

- Jet Aircraft -

Aircraft Model	W : Maximum Takeoff Weight (kg)	Fc : Fuel Consumption (US gal.)	Cruising Speed (KTAS)	Range: With Reserve Fuel (200 nm + 1 hr) (nm)	Range: With Reserve Fuel (1 hr) (nm)	Range: Without Reserve Fuel (nm)	$Fc/(W)^{2/3}$ (US gal. / $kg^{2/3}$)
B-747-200B	377,840	52,409 (Full)	471 (523X0.9)	5,700	5,900	6,371 (11,799 km)	10.03
DC-10-30	251,744	28,358 (with max. payload)	483	3,800	4,000	4,483 (8,303 km)	7.11
A-300 (AIRBUS B4-220)	165,000	16,933 (Full)	457	2,900	3,100	3,557 (6,588 km)	5.63
DC-9-30	44,450	3,679 (Full)	471	1,288	1,488	1,959 (3,628 km)	2.93
F-28 (Mk-3000)	32,200	3,445 (Full)	366	1,710	1,910	2,276 (4,215 km)	3.40

Note : Assumption (1) Fuel Specific Weight 6.7 lbs/US gal.
Source : JANE'S ALL THE WORLD'S AIRCRAFT

Table-3.22 (2) Fuel Consumption Vs. Range (2/2)

- Propeller Aircraft -

Aircraft Model	W : Maximum Takeoff Weight (kg)	Fc : Fuel Consumption (US gal.)	Cruising Speed (KTAS)	Range with Reserve Fuel (nm)	Reserve Fuel	Range without Reserve Fuel (nm)	$Fc/(W)^{2/3}$ $\left(\frac{\text{US gal.}}{(\text{kg})^{2/3}}\right)$
BN-2 ISLANDER	2,857	89 (with 8 pax.)	133	369	30min.	435.5 (806 km)	0.44
CASA 212-5	6,500	436 (with 19 pax.)	148	458	200nm + 45min.	569 (1,054 km)	1.25
DHC-6-300	5,670	336 (with 3,250lbs payload)	182	646	30min.	737 (1,365 km)	1.06
F-27 (Mk500)	20,410	1,357 (Full)	259	935	200nm + 30min. + 10% flight fuel	1,358 (2,515 km)	1.82
HS-748-2B	21,092	1,194 (with max. payload)	244	925	200nm + 45min.	1,308 (2,422 km)	1.56
L-188 ELECTRA	51,247 (not max. takeoff weight)	4,460	352	-		2,407 (4,458 km)	3.23

Note : Assumption (1) Fuel Specific Weight 6.7 lbs/US gal.
Assumption (2) Passenger : 200 lbs/passenger

Source : JANE'S ALL THE WORLD'S AIRCRAFT

Figure-3.19 FUEL CONSUMPTION VS. RANGE(1/2)

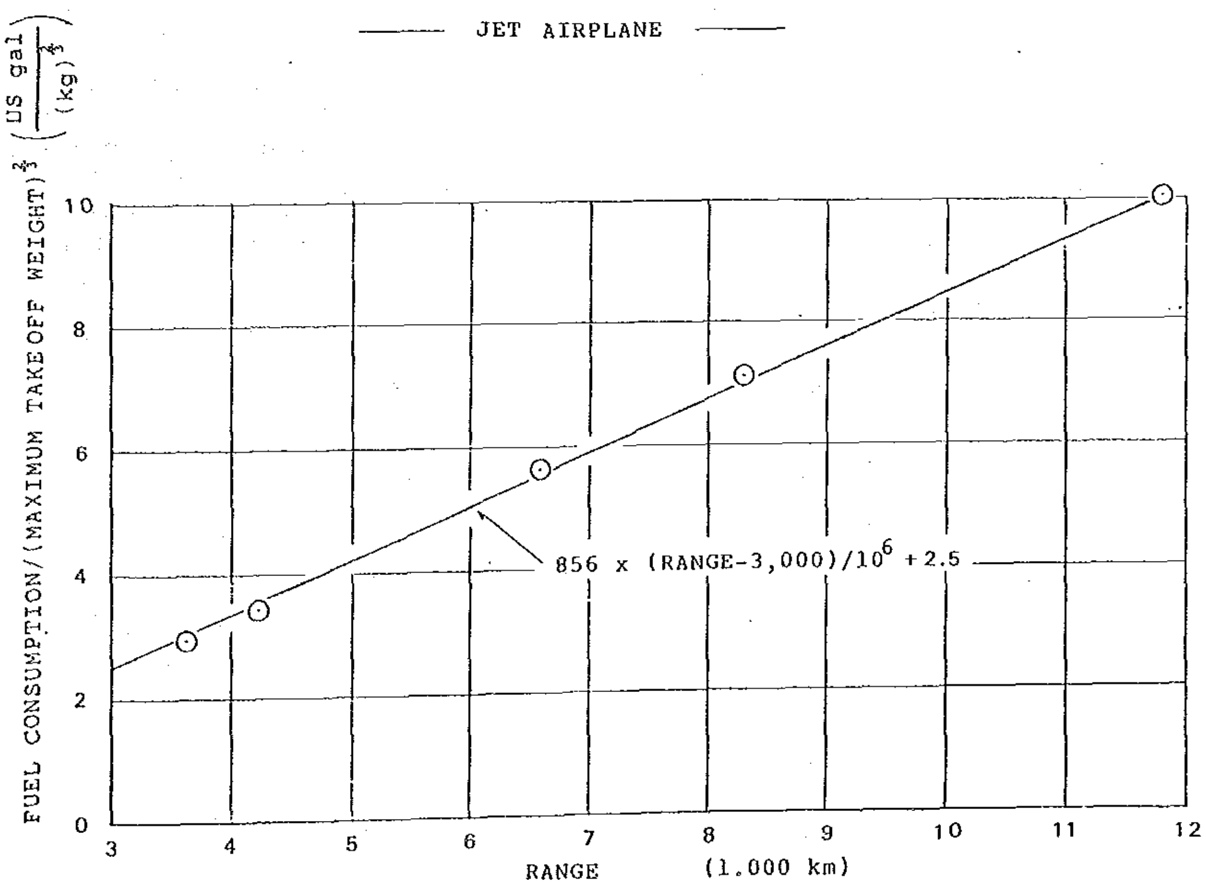
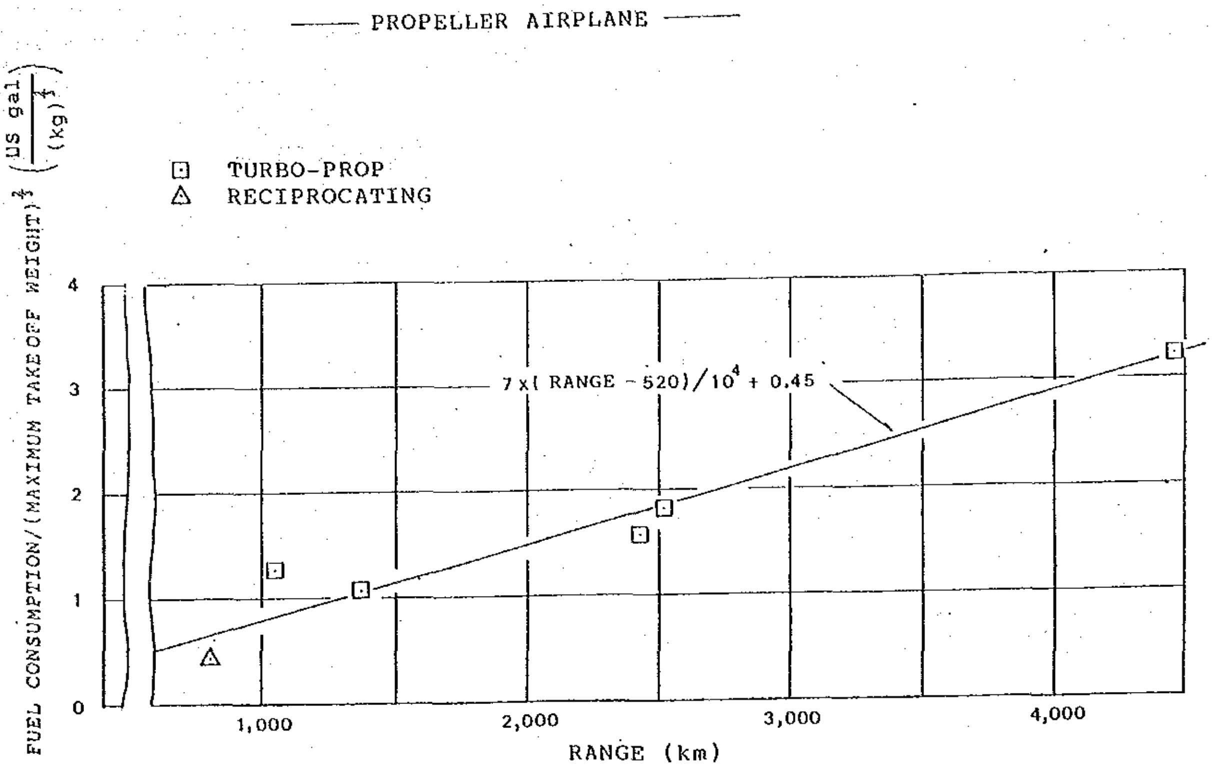


Figure-3.19 FUEL CONSUMPTION VS. RANGE(2/2)



(53) Data for aircraft price is necessary for estimating insurance cost and depreciation cost. Price in 1985 of 22 airplanes are tabulated with corresponding number of passenger seats in Table-3.23. This data is plotted in Figure-3.20. From Figure-3.20 the relation between airplane price and the number of passenger seats is obtained as follows.

- Airplane with turbo-fan engines (70 seats or more)

  Airplane Price (M$ in 1985)

  $= 0.75816 * SN^{0.68117}$

- Airplane with turbo-prop engines (no more than 70 seats)

  Airplane Price (M$ in 1985)

  $= 0.43486 * SN^{0.71319}$

where,
SN : Number of passenger seats

Table-3.23 Price of Aircraft

TURBO-FAN

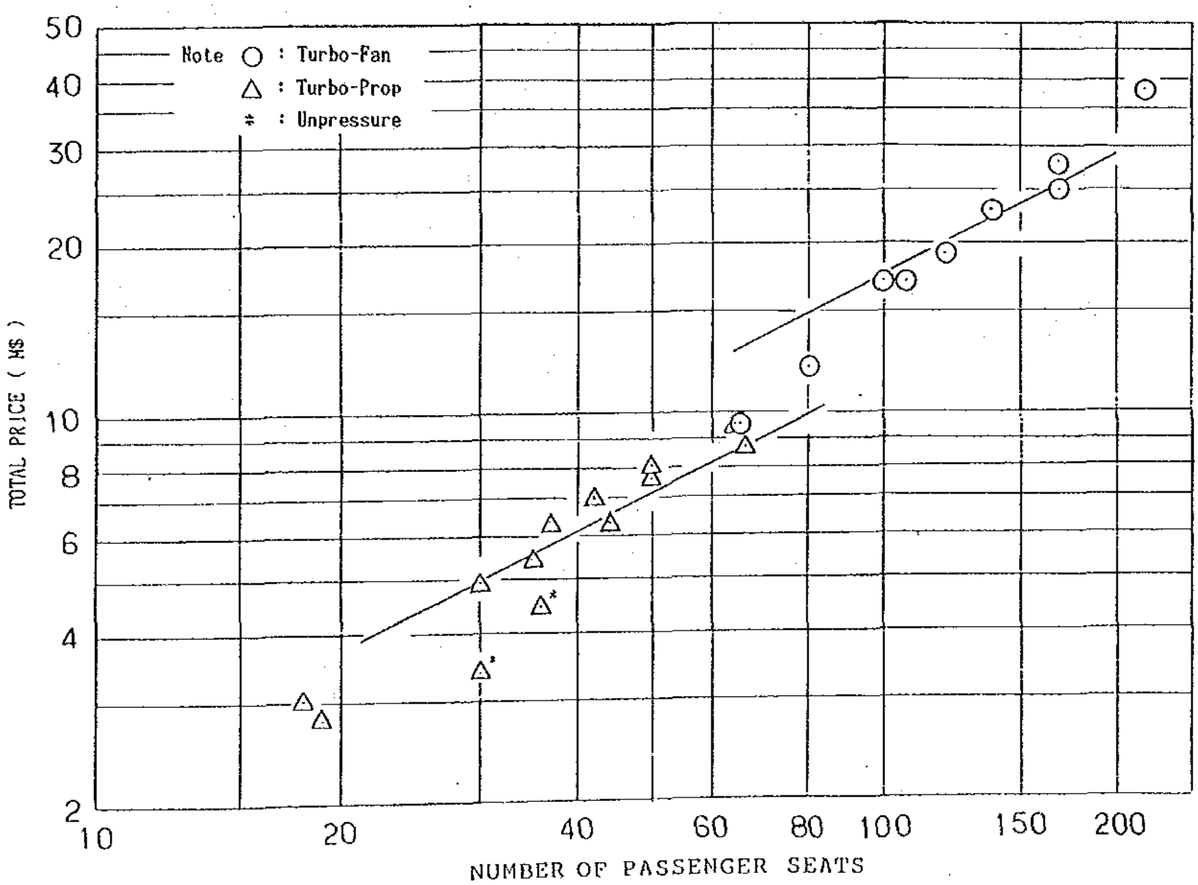
Aircraft Model	No. of Passenger Seat	Price of Aircraft (Mill. US$)
B-757-200	218	38
A-320-200	168	28
MD-80	168	25
B-737-300	138	23
B-737-200	120	19
F-100	107	17
BAe-146-200	100	17
F-28 (Mk-4000)	80	12
F-28 (Mk-3000)	65	9.5

TURBO-PROP

Aircraft Model	No. of Passenger Seat	Price of Aircraft (Mill. US$)
ATR-72	66	8.7
BAe ATP	64	9.5
DASH 7	50	8.0
DASH 8	37	6.3
F-50	50	7.5
ATR-42	42	7.0
CN-235	44	6.3
SF 340	35	5.4
EMB 120	30	4.9
SD 360	36	4.4
SD 330	30	3.4
BEECH 1900	19	2.8
JETSTREAM 31	18	3.0

Source : WORKING GROUP REPORT,
The Society of Japanese Aerospace Companies, Inc. (S.J.A.C.)

Figure-3.20 AIRCRAFT TOTAL PRICE (YEAR ; 1985)



(54) The relation between airplane price and number of passenger seats in 1973 had been defined as follows in the computer program TCHART for estimating of aircraft operating cost.

Airplane Price (M$ in 1973) = 0.045 * SN

To compare with this relation, average price of airplane in 1985 can be expressed as follows,

Airplane Price (M$ in 1985) = 0.1636 * SN

Therefore, airplane price in 1985 is about 3.636 times of airplane price in 1973 with same number of passenger seats. This means that the average rise of airplane price is about 11.4 % per year.

(55) Engine price data is required to estimate depreciation cost. As for turbo-fan engines, the relation between engine price and maximum takeoff thrust in 1973 had been defined as follows in the computer program TCHART for estimation of aircraft operating cost.

Engine Price ($) = 174.78 * $T^{0.8356}$

Where,
T : Maximum takeoff thrust (lbs)

As for turbo-prop engine, the relation between engine price and maximum takeoff power in 1973 had been defined as follows also in the computer program TCHART.

Engine price ($) = 289.72 * $P^{0.8356}$

Where,
P : Maximum takeoff power (shp)

These relations between engine price and maximum takeoff thrust or maximum takeoff power in 1973, can be corrected to those in 1985 applying the average rise in airplane price obtained in paragraph (50), because this study is a macroscopic one. Therefore,

Turbo-fan engine price in 1985 ($)

= 635.5 * $T^{0.8356}$

Where, T : maximum takeoff thrust (lbs)

Turbo-prop engine price in 1985 ($)

= 1,053.42 * $P^{0.8356}$

Where, P : maximum takeoff power (shp)

(56) There is no helicopter airliners in Indonesia at present. But there is a possibility that helicopters are considered as a suitable means for transportation in some districts depending on the airport availability and traffic demand in this study.
Even if there is no airport in a particular district, helicopter can takeoff and land, if a heliport is available in that district. But if large volumes of traffic demand can be expected in future, it may be more efficient to construct an airport and operate airplanes than to operate large helicopter. Therefore, the data of maximum takeoff weight, maximum takeoff power and cruise fuel flow of helicopters with no more than 10 passenger seats is prepared here for this study. From Table-3.17 five types of helicopter are selected which have 10 or so passenger seats and the data for maximum takeoff weight, maximum takeoff power and cruise fuel flow of these helicopters are tabulated in Table-3.24. Average value of maximum takeoff weight/number of passenger seats in Table-3.24 is 400.6 (kg/passenger seat). Therefore, the maximum takeoff weight of helicopter with 10 passenger seats is estimated as follows.

Maximum takeoff weight (kg) = 400.6 * 10
= 4,006

Table-3.24 Number of Passenger Seats, Maximum Takeoff Weight, Maximum Takeoff Power and Cruising Flow of Helicopter (Turbo-Shaft Engine)

Helicopter Model	① No. of Passenger Seat (max.)	② Maximum Takeoff Weight (kg)	③ Maximum Takeoff Power X No. of Engine (shp)	④ Total Fuel Flow at Cruising (lbs/hr)	②/① (kg/pax.)	②/③ (kg/shp)	④/③ (lbs/hr/shp)
MBB BK117-A3	9	3,200	600 X 2	436	355.6	2.67	0.363
BELL 222B	8	3,742	684 X 2	551	467.8	2.74	0.403
AEROSPATIALE SA365N	12	4,000	700 X 2	589	333.3	2.86	0.421
BELL 412	13	5,400	900 X 2	740	415.4	3.00	0.411
SIKORSKY S-76B	12	5,171	960 X 2	625	430.9	2.69	0.326

(57) Average value of maximum takeoff weight/maximum takeoff power in Table-3.24 is 2.79 (kg/shp). Therefore, the maximum takeoff power of helicopter with 10 passenger seats and 2 engines are estimated as follows.

Maximum takeoff power (shp) = 4,006/(2.79 * 2)
= 717.9 per engine

(58) Average value of cruise fuel flow/maximum takeoff power in Table-3.24 is 0.385 (lbs/hr/shp). Therefore, cruise fuel flow (total fuel flow at cruise) for helicopter with 10 passenger seats is estimated as follows.

Total fuel flow at cruise (lbs/hr) = 0.385 * 717.9 * 2
= 552.8

(59) Maximum takeoff weight, maximum takeoff power and total fuel flow at cruise of helicopter with 10 passenger seats can be summarized as follows.

- Maximum takeoff weight = 4,000 kg
- Maximum takeoff power = 720 shp per engine
- Total fuel flow at cruise = 550 lbs/hr
- Number of engines = 2

(60) Number of crew and cabin attendants for one flight of helicopter with 10 passenger seats are assumed as follows.

- Number of crew = 2
- Number of cabin attendants = 0

As for price of helicopter with 10 passenger seats, the following value has been used in the computer program TCHART.

Helicopter price in 1984 = $1.72 millions.

For engine price, the relation between engine price and maximum takeoff power described hereinbefore can be used also for helicopter engines (Turbo-Shaft engines) in this study.

(61) Only 1 class of STOL plane, having 50 seats, has been assumed in this paragraph. The following parameters have been assumed for this plane for calculation of operating cost.

- Maximum takeoff weight :

According to Figure-3.21, maximum takeoff weight of STOL has been assumed to be 1.1 times that of conventional aircraft (20,000 kg), that is ;

MTW = 20,000 * 1.1 = 22,000 (kg)

- Empty weight :

Based on the same assumptions used for the conventional aircraft :

EW = 0.46875 * MTW = 10,313 (kg)

- Number of crew and cabin attendants ;

Based on the same assumptions used for the conventional aircraft :

Number of crew = 4
Number of cabin attendant = 2

- Maximum takeoff thrust :

According to Figure-3.15, the weight loading of a STOL (W/S) is 413.35. (Becouse , maximum cruise speed of STOL has been assumed to be 464 KTAS.) assuming the maximum takeoff weight (W) of 22,000 kg , the wing area is 53 m^2.
With the takeoff thrust of a conventional aircraft of 6476.7 kg, the thrust of STOL is 1.66 times this figure, according to Figure-3.21, that is :

T = 6476.7 * 1.66 = 10,751 (kg)

- Fuel burn :

The ratio of the fuel consumption of STOL having required field length of 3,000 ft to that of a conventional aircraft requiring a 5,200 ft field can be obtained by Figure-3.22, that is ;

(Fuel burn out of STOL)/(Fuel burn out of CTOL)
= 2.06 / 1.66 = 1.24

Therefore, the fuel burn of STOL is assumed to be 1.24 times that of a conventional aircraft.

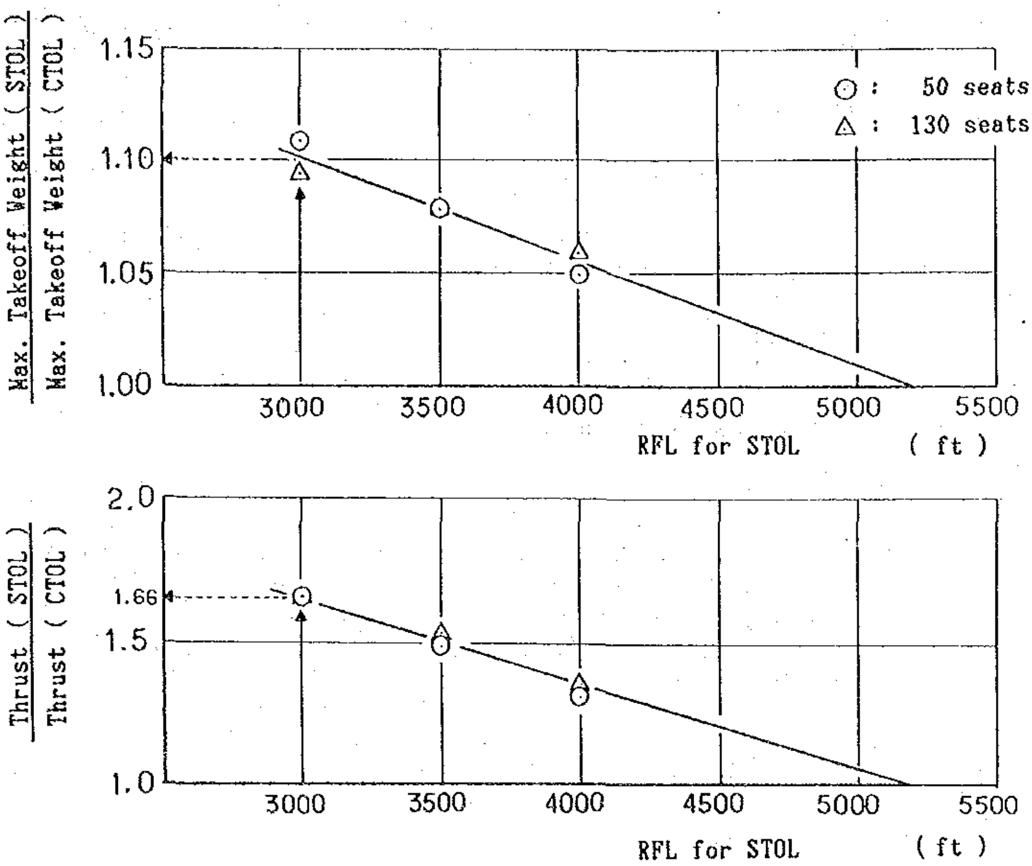
- Price :

Figure-3.23 also gives the price ratio of STOL requiring 3,000 ft field length and conventional aircraft requiring 5,200 ft as below.

(Price of STOL)/(Price of CTOL)
= 8.70 / 7.25 = 1.20

Therefore, the price is assumed to be 1.20 times that of a conventional aircraft.

Figure-3.21 Increment Ratio of Max. Takeoff Weight / Thrust for STOL



(RFL : Required Field Length)

Figure-3.22 FUEL BURN OUT (50 SEATS)

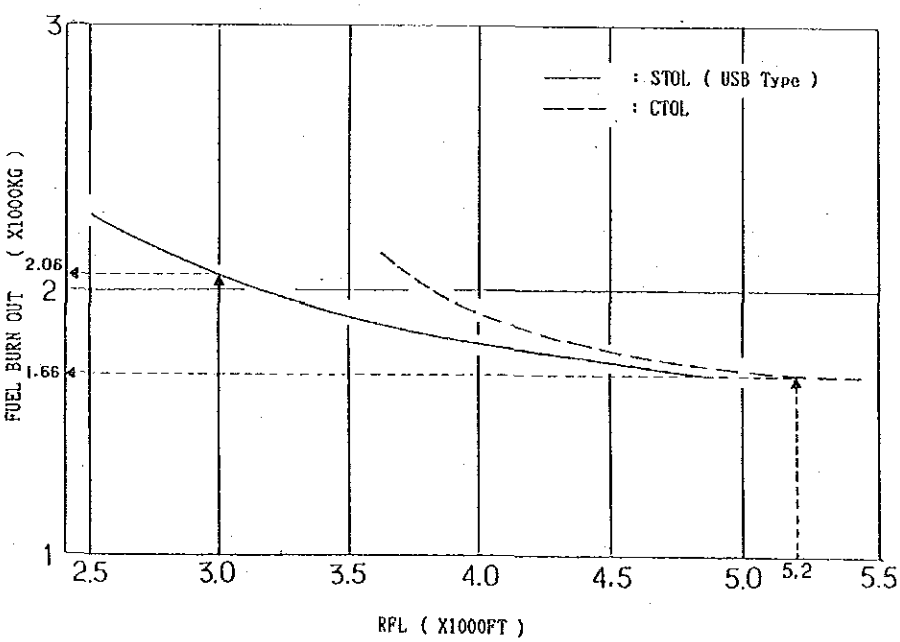
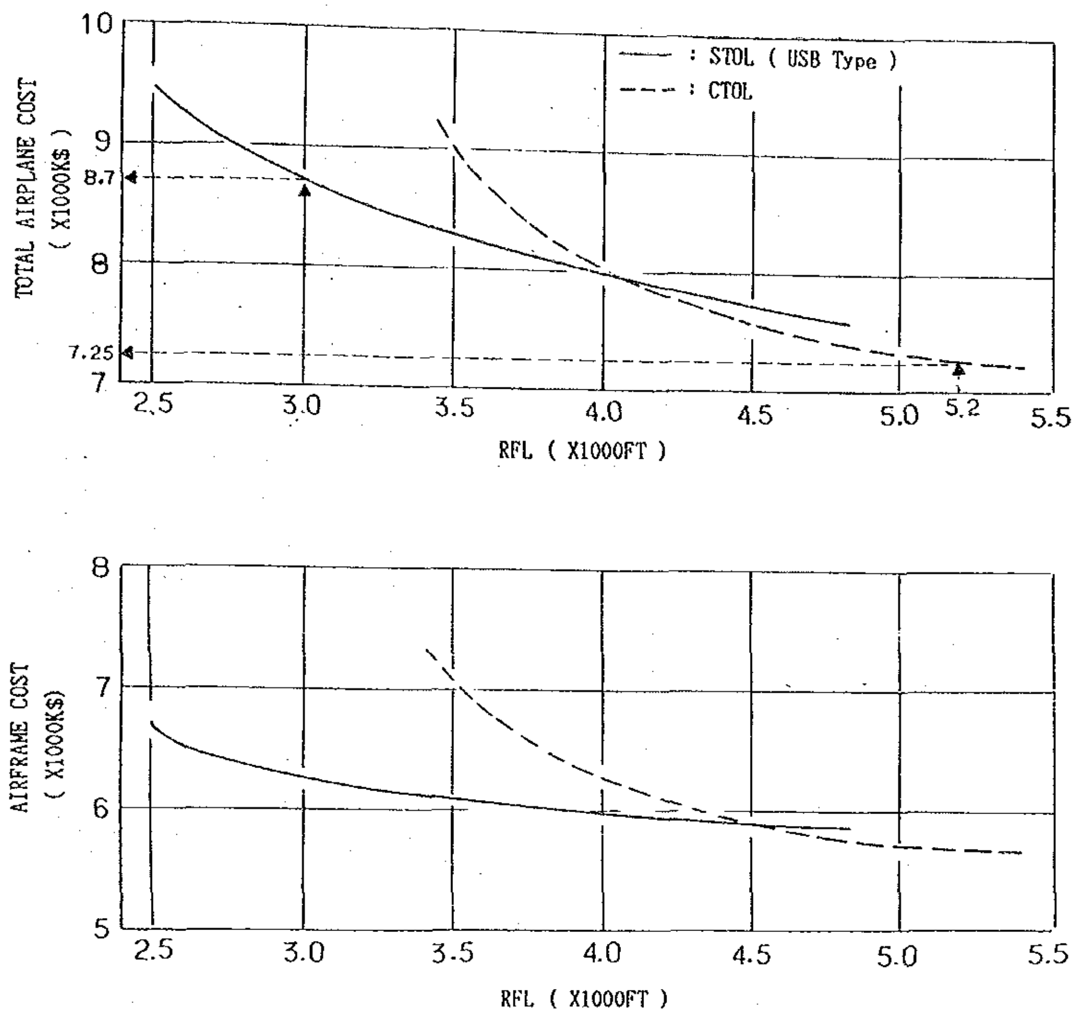


Figure-3.23 TOTAL AIRPLANE AND AIRFRAME COST (50 SEATS)



(62) The parameters of amphibians assumed in this study are as below.

- Maximum take off weight :

50 seats type	----	22,885 kg
35 seats type	----	17,300 kg
20 seats type	----	9,805 kg

- Empty weight :

The empty weight of amphibians are assumed based on the same concept as with a conventional aircraft.

$EW = 0.46875 * MTW$

50 seats type	----	10,767 kg
35 seats type	----	8,110 kg
20 seats type	----	4,596 kg

- Number of crew and cabin attendants :

  Based on the same concept as with a conventional airplane.

	50 seats	35 seats	20 seats
crew	4	2	2
Cabin attendants	2	2	1

- Maximum takeoff power :

  As all amphibians are airplanes with turbo-prop engines, the engine power is assumed as below.

50 seats type	----	9,636 SHP
35 seats type	----	6,080 SHP
20 seats type	----	2,952 SHP

- Fuel burn :

  Fuel burn is assumed as below.

50 seats type	----	$1.093\ (fuel)/\frac{1}{4}(MTW)^{2/3}$¶
35 seats type	----	$0.868\ (fuel)/\frac{1}{4}(MTW)^{2/3}$¶
20 seats type	----	$0.456\ (fuel)/\frac{1}{4}(MTW)^{2/3}$¶

- Price :

  The price of amphibian is assumed to be 1.2 times that of a conventional aircraft of same class.

(63) Table-3.25 shows fuel price, oil price, insurance rate, depreciation period, labour rate, crew rate and cabin attendant rate.

Table-3.25 Fuel and Oil Prices, Insurance Rate, Depreciation Years, Labor Rate, and Crew and Cabin Attendant Rates

Item	
Fuel Price	250 Rp/l
Oil Price	2,225 Rp/l
Insurance Rate	1 %
Depreciation Years	10 years
Labor Rate	1,600 Rp/hr (Government Airlines) 9,000 Rp/hr (Private Airlines, Company) 5,600 Rp/hr (Average)
Crew Rate	20 US$/hr
Cabin Attendant Rate	8 US$/hr (Average of All Airlines)

Source : Based on hearings from airline officials

SECTION 4

SEA TRANSPORT

SECTION 4
SEA TRANSPORT

4.01 ANALYSIS OF PRESENT SITUATIONS

(01) Indonesia is the largest archipelago country in the world. It is composed of about 17,000 inhabited islands. Sea transport plays a very important role in domestic transport in Indonesia, as well as international transport. The Government of Indonesia therefore put priority on the improvement and expansion of sea transport in their development policy. The present situation concerning domestic sea transport is mainly discussed in this study.

4.01.1 Domestic Sea Transport

4.01.1.1 General Aspect

(02) The domestic sea transport is classified into 7 categories as (1) Inter-island sea transport, (2) Local sea transport, (3) Rakyat (people's) sea transport, (4) Pioneer sea transport, (5) Special sea transport, (6) Sea train, and (7) Ferry Services.

- Inter-island sea transport

(03) The Inter-island sea transport plays a significant role in domestic sea transport and most of the passengers and cargo are carried by the Regular Liner Service (RLS). In 1987, RLS. operated 24 Nusantara routes, 6 Penumpang (Passenger) routes, and 27 Singapore/Malaysia routes. The total number of routes counted were 57 routes. Every vessel utilized for the above mentioned routes is passenger-cargo type vessels, except Penumpang route with passenger vessels, and RLS carry the majority of passengers traveling between islands.

- Local sea transport and Rakyat sea transport

(04) The Local sea transport is mainly used for the coastal sea transport. It is operated by small size ships of less than 175 GRT (Gross Registered Tonnage), while the Rakyat operates much smaller boats such as sail boats or motorized sail boats. These two types of sea transport mainly supplement the Inter-island sea transport. They also operate boats between major ports within the routes of the RLS and to other ports.

- Pioneer sea transport

(05) The pioneer sea transport started operation in 1974. It utilized 11 routes operated by 9 vessels. It's aim was to assist rural development in remote areas such as Irian Jaya. By 1984, their operation had expanded to 14 routes by 25 vessels. The basic concept of the pioneer transport was to achieve the main target of PELITA-III "equalization of development" by assist development of rural areas. This policy is also included in REPELITA-IV.

- Special sea transport

(06) The special sea transport is the tramper liners service transporting homogeneous bulk cargo, such as petroleum and liquid natural gas, by special vessels; mainly tanker. In 1985, 2,715 vessels were utilized for this special sea transport.

- Sea train

(07) The Sea train is mostly operated as an off shore shipping activity. This kind of transport uses barges which are towed by a tug boat. Usually, they are used for carrying dry bulk cargoes such as iron sand, white sand for glass industry and Buton asphalt, which are commercially determined feasible when carried by barges.

- Ferry services

(08) The Ferry services cover about 53 routes established mainly between islands with a comparatively short distance between them - mostly within 50 miles. The Ferry services have been playing a very important role in the sea transport between islands.

4.01.1.2 Vessels for Domestic Sea Transport

(09) The past number of vessels, their dead weight tonnage (DWT) or gross registered tonnage (GRT), and average DWT or GRT for the last 5 years are summarized in Tables 4.1 to 4.3, respectively. The total number of vessels in 1985 was 9,110. The RLS fleet occupy 5.3% (486 vessels) of the share, followed by sailing fleet (45.0%) and special fleet (29.8%). On the other hand, RLS and special vessels occupy 13.3% and 69.5% by DWT respectively, and these two types of vessels occupy almost 85% of the share in total. (conversion factor 1 GRT = 1.5 DWT was used for calculations)

(10) The average ship size of RLS fleets, special vessels and local vessels is about 1,200 DWT, 1,100 DWT and 120 GRT, respectively, and there have been no drastic changes in these sizes for the last 4 years. Since many vessels have been converted from RLS to the Pioneer sea transport, there are also a variety of ships between 500 to 900 DWT operated as the pioneer sea transport. The 78 ferry boats, some of which are ro-ro type, have an average size of 400 GRT.

Table-4.1 Number of Vessels for Domestic Transport (1981 - 1985)

Type of fleet	1981	1982	1983	1984	1985
Regular Liner Fleet	361	397	387	483	486 (5.3%)
Local Fleet (up to 175 GRT)	997	1,049	1,139	963	1,055 (11.6%)
Sailing (motorized) Fleet	3,346	3,486	3,511	3,759	4,100 (45.0%)
Pioneer Vessels	35	36	31	25	25 (0.3%)
Port Assisting Fleet	636	645	645	645	651 (7.1%)
Special Vessels, Carrying Homogeneous Bulk	2,242	2,510	2,542	2,576	2,715 (29.8%)
Ferry Boats	n.a.	n.a.	n.a.	n.a.	78 (0.9%)
Total	7,607	8,123	8,255	8,451	9,110

Source : Data dan Informasi Sector Perhubungan 1985, Departemen Perhubungan

Table-4.2 Vessels' DWT/GRT for Domestic Transport (1981 - 1985)

(Unit : 1,000 tons)

Type of fleet	1981	1982	1983	1984	1985
Regular Liner Fleet (DWT)	425.56	503.37	486.82	521.99	552.62 (13.3%)
Local Fleet (GRT) (up to 175 GRT)	120.15	129.48	134.34	118.41	125.51 (4.5%)
Sailing (motorized) Fleet (GRT)	179.03	180.45	195.46	201.51	209.73 (7.6%)
Pioneer Vessels (DWT)	23.18	20.81	16.43	12.27	22.47 (0.5%)
Port Assisting Fleet (GRT)	96.83	104.20	104.20	73.21	90.38 (3.4%)
Special Vessels, Carrying Homogeneous Bulk (DWT)	1,505.25	2,856.62	2,846.95	2,872.18	2,885.36 (69.5%)
Ferry Boats (GRT)	n.a.	n.a.	n.a.	n.a.	32.28 (1.2%)

Source : Data dan Informasi Sector Perhubungan 1985, Departemen Perhubungan

Table-4.3 Vessels' Average DWT/GRT for Domestic Transport (1981 - 1985)

(Unit : ton)

Type of fleet	1981	1982	1983	1984	1985
Regular Liner Fleet (DWT)	1,178.8	1,267.9	1,257.9	1,080.7	1,137.1
Local Fleet (GRT) (up to 175 GRT)	35.9	123.4	117.9	123.0	119.0
Sailing (motorized) Fleet (GRT)	53.5	51.8	55.7	53.6	51.2
Pioneer Vessels (DWT)	662.3	578.1	530.0	490.8	898.8
Port Assisting Fleet (GRT)	152.2	161.6	161.6	113.5	138.8
Special Vessels, Carrying Homoge-neous Bulk (DWT)	671.4	1,138.1	1,120.0	1,115.0	1,062.7
Ferry Boats (GRT)	n.a.	n.a.	n.a.	n.a.	413.8
Average	308.9	467.2	458.4	449.6	455.6

Source : Data dan Informasi Sector Perhubungan 1985, Departemen Perhubungan

4.01.1.3 Domestic Cargo Transport

(11) Table-4.4 summarizes the cargo volume carried by each type of domestic sea transport for the last 6 years. The total cargo volume carried in 1984 was 36.5 million tons and RLS carried only 8.8% of this. On the contrary, the petroleum tankers carried more than a half of the total cargo volume, followed by the special ships, the vegetable oil tankers, the salt industry ships, the fertilizer industry ships and the cement industry ships. Cargo carried by these 6 types of oil/ bulk carriers was 67.8% of the total. For the last 5 years, the total volume of cargo has been increasing by an average annual growth rate of 8.6%. The annual growth rate of cargo volume carried by petroleum tankers (9.3%) and oil/bulk carriers (11.3%) are especially high. The annual growth rate of cargo volume transported by the RLS was only 1.7%.

Table-4.4 Domestic Cargo Carried by Ship Types (1979 - 1984)

(Unit : 1,000 tons)

Ship Type	1979	1980	1981	1982	1983	1984
1. RLS Fleet	2,938	3,496	3,063	2,999	3,262	3,198
2. Local Fleet	2,236	2,755	2,743	2,406	2,116	1,763
3. Sail Boat	1,643	1,884	2,176	2,068	2,344	2,876
4. Ocean-going	117	340	229	179	409	114
5. Foreign Vessels	376	421	253	557	382	161
6. Barge	1,643	2,017	3,044	3,274	3,448	3,115
7. Ferry Boat	705	924	1,279	1,278	575	521
8. Special Ship	747	1,118	1,006	1,418	1,666	1,841
9. Vegetable Oil Tanker	34	38	321	432	530	877
10. Salt Industry	5	3	1	5	43	95
11. Fertilizer Industry	917	1,114	1,125	1,122	1,105	1,650
12. Cement Industry	58	12	-	57	179	442
13. Others	3	15	0	-	-	-
14. Petroleum Tanker	12,734	11,207	10,651	11,769	12,601	19,870
Total	24,156	25,344	25,891	27,564	28,660	36,523

Source : Lalu Lintas Angkutan antar Pulau dan Angkutan Samudera 1984, Proyek Persiapan dan Perencanaan Proyek-proyek Kerjasama Teknik Luar Negeri dan Biro Pusat Statistik, Departmen Perhuburgan, Direktorat Jenderal Perhubungan Laut.

(12) In addition, it should be noted that cargo carried by foreign vessels in 1984 was 160,000 tons, which occupied only 0.4% of the whole. This is because the policy of the Government of Indonesia states that domestic shippings have to be entirely carried out by the national flags (Cabotage policy) based on the Government Regulation No.2, 1969. International shipping fairshare principles are maintained. Permits are only granted by the Government of Indonesia to foreign flag carriers under specific conditions; for example the foreign flags are required to make use of an Indonesian operator for domestic trade and an Indonesian general agent, who submits the tariffs, manifests and conference membership to the Minister of Communications for approval.

4.01.1.4 Inter-island Sea Transport by Regular Liner Service

(13) In 1984, 50 shipping companies operated 68 regular liner service routes using 393 intermediate ships. These 68 routes were a reorganization of 73 routes in 1983 based on the Regulation 13/2/5, issued on the 22nd of December, 1983. These 68 routes are categorized into 47 routes (23 routes for the west region and 24 routes for the east region) by the N-line (Nusantara : Inter-island), 13 routes by the S-line (Indonesia - Singapore) and 8 routes by the P-line (Penumpang : Passenger). For these routes, the N-lines operated ships for 774 trips per year (8 - 28 trips/year/route, on average 16.5 trips/ year/ route), the S-line operated ships for 250 trips per year (7 - 33 trips/year/route, on average 19.2 trips/ year/route) and P-line operated ships for 262 trips per year (10 - 52 trips/year/route, on average 32.8 trips/year/ route). The total number of trips were counted as 1,286 trips per year (On average 18.9 trips/year/route).

(14) 17 routes within the allocated 24 routes of the N-line in the east region were abandoned based on the Regulation 59/2/8 issued on the 3rd of December, 1986. And in 1987, RLS operated 24 Nusantara routes, 6 Penumpang (Passenger) routes, and 27 Singapore/Malaysia routes. The total number of routes counted were 57 routes.

(15) Table-4.5 summarizes the number of vessels owned and operated by RLS and also the cargo volume carried by RLS. The actual operation ratio of RLS vessels was 77%, and 14 of RLS vessels also transported to other than RLS's special routes and they carried 190,000 tons of cargo, about 4% of the total cargo carried by RLS. In addition, some of RLS vessels were assigned to the Pioneer sea transport. The load factors of RLS fleets for N-line and S-Line are about 50 - 60%, however, that for P-Line is only 10 - 20%.

Table-4.5 Capacity of RLS Vessels and Cargo Volume Carried in 1984

Line	Placement		Realization		Carried Cargo Volume (Weight ton)
	Number	DWT	Number	DWT	
Inter-Island	334	407,153	252	333,246	3,786,798
Singapore-Indonesia (Indonesian Owner)	50	72,825	40	61,367	831,890
Passenger	9	25,590	9	25,590	75,097
Sub-Total	393	505,568	301	420,203	4,693,785
Correction factor 2% for Pioneer transport					93,875
Total					4,787,660
Not settled to the line			14	35,429	189,033
Non RLS, Navy and barge transporting important commodities			61 trips	-	74,080
Non RLS Ocean-going or special vessel transporting important commodities			164 trips	-	925,384
Non RLS local fleet or sailing boat transporting important commodities			-	-	383,457
Non RLS foreign vessels transporting important commodities			-	-	-
Singapore-Indonesia (Singapore ship owner)			39	86,115	759,114
Total for Indonesia					7,118,728

Source : Laporan Kegiatan Kapal-Kapal RLS Nusantara, Tahun : 1984, Bopberpan

(16) Within the 50 companies operating RLS routes, the state owned national shipping company PT.PELNI owns the largest number of vessels (57 vessels), 14.5% of the total number of RLS fleet, and carried 620,000 tons (13.2%) of cargo, as shown in Table-4.6. The average size of fleet owned by the PT.PELNI is rather larger than that of the RLS fleet. The average size of registered and actually operated fleet is 1,487 DWT and 1,727 DWT, respectively.

(17) The cargo volume carried by RLS fleet by commodity types is summarized in Table-4.7. In 1984, 65.5% of the total cargo volume, 4.88 million tons, was general cargo, and this situation indicates the specific characteristics of regular liners. Within general cargoes, cements occupied 14.4%, followed by rice (6.9%) and fertilizers (5.4%).

Table-4.6 RLS Vessels and Cargo Volume Carried (1984)

		PT.PELNI	Other Private Companies	Total
Placement	Number	57 (14.5%)	336 (85.5%)	393
	Total DWT	84,769 (16.8%)	420,799 (83.2%)	505,568
	Ave. DWT	1,487	1,252	1,286
Realization	Number	46 (15.3%)	255 (84.7%)	301
	Total DWT	79,434 (18.9%)	340,769 (81.1%)	420,203
	Ave. DWT	1,727	1,336	1,396
Cargo Transported (Weight ton)		621,525 (13.2%)	4,072,260 (86.8%)	4,693,785

Prepared from "Laporan Kegiatan Kapal-Kapal RLS Nusantara, Tahun : 1984, Bopberpan

Table-4.7 Cargo Carried by RLS Vessels (1980 - 1984)

(Unit : ton)

Commodity	1980	1981	1982	1983	1984
1. Rice	200,835	171,147	232,860	366,103	337,109 (6.9%)
2. Sugar	120,802	87,878	85,499	92,453	121,981 (2.5%)
3. Flour	54,164	55,807	65,486	69,177	47,563 (1.0%)
4. Fertilizer	201,736	187,674	228,246	297,832	265,983 (5.4%)
5. Copra	124,848	79,060	82,846	66,146	36,985 (0.8%)
6. Asphalt	84,083	78,407	50,822	69,085	62,690 (1.3%)
7. Cement	436,897	399,489	478,036	564,217	702,112 (14.4%)
8. Sawn Timber	58,373	85,314	126,307	124,932	111,427 (2.3%)
9. General Cargo	3,062,091	2,850,699	3,023,292	3,231,599	3,196,968 (65.5%)
Total	4,343,829	3,995,475	4,373,394	4,881,547	4,882,818
10. Animal (unit : head)	38,138	21,650	40,571	38,893	47,881

Prepared from "Laporan Kegiatan Kapal-Kapal RLS Nusantara, Tahun : 1980,1981, 1982,1983,1984, Bopberpan"

4.01.1.5 Local Sea Transport

(18) The main aim of the Local sea transport is to carry cargoes between a regional major port, which is on a RLS route, and a smaller port. The length of their routes are usually less than 200 miles. According to the Indonesian Sea Transport Act, the size of fleet assigned to the Local sea transport is defined as a maximum of 175 GRT. The actual fleets assigned to Local sea transports in 1985 were 1,055 in number, and the average ship size and average dead weight tonnage was 1,264 DWT and 119 tons, respectively. In 1984, the Local sea transport fleets carried 1,763 thousand tons of cargo (4.8% of total cargo and 15% of cargo excluding cargo carried by bulk/ore carriers). Carried cargo volume in recent years has been almost the same or rather less than previous years.

4.01.1.6 Rakyat Sea Transport

(19) The main aim of the Rakyat sea transport is to carry a small volume of cargo on short distance routes using sailing boats (including motorized sailing boats). Since the Rakyat sea transport can supplement the local sea transport, it is widely utilized in Indonesia. In 1985, the number of ships assigned to the Rakyat sea transport was 4,100 in number, 210,000 in total tonnage and 51 GRT in average ship size. Volume of cargo carried by the Rakyat sea transport in 1984 was 2,876 thousand tons (7.9% of total cargoes and 24.5% of cargo excluding cargo carried by bulk/-ore carriers). These cargo volumes have been increasing for the last 5 years with an average annual growth rate of 11.9%.

(20) Since the size of ships assigned to the Rakyat sea transport is generally small with shallow draught, they have advantages such as to accommodate to the ports without

sufficient facilities and to operate non- scheduled ships accordingly. Therefore, the Rakyat sea transport together with the Local sea transport plays a very important role in remote island regions, such as the eastern part of Nusa Tenggara and Maluku, where cargoes can only be carried by the sea transport.

4.01.1.7 Pioneer Sea Transport

(21) In Indonesia, the speed of regional development is generally slow especially on remote small islands in eastern regions, where development is mainly affected by a deficient transport system. In order to provide adequate transport means for those remote areas, the Pioneer sea transport started operation in 1974, as a regular liner service operated by passenger-cargo vessels. 25 vessels were assigned to this service in 1985. Many of the vessels had been converted from RLS, total dead weight tonnage and average dead weight tonnage in 1985 was 22 thousand tons and 900 tons, respectively. Large size vessels were assigned for this operation, even though amount of cargo is small, because of the marine conditions along the routes. In 1984, total cargo volume transported by the Pioneer sea transport was reported as only 32 thousand tons and their operation was uneconomical, mainly due to their operational characteristics.

4.01.1.8 Passenger Transport

(22) For RLS, Local, Rakyat, Ferry and Pioneer services, passengers are carried by the same vessels as cargo. The number of passengers carried by each sector is presented in Table-4.8. It should be noted that statistics of the Pioneer sector have been compiled according to fiscal years. The total number of passengers carried by either passenger-cargo vessels or ferry boats in 1984 was 19 million persons. 91.5% were carried by Ferry, followed by RLS (3.8%),

Local (3.2%), Rakyat (0.8%) and the Pioneer (0.7%). The details of passenger transport by RLS, which occupies the largest share of passenger transport by passenger-cargo vessels, is summarized in Table-4.9.

(23) In 1984, 89 RLS vessels were assigned to carry passengers. Their dead weight tonnage was 138 thousand tons and average ship size was 1,554 DWT. They carried 727 thousand passengers compared to less than 500 thousand persons in 1982 and 1983. For these 4 years, the average annual growth rate was 3.4 %. The state owned national shipping company PT.PELNI occupies a higher share of the total for passenger transport compared with cargo transport, as shown in Table-4.9. Their share of vessels and dead weight tonnage in 1984 was 47.2% and 57.8%, respectively. In particularly, 96.6% of passengers were carried by PT.PELNI in 1984, however this is usually about 90% per year. For passenger transport, the RLS operates their major route mainly from Tanjung Priok Port, an ocean-going port of Jakarta, and Tanjung Perak Port in Surabaya, a center port of eastern Jawa.

Table-4.8 Passengers Carried by Shipping Sector (1980 - 1984)

(Unit : Person)

Shipping Sector	1980	1981	1982	1983	1984
RLS	635,099	585,694	489,625	495,245	726,577 (3.8%)
Local	472,017	551,249	593,290	612,050	610,959 (3.2%)
Rakyat	-	121,817	260,739	274,347	144,107 (0.8%)
Pioneer	-	168,183	161,387	127,848	139,806 (0.7%)
Ferry	13,127,517	11,685,612	13,688,963	13,021,584	17.460,440 (91.5%)
Total	-	13,112,555	15,194,004	14,531,074	19,081,889

Source : Studi Kelayakan Kapal Penumpang 7 & 8, Jan, 1986, Team Pelaksana Studi Kelayakan Kapal Penumpang 7 & 8

Table-4.9 Passengers Carried by RLS Lines and Details of Their Vessels (1980 - 1984)

Company	Items	1980	1981	1982	1983	1984
PT.PELNI	Number of Vessels	47	36	40	47	42
	Total DWT	83,995	71,543	82,371	91,678	79,876
	Average DWT	1,787	1,987	2,029	1,951	1,902
	Passenger Trans-ported (persons)	585,371	501,118	439,569	433,533	701,694
Other Private Companies	Number of Vessels	41	45	47	53	47
	Total DWT	44,500	56,744	63,684	66,457	58,422
	Average DWT	1,085	1,261	1,355	1,254	1,243
	Passenger Trans-ported (persons)	49,728	84,576	50,056	61,709	24,883
Total	Number of Vessels	88	81	87	100	89
	Total DWT	128,495	128,287	146,055	158,135	138,298
	Average DWT	1,460	1,584	1,679	1,581	1,554
	Passenger Trans-ported (persons)	635,099 (1.000)	585,694 (0.922)	489,625 (0.771)	495,242 (0.780)	726,577 (1.144)

Prepared from "Laporan Kegiatan Kapal-Kapal RLS Nusantara, Tahun : 1980,1981 1982,1983,1984, Bopberpan.

(24) Within RLS transporting passengers mentioned above, PT.PELNI has been operating regular passenger liners since 1983, and it's present 6 routes are operated by 6 vessels as shown in Figure-4.1. Outlines of existing vessels assigned for these passenger transports and their ports of call are summarized in Table-4.10. 4 of the 3,400 DWT class vessels (service speed 20 knots) and 2 of the 1,400 DWT vessels (service speed 14 knots) are used. Maximum number of passengers range from 920 persons to 1,744 persons. They operate one route every 2 weeks. In addition, feasibility studies on additional 2 routes were carried out, and as a result, the PT.PELNI ordered construction of a 7th vessel on the 30th of January, 1987. It is expected to be completed after 22 months. Her specification is 3,200 DWT, 14,200 GRT, maximum number of passengers 1,829 persons and service speed 20 knots. The number of passengers carried by PT.PELNI passenger ships are summarized in Table-4.11.

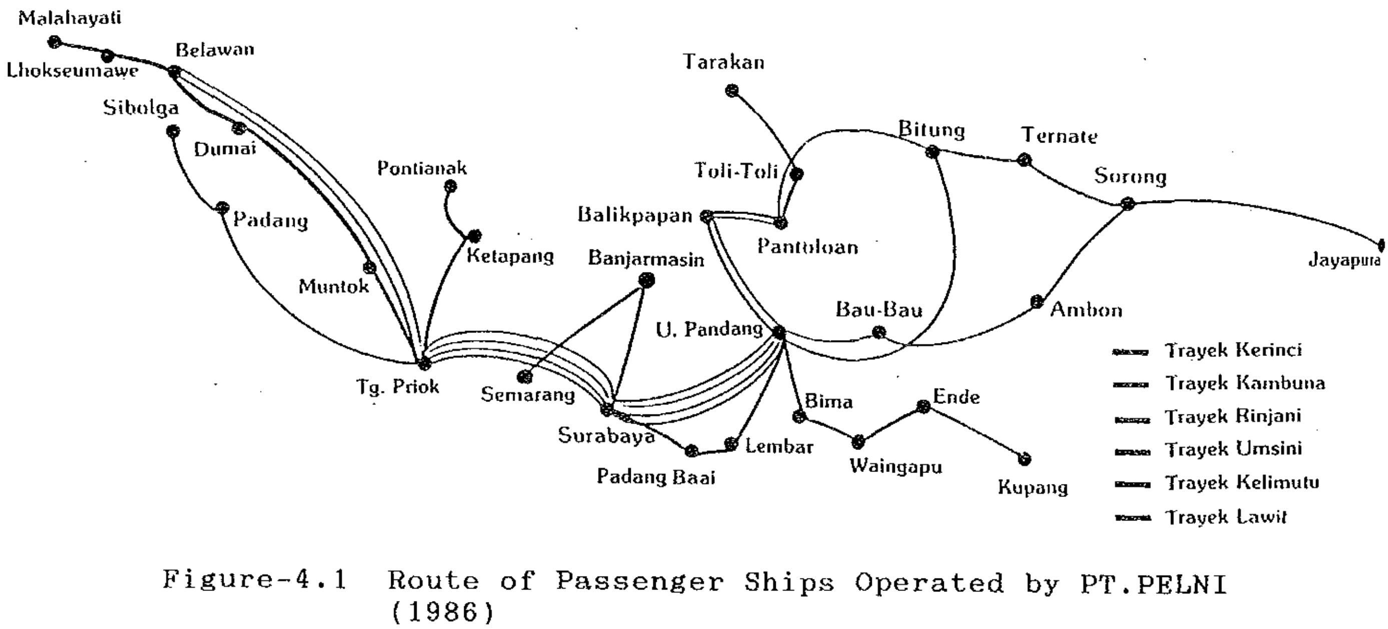


Figure-4.1 Route of Passenger Ships Operated by PT.PELNI (1986)

Table-4.10 List of Passenger Ships and Their Routes

Name of Ship	DWT	Carrying Capacity (person)	Route	Route Code No.
1. KM.KERINCI	3,400	1,596	Tg.Priok - Tg.Perak - Makassar - Balikpapan - Pantoloan - Toli-toli - Tarakan - Toli-toli - Pantoloan - Balikpapan - Makassar - Tg.Perak - Tg.Priok - Pulau Bay - Teluk Bayur - Sibolga - Teluk Bayur - Pulau Bay - Tg.Priok.	NP - 1
2. KM.KAMBUNA	3,400	1,596	Tg.Priok - Tg.Perak - Makassar - Balikpapan - Pantoloan - Bitung - Pantoloan - Balikpapan - Makassar - Tg.Perak - Tg.Priok - Belawan - Tg.Priok.	NP - 2
3. KM.RINJANI	3,434	1,727	Tg.Priok - Tg.Perak - Makassar - Bau-Bau - Ambon - Sorong - Ambon - Bau-bau - Makassar - Tg.Perak - Tg.Priok - Belawan - Tg.Priok.	NP - 3
4. KM.UMSINI	3,434	1,744	Tg.Priok - Tg.Perak - Makassar - Bitung - Ternate - Sorong - Jayapura - Sorong - Ternate - Bitung - Makassar - Tg.Perak - Tg.Priok.	NP - 4
5. KM.KALIMUTU	1,450	920	Tg.Emas - Banjarmasin - Tg.Perak - Padang Baai - Lembar - Makassar - Bima - Waingapu - Ende - Tenau/Kupang - Ende - Waingapu - Bima - Makassar - Lembar - Padang Baai - Tg.Perak - Banjarmasin - Tg.Emas.	NP - 5
6. KM.LAWIT	1,450	920	Tg.Priok - Muntok - Dumai - Belawan - Lhokseumawe - Malahayati - Lhokseumawe - Belawan - Dumai - Muntok - Tg.Priok - Ketapang - Pontianak - Ketapang - Tg.Priok.	NP - 6
	16,568			

Source : Direktorat Jenderal Perhubungan Laut

Table-4.11 Passengers Carried by PT.PELNI's Passenger Cruising Ships (1983 - 1985)

(unit : Person)

Name of Ship	1983	1984	1985
KERINCI	169,679	220,134	199,379
KAMBUNA	-	193,861	212,171
RINJANI	-	240,231	240,619
UMSINI	-	-	182,526
Total	169,679	654,226	834,695

4.01.1.9 Ferry Service

(25) The Ferry services cover about 50 routes mainly between islands with the comparatively short distance of 50 miles. Others have river crossing routes. In fact, the Ferry service is often considered as a part of the land transport system and the Ferry service in Indonesia is under the control of the Directorate General of Land Communications. In the Study, however, the Ferry service is discussed under sea transport, since some major inter-region sea transport routes are operated by ferry boats.

(26) Table-4.12 shows the number of passengers and vehicles, and volume of cargo carried by ferry boats. In this table, it can be noticed that the importance of ferry boats has been rapidly increasing. The annual growth rate of cargo volume carried is very high at about 21.1%. The number of passengers, vehicles, and volume of cargo carried on each ferry route in 1985 is shown in Table-4.13. The largest number of passengers (9.8 million persons - 55.6% of total) and vehicles (1.3 million vehicles - 53.5% of total) was carried on the Ujung - Kamal route, while largest volume of cargo was carried on Merak - Bakauheni route (1.5 million tons - 55.1% of total).

Table-4.12 Number of Passengers, Vehicles and Volume of Cargo Carried by Ferry Boats (1980 - 1985)

Item	1980	1981	1982	1983	1984	1985
Passengers (1,0000 persons)	13,128	11,686	13,689	13,022	17,460	17,637
Vehicles (1,000 vehicles)	1,747	1,562	1,602	1,644	2,659	2,474
Cargo (1,000 tons)	1,326	1,548	2,002	2,261	3,031	2,726

Note : Vehicles including motorcycles.
Source : Directorate General of Land Communications

Table-4.13 Number of Passengers, Vehicles and Volume of Cargo Carried by Ferry Boats on Major Routes in 1985

Ferry Routes	Number of Passengers (1,000 persons)	Number of Vehicles (1,000 vehicles)	Volume of Cargoes (1,000 tons)
1. Ujung-Kamal	9,800	1,323	384
2. Merak-Bakauheni	3,890	515	1,502
3. Ketapang-Gilimanuk	1,951	351	622
4. Padang-Lembar	274	27	68
5. Merak-Panjang	147	-	119
6. Lombok-Alas	238	6	3
7. Kodya Pontianak	257	89	-
8. Poka-Galala	535	0	0
9. Bajoe-Kolaka	109	2	11
10. Kodya Samarinda	192	134	6
11. Penajam-Balikpapan	7	8	4
12. Palembang-K.Arang	65	2	6
13. K.Pucang-Cilacap	12	0	0
14. Panarukan-K.Anget	39	2	1
15. Semuntai	17	4	1
16. Sorong-Jeffman	17	-	1
17. Bira-Pamatata	16	4	1
18. Meulaboh-Sinabang	14	0	1
19. Palembang-Bangka	12	0	1
20. S.Komodo-L.Bajo	13	0	0
21. Kartiasa	16	6	-
22. Luwuk-Salakan	6	0	0
23. Wainuru-Waipirit	10	1	1
Total	17,637	2,474	2,726

Note : Vehicles including motorcycles.
Source : Directorate General of Land Communications

4.01.1.10 Origin and Destination of Cargo Carried

(27) The Directorate General of Sea Communications under the Ministry of Communications has been carrying out origin and destination surveys on cargoes transported by sea transport. The collected data was compiled as the OD volume of cargo between 50 zones. These 50 zones consist of 47 zones in Indonesia, 1 special zone covers Sabang Island and 2 zones in Singapore and Malaysia. Sabang Island is the northernmost island of Indonesia. Since this island is treated as a free zone, cargo movements related to this zone are considered as international trade in the transport statistics on OD of cargo. In this statistic, OD volume of cargo is compiled by (1) commodity type (Dry cargo 31 items, Petroleum cargo 4 items, Total 35 items), (2) ship/transport sector categories (14 categories), (3) total OD of cargo volume between 43 major ports, between 1982 and 1984. In addition, cargo movements between ports by the Pioneer fleet (1984-1986) and the Ferry boat (1980-1985) are also available from PT.PELNI and the Directorate General of Land Communications, respectively. The results of analyses on cargo and passenger movements are described in the Main Report Part I.

4.01.1.11 Origin and Destination of Passengers Carried

(28) The Directorate General of Sea Communications has compiled OD of passengers transported by sea transport between 1981 and 1984. In these statistics, the same 50 zones used for cargo transport are employed. However, this OD table for passengers only covers passenger movements on RLS routes. Passenger movements between ports by the Pioneer fleet and the Ferry boats are also available.

4.01.2 International Sea Transport

(29) In 1984, the foreign trade cargo carried by sea transport was 107,239 thousand tons for exports, 24,901 thousand tons for imports and 132,140 thousand tons in total, hence exported cargo was 4.3 times greater than imported cargo volume. The details of foreign trade cargo by vessel type is summarized in Table-4.14. For exports, oil tankers carried 30.6%, conventional cargo ships (24.8%) and roll-on roll off types (17.6%). These three types of vessels carry about 75% of the whole. For imports, conventional cargo ships carried 29.4%, roll on roll off types (27.6%) and oil tankers (24.8%). These three types of vessels carry about 80% of the whole. Container vessels carried only about 1% of both export and import cargoes. It is clear that cargo movement in Indonesia is mostly dependent on conventional types of vessel.

Table-4.14 Foreign Trade Cargo Carried by Various Ships (1983 - 1984)

(Unit : 1,000 tons)

Ship Type	1983		1984	
	Export	Import	Export	Import
1. Conventional Cargo Ship	20,144	7,506	26,575	7,312
2. Twin Deck Vessel	410	1	568	22
3. Passenger Ship	349	25	338	83
4. Passenger/Cargo Ship	209	37	54	75
5. Semi Container Vessel	90	89	45	99
6. Container Vessel	237	266	1,365	309
7. Barge Carrier (Lash)	42	17	52	20
8. Roll on Roll off	86	99	18,860	6,882
9. Oil Tanker	36,761	5,854	32,832	6,166
10. Parcel Tanker	43	196	293	88
11. Ore Carrier	831	17	1,279	228
12. Bulk Carrier	4,127	1,092	5,953	2,032
13. Bulk/Oil Carrier	1,243	32	1,443	68
14. Lighter/Barge	1,657	55	5,498	114
15. Fishing Boat	684	160	1,248	270
16. Barge	2	0	6	2
17. Others	38,719	11,581	10,829	1,130
Total	105,634	27,027	107,238	24,900

Source : Lalu Lintas Angkutan antar Pulau dan Angkutan Samudera 1984, Proyek Persiapan dan Perencanaan Proyek-proyek Kerjasama Teknik Luar Negeri dan Biro Pusat Statistik, Departemen Perhuburgan, Direktorat Jenderal Perhubungan Laut.

(30) Table-4.15 summarizes the capacity of Indonesian national fleets in international trade in 1981. In this table, capacity of fleets are compiled by trade type. For general cargo vessels, the destination of trade is considered and for special cargo carriers by commodity type. Some vessels assigned for foreign trade are old and they are inefficient. The Government of Indonesia has been trying to increase Indonesian national fleet's share of cargo handling, so that the situation has been slightly improved for trampers. However, as shown in Table-4.16, the share of international trade by liners has been gradually decreasing. In addition, petroleum transport is mainly carried out by charter bases, and the share of Indonesian vessels is almost negligible.

Table-4.15 National Fleet Capacity in International Trade in 1981

Trade Type		No. of Ships	DWT	Ave. DWT
General	Europe Trade	15	180,567	12,038
	Japan Trade	25	229,344	9,174
	USA/Canada Trade	11	164,066	14,915
	Taiwan Trade	5	153,603	30,721
	Middle East Trade	5	74,045	14,809
	Sub-Total	61	801,625	13,141
Special	Mineral Oils	74	1,076,781	14,551
	Timber and Wood	96	781,050	8,136
	Others	7	227,754	32,536
	Sub-Total	177	2,085,585	11,783
Grand Total		238	2,887,210	12,131

Source : Maritime Sector Development Program in Indonesia, Directorate General of Sea Communications, Ministry of Communications.

Table-4.16 Indonesian Share in International Shipping

Trade Type	International Sea Transport (mil.tons)		Share of Indonesian Fleet (%)	
	1978	1981	1978	1981
Liner Trade	5.6	9.1	40.4	37.5
Outsider/Tramper Trade	6.5	8.5	16.0	22.4

Source : Maritime Sector Development Program in Indonesia, Directorate General of Sea Communications, Ministry of Communications.

4.01.3 Port and Harbor

(31) In indonesia, a large numbers of ports exist - more than 600 in the whole country. At about 320 public ports, port masters are stationed. There are also a number of special ports operated by private companies to handle specific commodities. At 91 of the public ports, either a port administration office or a port office is located and these ports are classified into 5 categories, from class 1 to class 5. Under this classification, there are 4 of class 1 port, 15 of class 2 port, 22 of class 3 port, 32 of class 4 port and 18 of class 5 port. Other than these classified public ports, there are also 85 ports mainly handling the Pioneer sea transport containing port offices.

(32) In addition to the above mentioned classification of ports, Indonesian ports are also classified into 4 types, i.e. the Gateway port, the Collector port, the Other Trunk port and the Feeder port, under the Maritime Sector Development Program prepared in June 1983. It aimed to establish a systematical and rational route network and to reduce transit cargo handlings, for the operation of the Inter-island liner system (ILS). The Gateway ports (4 ports) are major ports, handling mainly foreign trade and the Collector ports (15 ports) are a part of trunk ports to receive shuttle services from the Gateway ports. The Other Trunk ports (24 ports : 13 ports in category 1 and 11 ports in category 2) are the key stations of ILS route network connecting with the Gateway ports and the Collector ports, while the Feeder ports receive feeder services from the 3 types of ports mentioned above. The name of the ports (43 ILS ports) by port type is summarized in Table-4.17, while their location and the sphere of influence of 4 Gateway ports are illustrated in Figure-4.2.

Table-4.17 List of ILS 43 Ports

Type of Port	Name of Port			
Gateway Ports	Belawan	Tg.Priok	Surabaya	U.Pandang
Collector Ports	Lhok Seumawe Dumai Batam	Palembang Panjang Padang Pontianak	Semarang Lambar Kupang Balikpapan	Bitung Kendari Ambon Sorong
Other Trunk Ports	Krueng Raya Sibolga Pekanbaru Kuala Langsa	Bengkulu Cirebon Jambi Sintete	Cilakap Meneng Banjarmasin Tarakan Samarinda Kalianget Sampit Benoa	Gorontalo Pantoloan Ternate Jayapura Pare-pare Toli-toli Biak Merauke

4.01.3.1 Port Facilities

(33) Based on the Indonesian Pilot Vol. I, II and III, depths of water at approach channels, anchorages and berthing facilities are summarized in Table-4.18. Since many of these ports are located either at the mouth of rivers or along rivers, there are problems of buried sea ground by siltation. Maintenance dredging of the approach channels and berthing facilities are required at these ports. Table-4.18 indicates that maintenance dredgings have been carried out at ports with (+) mark.

(34) Due to soft foundations, pile supported piers are widely employed as mooring facilities at Indonesian ports. In most cases, reinforced concrete piles are used. Wooden piles or steel piles are also used however at smaller ports. Based on the Maritime Sector Investment Plan (1982), which was conducted by the Netherlands Maritime Institute, existing conditions of general cargo berths and 1988 improvement targets are summarized in Table-4.19.

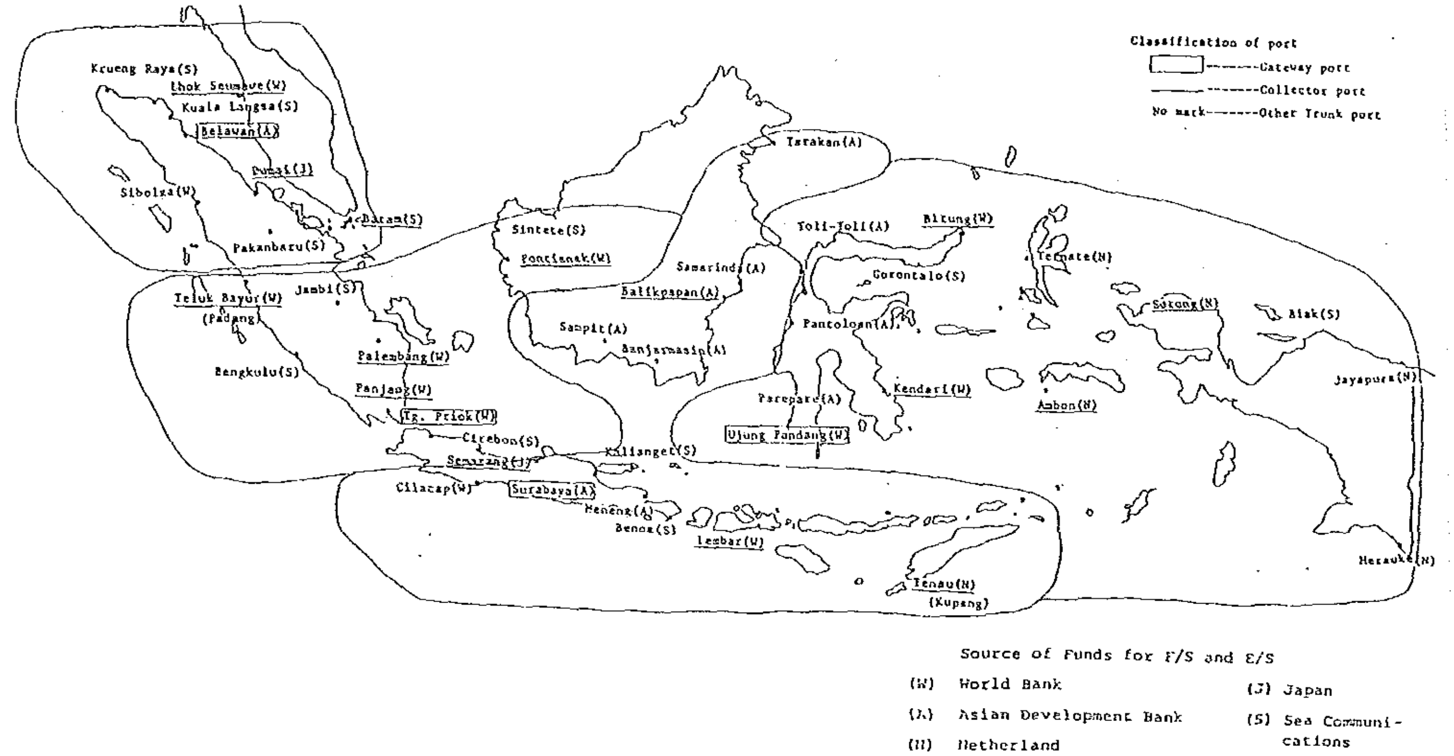


Figure-4.2 Location of 43 ILS Ports

Table-4.18 Depth of Approach Channels, Anchorages and Berthing Facilities in Main Ports

Name		Approach Channel	Anchorage	Berthing Facility
1. Krueng Raya	(+)	-	-	5 - 7 m
2. Sigli	(+)	-	3 - 5 m	1.7 - 2.5 m
3. Lhok Seumawe	(+)	5 - 8 m	-	2.5 - 5 m
4. Kuala Langsa	(+)	4 - 7 m	-	3 - 6 m
5. Meulaboh	(+)	-	3 - 5 m	1.5 - 3 m
6. Tapak Tuan	(+)	4 - 5 m	-	2 - 3.5 m
7. Singkil	(+)	3 - 4 m	-	1 - 3 m
8. Sibolga	(+)	-	-	6 - 10 m
9. Belawan	(+)	-	10 - 15 m	7 - 12 m
10. Asahan	(+)	5 - 6 m	-	3.5 - 5 m
11. Bagan Siapi-api	(+)	-	4 - 6 m	2 - 4 m
12. Dumai	(+)	-	-	5 - 8 m
13. Tembilahan	(+)	3 - 5 m	-	2 - 3 m
14. Rengat	(+)	5 - 7 m	-	6 - 7 m
15. Pekanbaru	(+)	4 - 5 m	-	1.7 - 3.5 m
16. Teluk Bayur	(+)	5 - 8 m	-	3.5 - 6 m
17. Jambi	(+)	-	-	2.7 - 3 m
18. Bengkulu	(+)	5 - 7 m	-	3 - 5 m
19. Palembang	(+)	- 4.4 m	6 - 10 m	5 - 12 m
20. Pangkal Pinang	(+)	3 - 4 m	5 - 9 m	2 - 3 m
21. Pangkal Balam	(+)	3 - 5 m	-	1.5 - 2.5 m
22. Panjang	(+)	-	9 - 13 m	4 - 7.5 m
23. Muara Sabak	(+)	- 0.7 m	-	- 5.8 m
24. Tanjung Uban	(+)	-	-	- 6.5 m
25. Tanjung Pinang	(+)	5 - 9 m	-	- 3.7 m
26. Kijang		-	-	- 9.7 m
27. Merak	(+)	9 - 15 m	11 - 22 m	- 5 m
28. Tanjung Priok	(+)	9 - 13 m	- 9.4 m	7.6 - 10.4m
29. Cirebon	(+)	6 - 7 m	-	- 3.5 m
30. Tegal	(+)	5 - 7 m	-	- 2.1 m
31. Semarang	(+)	5 - 11 m	-	- 3.5 m
32. Cilacap	(+)	11 - 13 m	- 9 m	7 - 11 m
33. Gresik	(+)	-	-	- 3 m 10 - 20 m
34. Surabaya	(+)	-	11 - 20 m	6.2 - 8.4 m
35. Banyuwangi	(+)	18 - 20 m	7 - 13 m	- 1 m
36. Probolinggo	(+)	-	- 12 m	- 0.8 m
37. Sambas	(+)	- 2.1 m	-	- 4 m
38. Pontianak	(+)	- 5 m	-	- 1.4 m 2.4 - 2.7 m
39. Banjarmasin	(+)	- 1.2 m	-	- 3.7 m

(Continued ....)

Name		Approach Channel	Anchorage	Berthing Facility
40. Balikpapan	(+)	11 - 20 m	- 7.3 m	4 - 6 m
41. Benoa (Bali)	(+)	-	- 18 m	3 - 5 m
42. Lembar	(+)	-	16 - 18 m	- 4.6 m
43. Dilly	(+)	- 49 m	- 20 m	5 - 7 m
44. Badas	(+)	20 - 5.5 m	- 26 m	- 5 m
45. Ende	(+)	- 20 m	-	3.5 - 4.5 m
46. Kupang/Tenau	(+)	18 - 33 m	-	- 11.3m
47. Tanjung Redep	(+)	-	-	- 4.9 m
48. Tarakan	(+)	-	- 30 m	- 4 m - 7.3 m - 14 m
49. Sangkulirang		- 6.1 m	-	- 5.4 m
50. Bontang	(+)	-	- 30 m	7 - 9 m
51. Samarinda	(+)	-	- 10 m	0.3 - 1.5 m - 3.2 m - 8.8 m
52. Makassar	(+)	15 - 48 m	20 - 23 m	8 - 12 m
53. Pare-pare	(+)	-	- 20 m	3.5 - 8 m
54. Donggala	(+)	-	18 - 29 m	0.4 - 1.5 m
55. Toli-toli	(+)	-	30 - 32 m	0.5 - 2 m
56. Kendari	(+)	-	15 - 18 m	2 - 2.7 m
57. Luwuk	(+)	-	- 46 m	1.5 - 2.5 m
58. Posso	(+)	-	- 69 m	- 3.5 m
59. Lorontalo	(+)	-	- 80 m	3 - 5 m
60. Parigi	(+)	-	- 48 m	- 1.5 m
61. Bitung	(+)	Under the Navy	- 53 m	5 - 9 m
62. Manado	(+)	-	- 55 m	0.5 - 1 m
63. Beo	(+)	-	-	- 2.1 m
64. Kawio	(+)	-	27 - 37 m	- 2.2 m
65. Tahuna	(+)	-	- 58 m	- 1.7 m
66. Ternate	(+)	-	- 40 m	3 - 5 m
67. Ceram	(+)	-	- 45 m	- 3 m
68. Piru		-	- 29 m	- 3 m
69. Ambon		-	25 - 50 m	- 8.5 m
70. Banda		-	Deep	Pier,drying
71. Tanimbar	(+)	13 - 45 m	-	- 5 m
72. Sorong		20 - 31 m	-	- 12 m
73. Biak		- 11 m	-	- 9 m
74. Bintuni		-	-	Jetty - 10.5m
75. Fak-fak	(+)	-	-	- 3 m
76. Merauke	(+)	- 2.7 m	-	- 5.5 m
77. Jayapura		-	40 - 46 m	6 - 8 m

Note : 1) Source of data : Indonesia Pilot Vol. I, II, III.
2) Remark : (+) mean that the ports are dredged.

Table-4.19 Existing and Planned General Cargo Berths at Indonesia's Main Ports

Port Name		General Cargo Berth in 1988			Capacity of Berth in 1988 (1,000 ton)	Production per gang per day
		Existing	Planned	Total		
Krueng Raya	I I+O O	1 - -	- - -	1 - -	70 - -	81
Belawan	I I+O O	2,4,7 - 8	- - 5	2,4,7 - 8,5	1,580 - 2,200	182
Teluk Bayur (Padang)	I I+O O	- - 1	4 - -	4 - 1	470 - 130	100
Dumai	I I+O O	1 - -	1 - -	2 - -	150 - -	100
P. Batam (Batu Ampar)	I I+O O	- 9 -	- - -	- 9 -	- 1,225 -	81
Palembang	I I+O O	3 - 6	- - -	3 - 6	325 - 480	182
Panjang	I I+O O	1,2 - 1,1	- - 2	1,2 - 1,3	310 - 550	100
Pulau Baai (Bengkulu)	I I+O O	New port under construction			- - -	-
Tg. Priok	I I+O O	7 - 42	15 - 2	22 - 44	2,875 - 11,500	182
Semarang	I I+O O	4 - -	- - 6	4 - 6	1,300 - 980	182
Tg. Perak (Surabaya)	I I+O O	9 - 23	7 - -	16 - 23	2,300 - 4,300	182

(Continued.......)

Port Name		General Cargo Berth in 1988			Capacity of Berth in 1988 (1,000 ton)	Production per gang per day
		Existing	Planned	Total		
Meneng	I	1	-	1	90	
	I+O	-	-	-	-	81
	O	-	-	-	-	
Pontianak	I	1	3	4	540	
	I+O	-	-	-	-	182
	O	-	-	-	-	
Banjarmasin	I	-	-	-	-	
	I+O	2	2	4	470	100
	O	-	-	-	for small vessels (100)	
Balikpapan	I	3	-	3	325	
	I+O	-	-	-	-	100
	O	-	2	2	280	
Samarinda	I	-	-	-	325	
	I+O	4	-	4	-	100
	O	-	-	-	130	
Tarakan	I	1	-	-	65	
	I+O	-	1	1	-	100
	O	-	-	-	-	
Bitung	I	6	7	13	1,885	
	I+O	-	-	-	-	100
	O	2	-	2	280	
Pantaloan (Donggala)	I	1	-	1	70	
	I+O	-	-	-	-	81
	O	-	-	-	-	
Ujung Pandang	I	6	-	6	760	
	I+O	-	-	-	-	182
	O	7	-	7	1,145/1,895	
Kendari	I	2	-	2	220	
	I+O	-	-	-	-	100
	O	-	-	-	-	
Ternate	I	2	-	2	220	
	I+O	-	-	-	-	100
	O	-	-	-	-	

(Continued.......)

Port Name		General Cargo Berth in 1988			Capacity of Berth in 1988 (1,000 ton)	Production per gang per day
		Existing	Planned	Total		
Ambon	I	4	–	4	470	100
	I+O	–	–	–	–	
	O	–	–	–	–	
Sorong	I	2	–	2	135	100
	I+O	–	–	–	–	
	O	–	1	1	130	
Gorontalo	I	–	–	–	50	182
	I+O	–	–	–	–	
	O	–	–	–	–	
Jayapura	I	–	–	–	185	81
	I+O	1	1	2	–	
	O	–	–	–	–	
Kupang/ Tenau	I	1	1	2	255	81
	I+O	–	–	–	–	
	O	–	–	–	–	
Lhok Seumawe	I	–	–	–	–	New port
	I+O	–	–	–	–	
	O	–	–	–	–	
Sibolga	I	1	–	1	70	81
	I+O	–	–	–	–	
	O	–	–	–	–	
Cirebon	I	–	–	–	590	100
	I+O	–	–	–	–	
	O	–	–	–	760	
Lembar	I	–	1	1	150	81
	I+O	–	–	–	–	
	O	–	–	–	–	
Cilacap	I	1	–	1	100	100
	I+O	–	–	–	–	
	O	2	–	2	280	

Note : I: Inter-island O: Ocean-going
I+O: Inter-island and ocean-going

Source : Maritime Sector Investment Plan, Vol.2, Part 3 Ports, Jan. 1982, Netherlands Maritime Institute.

4.01.3.2 Cargo Throughput at Ports

(35) The cargo throughput for the whole of Indonesia in 1984 was 67 million tons for foreign exports, 12 million tons for foreign imports, 31 million tons for domestic exports, and 48 million tons for domestic imports. Theoretically, domestic exports and domestic import for the whole country should be balanced, however, domestic imports in Indonesia is 1.54 times greater than domestic exports.

(36) Cargo throughputs at ports for the last 10 years are shown in Table-4.20. Inter-island throughput, both loadings and unloadings have been steadily increasing by annual growth rates of 8.5% and 9.8% respectively, since 1980. International throughput loading have also been gradually increasing by an annual growth rate of 2.2% since 1980. There were large fluctuations in international throughput unloadings, since they are fully affected by economic conditions and foreign currency stocks in Indonesia, therefore the unloading level in 1984 is lower than that in 1980.

(37) Cargo throughputs at ports by province in 1984 is summarized in Table-4.21. From this table, it can be noticed that handling volume of inter-island throughput is largest in Jawa, followed by Sumatera, Kalimantan and Timur, while they are at very low levels in other regions. For international throughput, a large handling volume of exports was recorded in Riau, D.I.Aceh, Kalimantan Timur and Irian Jaya (the origin of major export commodities, such as petroleum products and wooden products), while imports were concentrated into high population density provinces in Jawa.

(38) The cargo throughput at 43 ILS ports in 1984 are summarized in Table-4.22, based on the Maritime Sector Development Program. For the inter-island transport, 4 Gateway

Table-4.20 Trend of Cargo Throughput (1975 - 1984)

(Unit : 1,000 ton)

Year	Inter-island			International		
	Loading	Unloading	Total	Loading	Unloading	Total
1975	13,042	13,479	26,521	53,166	9,209	62,375
1976	15,770	16,912	32,682	67,152	9,653	76,805
1977	18,424	18,827	37,251	65,763	11,968	77,731
1978	16,129	26,577	42,706	60,845	10,842	71,687
1979	20,292	28,655	48,947	60,295	10,981	71,276
1980	22,298	32,764	55,062	61,166	13,354	74,520
1981	24,593	35,356	59,948	59,463	13,758	73,220
1982	25,465	39,284	64,748	57,372	16,296	73,668
1983	26,285	40,075	66,360	62,402	16,868	79,270
1984	30,930	47,670	78,600	66,801	12,427	79,228

Source : Statistik Bongkar Muat Barang di Pelabuhan Indonesia, 1975 - 1984

Table-4.21 *Port Cargo Throughput by Province in 1984*

(Unit : Weight ton)

Province Name	Inter-island		International	
	Loading	Unloading	Loading	Unloading
D.I.Aceh	853,312	563,156	18,607,813	70,690
Sumatera Utara	1,730,675	3,281,957	1,444,032	907,564
Sumatera Barat	742,616	393,803	496,358	141,709
Riau	4,495,680	2,171,469	31,697,000	541,928
Jambi	57,101	251,010	321,736	23,655
Sumatera Selatan	2,325,626	1,149,931	421,210	92,713
Bengkulu	7,012	51,772	17,929	645
Lampung	59,237	575,719	421,521	98,612
DKI Jakarta	1,718,702	7,661,933	932,093	5,531,466
Jawa Barat	1,078,915	1,316,441	166,124	1,272,440
Jawa Tengah	5,596,272	11,550,256	1,315,116	368,708
Jawa Timur	2,532,141	3,464,045	1,323,987	2,529,658
Bali	58,026	946,347	2,012	34,997
Nusa Tenggara Barat	144,855	343,096	-	1,951
Nusa Tenggara Timur	125,160	318,414	50	2,132
Timor Timur	11,637	126,037	6,189	-
Kalimantan Barat	317,025	814,453	626,264	86,089
Kalimantan Tengah	428,263	175,331	538,125	1,385
Kalimantan Selatan	507,439	785,095	726,842	29,970
Kalimantan Timur	6,005,804	8,338,418	5,127,659	129,162
Sulawesi Utara	242,027	719,650	31,616	32,985
Sulawesi Tengah	288,294	307,667	54,038	5,207
Sulawesi Selatan	763,029	1,258,842	145,313	497,546
Sulawesi Tenggara	381,885	373,930	350,596	4,587
Maluku	309,607	250,626	120,644	328
Irian Jaya	149,306	480,815	1,906,494	39,628
Total	30,929,646	47,670,213	66,800,769	12,426,755

Source : Statistik Bongkar Muat Barang di Pelabuhan Indonesia, 1984 ports and 15 Collector ports handled 55% of total cargo throughput, while 43 ILS ports occupied 84% of the share. This situation indicates the significance of these types of ports in inter-island transport.

(39) For international transport, the Gateway and the Collector ports, and 43 ILS ports occupied 87% and 94% of shares of loadings, respectively. While the Gateway and the Collector ports and 43 ILS ports also occupied 80% and 82% of shares of unloading, respectively. In particular, 4 Gateway ports occupied 71% of unloading. Therefore, the importance of these ports for international transport is considered higher than that of inter-island transport.

Table-4.22 Cargo Throughput of ILS 43 Ports in 1984

Port Name	Inter-island		International	
	Loading	Unloading	Loading	Unloading
Gateway Ports				
Belawan	1,250,522	2,904,319	962,043	883,669
Tg.Priok	1,085,329	6,376,077	932,093	5,531,466
Surabaya	1,834,302	2,074,419	1,245,119	1,916,503
Ujung Pandang	593,484	1,028,990	144,664	479,546
Sub-Total	4,763,637	12,383,805	3,283,919	8,811,184
Collector Ports				
Lhok Seumawe	253	91,334	18,390,613	4
Dumai	3,308,567	1,064,522	29,242,358	47,844
Batam	32,095	110,261	346,448	194,888
Palembang	2,232,819	822,815	366,570	81,083
Panjang	57,970	573,159	421,521	98,612
Padang	681,040	378,501	496,358	141,709
Pontianak	268,767	754,079	474,372	86,089
Semarang	182,464	1,711,014	223,240	311,213
Lembar	70,714	221,652	-	1,951
Kupang	58,754	125,154	20	2,132
Balikpapan	4,893,199	7,595,379	2,998,813	83,990
Bitung	164,572	556,173	7,316	31,185
Kendari	21,640	106,178	2,645	4,587
Ambon	61,684	78,716	57,914	1,190
Sorong	78,714	126,302	1,666,036	16,736
Sub-Total	12,113,252	14,315,239	54,694,224	1,103,213
Other Trunk Ports				
Krueng Raya	-	-	-	-
Sibolga	104,583	177,892	15,545	-
Pekanbaru	7,283	27,039	25,885	9,613
Kuala Langsa	193,501	42,043	86,525	3,749
Bengkulu	7,012	51,772	17,929	645
Cirebon	101,887	96,376	95,541	53,184
Jambi	57,101	251,010	321,736	23,655
Sintete	5,337	26,934	4,699	-
Cilacap	5,411,266	9,811,665	955,106	57,495
Meneng	86,048	334,468	2,796	37,811
Banjarmasin	490,581	756,282	600,205	29,128
Tarakan	425,538	287,603	1,135,805	6,450
Samarinda	650,186	453,761	988,372	38,722
Kalianget	129,630	222	-	-
Sampit	178,812	120,972	210,172	1,171
Benoa	20,707	587,512	2,012	34,437
Gorontalo	42,054	107,831	24,300	1,800
Pantoloan	159,923	173,852	10,613	-
Ternate	138,364	85,806	62,730	136
Jayapura	10,127	130,768	25,578	14,259
Pare-pare	127,582	180,841	-	-
Toli-toli	25,301	35,211	6,587	3,000
Biak	28,634	102,130	49,385	7,603
Merauke	9,846	1,355	8,122	30
Sub-Total	8,411,303	13,843,346	4,649,643	322,888
Total of ILS 43 Ports	25,288,192	40,542,390	62,627,786	10,237,285
Grand Total	30,929,646	47,670,213	66,800,769	12,426,755

Source : Statistik Bongkar Muat Barang di Pelabuhan Indonesia, 1984

4.02 REVIEW AND EVALUATION OF EXISTING PLAN

4.02.1 Maritime Sector Development Program

(40) The Maritime Sector Development Program is the present sea transport development plan. It was prepared by the DGSC. This plan is also the base of the sea transport development plan in the REPELITA-IV. The background of the Maritime Sector Development Program is shown in Figure-4.3. The "Integrated Sea Transport Study" prepared by the Netherlands Maritime Institute was the base of the "Maritime Sector Development Program". The Maritime Sector Development Program consists of the following items and the integrated liner system is discussed as the main topic. The implementation of this program is planned to be carried out by the administrative organization shown in Figure-4.4.

I. Integrated Liner System - Phase I
II. Super Crash Program (Ports)
III. Port Planning & Engineering
IV. Ship Repair and Maintenance Improvement
V. Navigational Aid & Telecom System Improvement
VI. Dredging Improvement
VII. Maritime Safety Improvement
VIII. PELNI Operations & Management Improvement
IX. Container Operations & Management Improvement
X. Sea Communications Organizations & Management
XI. Legal Aspects
XII. Manpower Development and Training
XIII. Customs Procedures Improvement
XIV. Fleet Development

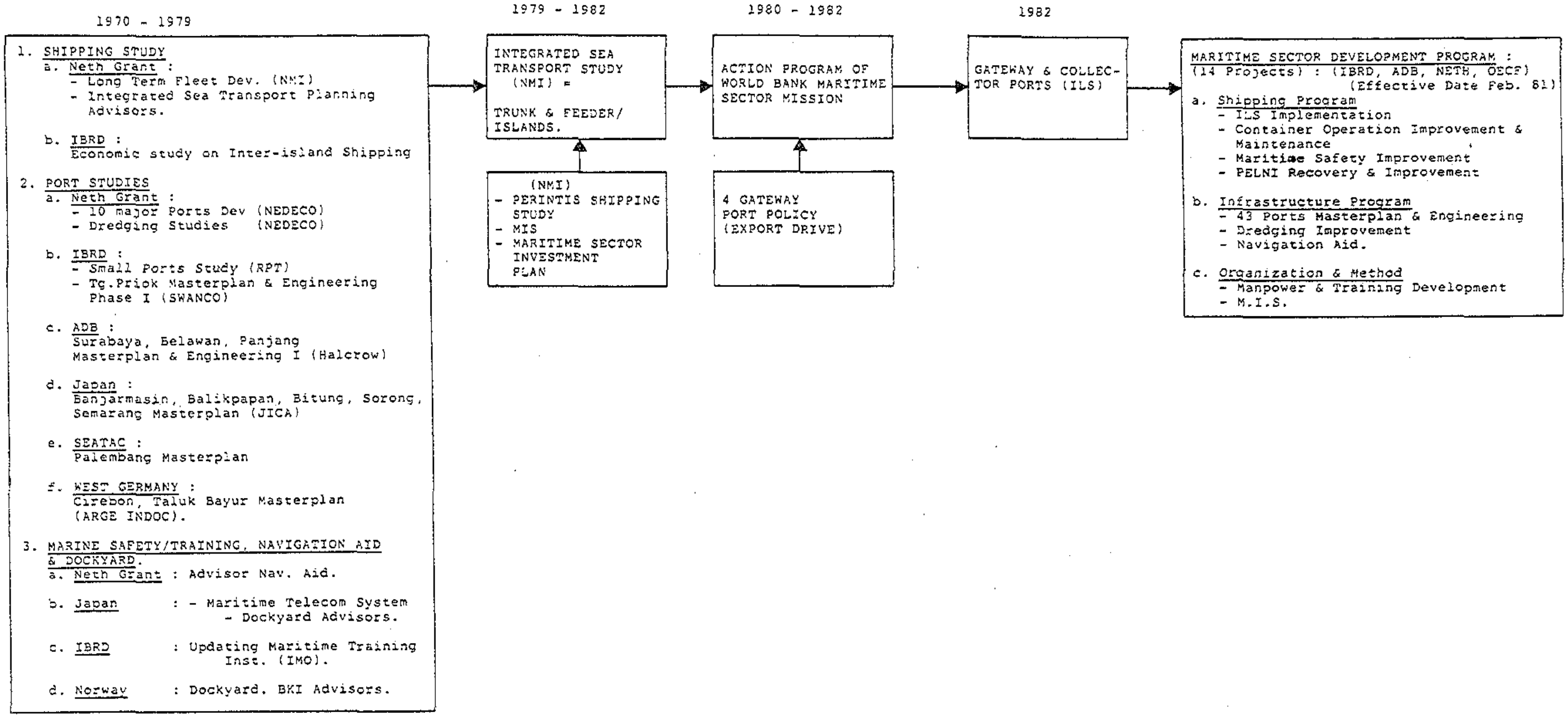


Figure-4.3 Background of Project Preparation of Maritime Sector Development Program

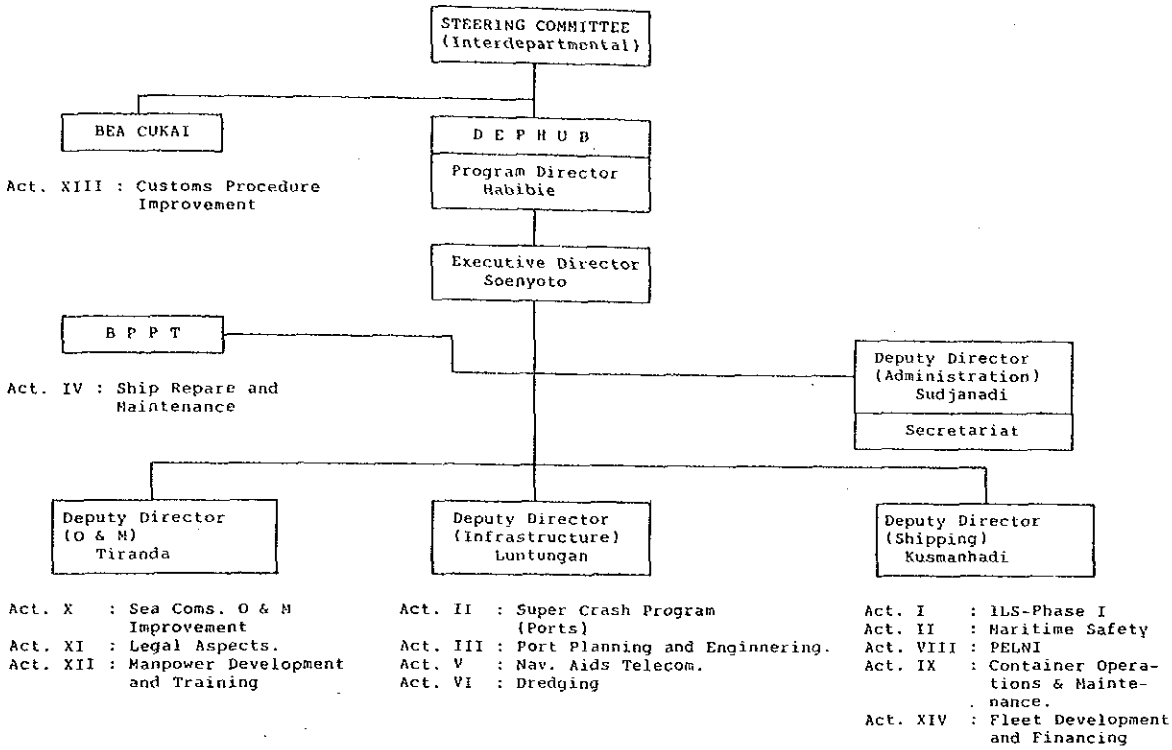


Figure-4.4 Maritime Sector Development Program Organization Scheme

4.02.1.1 Integrated Liner System

(41) The basic concept of the integrated liner system is to upgrade the existing inter-island liner system, and the target of the future inter-island cargo movements in 1988 are projected as 6.95 million tons, together with efforts to reduce the volume of transhipment (projected as 0.22 million tons) as far as possible. This integrated liner system was considered mainly based on the hierarchy of ILS ports, i.e. Gateway ports (4 ports), Collector ports (15 ports), Other trunk ports (24 ports) and Feeder ports, which was mentioned in Section 4.1.3. In this system, most of operations between trunk ports are planned to be carried out by the ILS, while operations between trunk ports and feeder ports are planned to be carried out by the Local vessels (less than 175 GRT) and the Rakyat (Sailing boats). Under this simplified system, the volume of cargo carried on more than 2 routes is expected to be reduced from 53% in 1979 to 11% in 1988.

(42) The handling of foreign trade cargo is planned to be mainly concentrated into the 4 Gateway ports at Tanjung Priok (Jakarta), Tanjung Perak (Surabaya), Belawan and Makassar (Ujung Pandang), with the exception of bulk and liquid cargoes carried by special cargo carriers. Foreign trade cargo generated from ports other than the Gateway ports will be carried to the Gateway ports from Collector ports (15 ports) by shuttle services. Collector ports and Other trunk ports will therefore be considered as the hinterlands of the Gateway ports. Indonesia will also be divided into 4 regions according to the coverage area of each Gateway port. (refer to Figure-4.2 and Table-4.17). The estimated volume of dry cargo to be carried under the ILS-Gateway policy is shown in Table-4.23. However, bulk cargoes are excluded in this system, if they are carried by special carriers with full loading conditions.

Table-4.23 Impact of ILS-Gateway Policy in Dry Cargo Movement in 1988

(Unit : million tons)

	Foreign Trade			Domestic Trade
	Import	Export	Total	
Dry Cargo	11.6	15.8	27.4	31
General Cargo	4.3	4.4	8.7	15
Through Gateway Ports				
Direct	8.5	3.2	11.7	
Indirect (Transshipment)	2.2	2.2	4.4	
Direct + Indirect	10.7	5.4	16.1	

4.02.1.2 Super Crash Program for the 4 Gateway Ports

(43) Under the new ILS-Gateway port system, immediate improvement measures are recommended in order to increase capacity and capability of handling cargo in order to fully achieve their major roles as 4 Gateway ports concerned with the transportation of cargo other than the export of mineral oils and gases.

4.02.1.3 Port Planning and Engineering

(44) In order to achieve a major role in the ILS-Gateway port system, preparation and review of the master plan, feasibility studies and the preparation of engineering designs on improving or expanding 43 ILS ports are planned to be carried out. Implementation of port planning and engineering for these 43 ports are scheduled to be financed either by loans from IBRD, ADB, Netherlands and Japan, or funds from the Government of Indonesia. Details are shown in Table-4.24.

Table-4.24 Port Planning and Engineering (43 Ports)

1. IBRD	: - Package A (Lhok Seumawe, Sibolga, Teluk Bayur and Panjang). Lavalin International, Canada. - Package B (Palembang, Pontianak, Cilacap). Haskoning, the Netherlands. - Package C (Tanjung Priok). Peter Freankel & Partners, U.K. - Package D (Ujung Pandang, Bitung, Kendari and Lembar). PRC Engineering, U.S.A.
2. Netherlands	: - Package E (Ambon, Ternate, Sorong, Tenau, Jayapura and Merauke).
3. ADB	: - Package F (Balikpapan and Banjarmasin). - Package G (Surabaya). Randel, Palmer & Tritton. - Package H (Meneng, Tarakan, Samarinda, Sampit, Toli-toli, Pantoloan, Pare-pare)
4. Japan	: Semarang and Dumai
5. Self-reliant	: (Eigenbeheer). 11 ports.

4.02.2 REPELITA-IV

4.02.2.1 Present Situations and Problems

(45) The basic concept of development of the sea transport sector in the REPELITA-IV is to further consolidate the improvement of sea transport facilities, which were mainly developed under the PELITA-I, -II and -III. In the final stage of the PELITA III, fleets allocated for Inter-island sea transport (RLS) and the Local sea transport were respectively 379 vessels (503,371 DWT) and 1,049 ships (129,476 DWT). Fleets allocated for Rakyat sea transport and the Pioneer sea transport were respectively 3,486 boats (sailing boats including motorized boats - 180,447 GRT) and 35 vessels (20,805 DWT). These fleets were reported to have made calls at 214 ports.

(46) Fleets allocated for the transport of petroleum, palm oil, liquid gas, timber, nickel, iron sand, asphalt, fertilizer, cement, etc. were 2,501 vessels (2,267,740 DWT) of special cargo carriers, and 578,875 GRT of barges and 379,603 HP tug boats of Sea train transport. In addition, 62 ocean going vessels with 827,227 DWT and 96 ocean going special carriers vessels with 774,603 DWT were allocated. The details of these types of fleets and their transported cargo volume in 1978 and 1983 are summarized in Table-4.25.

Table-4.25 National Ship Capacities and Cargo Volume Carried

Type of Ship	1978			1983		
	Number	DWT	Cargo Volume (ton)	Number	DWT	Cargo Volume (ton)
RLS	343	348,162	5,277,729	397	503,371	7,457,610
Local	1,363	118,923	1,899,484	1,049	129,476	2,444,677
Rakyat (Sailing boat)	2,182	96,019	1,012,553	3,486	180,447	2,155,316
Pioneer	21	11,171	52,661	36	20,805	98,016
Special Domestic Berge Tug Boat	1,941	1,222,646 265,032 GRT 281,338 HP	38,075,048	2,501	2,267,740 578,875 GRT 379,226 HP	54,812,073
Inter-national	97	620,296	96,755,385	96	774,603	101,063,658
Ocean-going	52	512,705	12,121,164	62	827,227	18,464,696

(47) Since port facilities are the most important infrastructure component in the field of sea transport, during the course of the PELITA-III, rehabilitation of existing port facilities and improvement of port facilities were carried out. As a result, 5,775m of additional quays, 41,621m^2 of warehouse and 184,672m^2 of open storage yards were provided. Furthermore, at the end of the PELITA-III, total quay length , area of warehouses and open storage yards were counted as 21,555m, 113,160m^2 and 321,840m^2, respectively. In addition, improvement in the experience of port workers and cargo handling machinery, achieved an improvement of productivity at quays between 700 - 800 tons/meter/year at the final stage of the PELITA-III. For the improvement of services at ports and dredging, 4 Public Corporations of Port (Perum Pelabuhan) and Public Corporations of Dredging (Perum Pengerukan) were established in 1983.

4.02.2.2 Improvement Policy and Measures

(48) During the course of the REPELITA-IV, development of domestic sea transport as well as international sea transport, and dredging in port areas will proceed accordingly. And also, measures for safe navigation and the development of shipbuilding industries will be implemented. Development of 43 ILS ports, i.e. 4 Gateway ports, 14 Collector ports and 25 Other trunk ports, will soon be implemented. And also, in order to deal with the increasing demand of passenger transport, the introduction of passenger services on new routes, i.e. Ujung Pandang - Ambon, Ambon - Jayapura, Banjarmasin - Surabaya and Batam - Tanjung Priok will be started in the near future.

(49) In order to cope with increasing domestic cargo movement due to the developments of shipping routes and the sea transport system, targets have been set on the improvement of productivity of fleets at 20 tons/ DWT/year for RLS fleets, 19.4 tons/DWT/year for Local fleets and 15 tons/ DWT/year for Rakyat fleets. By achieving these productivity targets, the total volume of cargo carried at the end of the REPELITA-IV is expected to be 14.75 million tons by RLS fleets, 4.2 million tons by Local fleets and 3.4 million tons Rakyat fleets. The consolidation plan for national fleets is summarized in Table-4.26.

(50) Table-4.27 summarizes the improvement plan for port facilities and dredging in port areas. Under the REPELITA-IV, at 4 Gateway ports, 3,600m of additional quay, 117,000m^2 of container yard, 13,000m^2 of open storage yard and 39,000m^2 of warehouse are planned to be constructed. At 14 Collector ports, additional 5,230m of quay, 53,000m^2 of container yard, 139,620m^2 of open storage yard and 124,600m^2 of warehouse will be constructed. In addition, at 25 distribution ports, additional quays (3,645m), open storage

yards (117,380m^2) and warehouses (26,600m^2) will also be constructed. Additional quays (6,250m) and warehouses (165,900m^2) will be constructed at other ports, including pioneer ports. Development plans for navigation aids and port service boats and shipbuilding industries are summarized in Table-4.28.

Table-4.26 Targets in National Fleet Capacity During REPELITA IV

Type of Fleet		Increment and Replacement During REPELITA IV
I. Domestic Fleet		
1. RLS	(DWT)	420,300
2. Passenger Vessels	(GRT)	185,600
3. Local Fleet	(DWT)	98,000
4. Rakyat Fleet	(GRT)	85,000
5. Pioneer Fleet	(DWT)	4,600
6. Special Fleet	(DWT)	318,900
Berge	(GRT)	150,000
Tug Boat	(HP)	246,300
7. Tanker	(DWT)	4,129,400
II. Ocean-going Fleet		
1. General Cargo Fleet	(DWT)	490,500
2. Special Fleet	(DWT)	489,200
3. Tanker	(DWT)	659,800

Table-4.27 Target in Development of Port Facilities and Dredging During REPELITA IV

Type of Facility		Quantity
I. Development of Port Facilities		
1. Quay	(m)	18,815
2. Warehouse	(m2)	190,200
3. Open Storage Yard	(m2)	270,000
4. Container Yard	(m2)	170,200
II. Dredging		
1. Maintenance Dredging	(1,000 m3)	140,600
2. Dredging of Sea Bottom	(1,000 m3)	55,000

Table-4.28 Target in Navigation Aids and Shipbuilding Industry During REPELITA IV

Activities/Facilities		Quantity
I. Navigation Aids		
1. Beacon		
a. Light House	(unit)	108
b. Light Beacon	(unit)	150
2. Beacon Vessel	(unit)	33
3. Port Service Ship	(unit)	76
II. Shipbuilding Industry		
1. Rehabilitation of Dock	(DWT)	101,200
2. Construction of Dry Dock and Slipway	(DWT)	136,000
3. Floating Crane	(ton)	600
4. Mobile Crane	(ton)	100

SECTION 5

LAND TRANSPORTATION

SECTION 5
LAND TRANSPORTATION

5.01 GENERAL

(01) The land transportation herein discussed covers road transportation, railway transportation and inland water transportation. The present degree of development concerning the land transportation is significantly different dependent on a region, since these modes of transportation have historically been developed in accordance with the prevailing local economic, social and natural conditions, the degree of development is significantly different. In Jawa, the networks of railway and road have been developed considerably, while in Kalimantan and Central and South Sumatera, the inland water transportation is comparatively popular.

(02) Out of these 3 modes of transports, railway and road transports have constituted a part of the inter-island transportation network in Sumatera, Jawa and Bali by the aids of ferry services connecting these islands. In this Section, however, the intra-island land transport is mainly focused on.

(03) Through REPELITA-I to -IV, the land transportation subsector has been developed by the development budget, which corresponds to over 50% of the total development budget allocated to the Transportation, Communication and Tourism Sector.

5.02 ROAD TRANSPORTATION

(04) The total road length under control of the governmental administrative body extends to 203,819 km or about 100m per sq.km, in 1985. Roads of Indonesia may be classified by administrative viewpoint and functional viewpoint, that is: administratively, the National, the Provincial, Kabupaten and Kotamadya roads as presented in Table-5.1, and functionally the arterial, the collector and the local roads. National Road plays the role of arterial and collector road. Province and Kabupaten Roads functions mainly as the collector and as the local road respectively. While Kotamadya Road plays the role of urban road in large size cities. The road standard consists of 6 classes. Class-I and Class-II generally correspond to the arterial and the collector roads. The roads below Class-III account for the local roads.

Table-5.1 Road Length by Road Classification

(Unit : km)

YEAR	NATIONAL	PROVINCE	KABUPATEN	TOTAL
1975	11,267	28,196	65,218	104,681
1976	11,335	27,486	82,978	121,799
1977	11,436	27,410	83,948	122,794
1978	11,572	27,911	89,232	128,715
1979	11,573	28,772	88,717	129,062
1980	12,152	33,164	96,998	142,314
1981	11,857	33,182	109,142	154,181
1982	11,935	33,973	119,230	165,138
1983	11,988	35,983	136,768	184,739
1984	11,938	36,310	146,696	194,944
1985	12,016	34,278	157,525	203,319
Average Growth	(0.6%)	(1.9%)	(9.2%)	(6.8%)

Source: Statistical Year Book of Indonesia

The averaged annual growth rate for the latest 10 years corresponds to 0.6% for National road, 1.9% for Provincial road and 9.2% for Kabupaten and Kotamadya road. While, the percentage share of respective administration in length accounts for 5.9% for National road, 16.8% for Provincial road and 77.3% for Kabupaten and Kotamadya, in 1985 estimated statistics.

(05) While, the historical road development recorded by island is tabulated in Table5.2.

Table - 5.2 Historical Record of Road Development by Region

(Unit : km)

Year	Sumatera	Jawa	Kalimantan	Sulawesi	Other Region	Total
1981	49,052	41,667	11,260	28,081	24,121	154,181
1982	52,405	42,919	12,632	30,044	27,138	165,138
1983	58,450	47,137	14,810	31,870	32,472	184,739
1984	61,924	49,192	17,270	33,740	32,818	194,944
1985	65,554	52,383	18,241	34,697	32,944	203,819
Average Growth	7.5 %	5.9 %	12.8 %	5.4 %	8.1 %	7.2 %

Source: Statistical Year Book of Indonesia

The annual growth rate averaged in the recent 5 years varies from 5.4% in Sulawesi to 12.8% in Kalimantan. These figures show that the recent development have generally been concentrated on the rural road.

(06) The road density (Length/Area) and (Length/Population) vary very widely by region, being reflected by difference of population and economic activities, as shown in Table-5.3. When compared between the two extreme cases, Jawa & Bali and Irian Jaya, the length/area(km/km^2)is 0.40 for Jawa & Bali and 0.01 for Irian Jaya, while the length/1,000 population is, on the contrary, 3.71 for Irian Jaya and 0.55 for Jawa & Bali.

Table-5.3 Road Density (1984)

Region	Road Length (km)	Area (km 2)	Population (1000)	Length/Area (km / km 2)	Length Population (km/1000)
Sumatera	61,924	473,606	31,928	0.13	1.94
Jawa & Bali	55,281	137,748	101,345	0.40	0.55
Nusa Tenggara	17,935	82,927	6,527	0.22	2.75
Kalimantan	17,270	539,460	7,564	0.03	2.28
Sulawesi	33,740	189,216	11,341	0.18	2.98
Maluku	3,973	74,505	1,576	0.05	2.52
Irian Jaya	4,821	421,931	1,300	0.01	3.71
Whole Indonesia	194,944	919,433	161,580	0.21	1.21

Source: Statistical Year Book of Indonesia

(07) The surface conditions of the road are shown on Tables-5.4 and 5.5. The paved roads are lengthened by 2.45 times during the period from 1975 to 1985 as detailed in Table-5.4. The percentage of the paved road against the total road length, thereby, is increased from 31.6% in 1975 to 39.6% in 1984, but still remains at low level.

Table-5.4 Length of Road By Type of Surface

(Unit : km)

Year	Paved	Gravel & Earth	Others	Total
1975	33,051(31.6)	44,856(42.9)	26,774(25.5)	104,681(100)
1976	48,369(35.6)	65,619(53.9)	7,811(6.5)	121,799(100)
1977	49,319(40.2)	65,017(52.9)	8,458(6.9)	122,794(100)
1978	59,029(45.9)	62,086(48.2)	7,600(5.9)	128,715(100)
1979	57,746(44.7)	62,889(48.7)	8,427(6.6)	129,062(100)
1980	56,519(39.7)	74,153(52.1)	11,642(8.2)	142,314(100)
1981	62,319(40.4)	79,890(51.8)	11,580(7.5)	154,181(100)
1982	66,319(40.2)	88,272(53.5)	10,547(6.3)	165,138(100)
1983	72,646(39.3)	98,279(53.2)	13,814(7.5)	184,739(100)
1984	77,825(39.9)	103,062(52.9)	14,057(7.2)	194,944(100)
1985	80,819(39.6)	108,006(53.0)	14,994(7.4)	203,819(100)

Note: ( ) means percentage

As shown in Table-5.5, most part of road, except in Jawa & Bali, is surfaced by gravel stone and earth. In general, improvement of quality has been stressed in Jawa & Bali, and quantity has been emphasized in other regions.

Table-5.5. Road Surface Condition by Region

(Unit : km)

REGION	ROAD SURFACE CONDITION				
	Paved	Gravel Stone	Earth	Other	Total
Sumatera	21,657 (35)	16,088 (26)	19,494 (31)	4,685 (8)	61,924
Jawa & Bali	36,627 (66)	8,853 (16)	7,555 (14)	2,246 (4)	55,281
Nusa Tenggara	4,167 (23)	6,072 (34)	6,120 (34)	1,576 (9)	17,935
Kalimantan	4,505 (26)	3,681 (21)	8,741 (51)	343 (2)	17,270
Sulawesi	8,845 (26)	9,357 (28)	11,882 (35)	3,646 (11)	33,740
Maluku	1,268 (32)	1,012 (25)	508 (13)	1,185 (30)	3,973 (100)
Irian Jaya	756 (16)	695 (14)	2,994 (62)	376 (8)	4,821 (100)
Total	77,825 (40)	45,768 (23)	57,294 (30)	14,057 (7)	194,944 (100)

Source : Statistical Year Book of Indonesia.
Note : ( ) means percentage

As stated-above, there exists significant difference in quality and quantity of development or road by island. As to quantity, it can not be discussed from the same standpoint, since there obviously exists regional differences in natural condition such as geography, climate etc., which affect the road construction and maintenance. While, improvement of quality of road will be stressed much more in and around the cities in the regional area.

(08) In accordance with rapid development of the urban area, the necessity of construction of a toll road in sub-urban area came out. The toll road has been planned and constructed since 1970's. The total length of the toll road on service is 350 km approximately, out of which 300 km or 85% run in Jawa. The list of the toll road on service and proposed is presented in Table-5.6. It may be conceivable to turn the high standard road running in the suburban area to a toll road to make the fund available for improvement of the urban road and the regional roads to cope with the rapid growth of urban traffic and the important regional development.

Table-5.6 Toll Road Network

Route	Length (km)	Year
Jagorawi	50.7	-
Jakartan - Citeureup	26.7	1978
Citeureup - Ciawi	24.0	1980
Jagorawi - Stage II	8.0	1985
Jakarta - Merak	120	-
Jakarta - Tangerang	26.6	1984
Ciujung By Pass	3.8	1983
Serang By Pass	8.4	1983
Jakarta - Cikampek	74.5	1986
Jakarta Inter Urban (South-West Arc)	16	-
a. Cawang Interchange I/II	6.5	1984/86
b. Tebet Flyover	936m	1984
c. kuningan Flyover	1.6	1985
d. Tomang Flyover	1.2	1986
e Grogol Flyover	1.0	1985
f. Road Work Cawang - Grogol	16.0	1987
Cengkareng Access	14.0	1984
Berawan - Medan - Tanjung Morawa	34.6	1986
Bandung By Pass	51	-
a. Padalarang - Bandung	33	
b. bandung - Cileunyi	18	
Semarang Artery	27.1	-
a. Jatingaleh - Krapyak	8.7	1987
b. Srondol Jattingaleh	6.3	1983
c. Jangli - Harbour	12.1	1987
Surabaya - Malang (Gempol)	39.4	1985

(09) Motorization in Indonesia has been rapidly progressed. In the latest 10 years form 1975 to 1984, the numbers of registered vehicles record 3.6 times increment, or

15% in average annual growth rate. The vehicle compositions are, in 1984, 14.3% of passenger car, 12.2% of truck, 3% of bus and 70.5% of motor cycle. The numbers of motor cycle are outstanding.

Table-5.7 Number of Registered Vehicles

Year	Passenger Car	Truck	Bus	Motor Cycle	Total
1975	383,061	196,416	35,103	1.191,771	1.806,351
1976	420,488	222,310	39,804	1.413,228	2.099,866
1977	479,335	278,979	48,089	1.704,964	2.511,367
1978	535,442	336,753	58,389	1.990,245	2.920,834
1979	581,531	393,109	69,770	2.307,215	3.351,625
1980	639,464	473,831	86,284	2.671,978	3.871,557
1981	710,946	575,426	109,986	3.163,284	4,559,642
1982	791,019	657,104	135,151	3,764,442	5,347,716
1983	685,940	717,893	717,873	4,135,677	5,879,750
1984	925,335	987,677	787,677	4,550,942	6,454,562

source : Statistical Year Book of Indonesia

(10) While, as understood in Table-5.8 below, the composition of the vehicles varies by islands. In Sumatera and Kalimantan, the composition of the passenger cars is comparatively lower, whilst in Jawa and Maluku, it is higher. The composition rate of trucks in Irian Jaya is higher.

Table-5.8 Number of Vehicle by Region in 1984

(Unit : 1,000)

Region	Passenger Car	Truck	Bus	Motor-cycle	Total
Sumatera	117.6 (8.9)	171.6 (13.1)	42.1 (3.2)	983.0 (74.8)	1314.0 (100.0)
Jawa & Bali	724.0 (16.7)	510.4 (11.8)	125.8 (2.9)	2970.9 (68.6)	4332.0 (100.0)
Nusa Tenggara	8.8 (10.3)	11.6 (13.5)	4.1 (4.8)	61.3 (71.4)	85.8 (100.0)
Kalimantan	26.3 (9.0)	28.3 (9.7)	7.4 (2.5)	230.6 (78.8)	292.6 (100.0)
Sulawesi	37.7 (10.0)	56.8 (15.1)	9.6 (2.6)	271.7 (72.3)	375.8 (100.0)
Maluku	3.6 (24.3)	0.9 (6.1)	0.1 (0.7)	10.2 (68.9)	14.8 (100.0)
Irian Jaya	6.4 (16.5)	7.9 (20.3)	1.6 (4.1)	23.0 (59.1)	38.9 100.0
Total	925.3 (14.4)	787.7 (12.2)	190.8 (3.0)	4550.7 (70.5)	6454.6 (100.0)

(11) Region-wise distribution distribution of the vehicles is presented in Table-5.9. About 67% of vehicles are concentrated on Jawa and Bali. The numbers of registered vehicle per 1,000 population come up about 40 vehicles on an average in Indonesia. Those in Nusa Tenggara and in Maluku are extremely low.

Table-5.9 Number of Vehicle Share

Region	No. of Registered Vehicle (1000)	Share (%)	Vehicle/ 1000 population
Sumatera	1,314	20,5	41,2
Jawa & Bali	4,332	67,1	42,7
Nusa Tenggara	86	1,3	13,2
Kalimantan	293	4,5	38,7
Sulawesi	376	5,8	33,2
Maluku	15	0,2	9,5
Irian Jaya	39	0,6	30,0
Total	6,455	(100)	39,9

Source: Statistical Year Book of Indonesia.

(12) The Inter-Kabupaten transport volume carried by the vehicles in 1982 is shown in Table-5.10. In the nationwide land transport, the passengers of 1,469 million persons and the cargoes of 175 million tons are recorded. When compared to those of the year of 1977, the annual average growth rates are 18% for the passenger trip and 15% for the cargo carriage. In the light of the region-wise figures, the transport volume in Jawa & Bali is ranked at the highest level, followed by that in Sumatera, as numbers of registered vehicles show likewise. Average trip length is relatively short in Jawa and Bali, and longer in Sumatera and Kalimantan.

Table-5.10 Transport Volume by Vehicle

Region	PASSENGERS			GOODS TONNAGE		
	Passenger Trips 10^6	Passenger KMS 10^9	Average Trip KMS	Tonnage Trips 10^3	Tonne KMS 10^6	Average Haul KMS
Sumatera	166	18	109	20,800	3,700	178
Java & Bali	1,207	78	65	146,500	15,040	103
Nusa Tenggara	17	1	68	1,100	100	87
Kalimantan	15	2	100	1,600	180	110
Sulawesi	64	4	68	5,000	390	79
Total for Indonesia	1,469	103	70	175,000	19,410	111

Source : 1982 National Origin and Destination Survey

(13). Share of the cargo transport by commodity is governed at maximum by the mineral and forest products except Nusa Tenggara, where foods and farm product occupies the largest share. As a whole, there find no any big difference in the composition of cargo transport by region.

Table-5.11 Commodity Group Distribution

(Unit : %)

Region	Liquid Fuels	Food and Farm Products	Plantation Products	Mineral & Forest Product	Consumer Goods	Capital Goods
Sumatera	10	20	17	25	10	18
J a w a	9	22	10	37	9	13
B a l i	10	14	10	41	8	17
NusaTenggara	16	32	5	20	5	22
Kalimantan	13	20	8	38	10	11
Sulawesi	12	17	7	36	10	18
Indonesia	9	22	11	35	9	14

Source : 1982 National Origin and Destination Survey

Conclusively, transport volume by vehicle is likely to maintain the steady growth rate in the years to come, in view of the positive investment on the land transportation sector and increasing numbers of car ownerships.

5.03 RAILWAY TRANSPORTATION

(14) The railway transport networks in Indonesia are composed of the following four systems.

- Jawa	4,986	km
- South Sumatera	692	km
- West Sumatera	257	km
- North Sumatera	561	km
Total	6,496	km

(15) In Jawa, the railway runs from the west to the east through the island. While in Sumatera, there exist three independent railway systems in the north, the central and the south Sumatera. These systems are not connected. The south Sumatera network covers two provinces, Sumatera Selatan and Lampung, connecting Panjang, Palembang and Lubuklinggau. The west Sumatera network services Sumatera Barat, centralized in Padang. The north Sumatera network extends in the eastern part of the north Sumatera and the main station is Medan. Table-5.12 gives the numbers of station in the networks.

Table-5.12 Number of Station by Region (1986)

REGION	PASSENGER STATION	FREIGHT STATION
Jawa	740	16
South Sumatera	109	2
West Sumatera	63	4
North Sumatera	91	3
TOTAL	1,503	25

(16) The gauge is 1,067 mm, and the railway has primarily single track except for the double track section between Jakarta and Cikampek, 163 km. Electrified section is 30 km only in the JABOTABEK area, using 1,500 volts D.C. In the other section, diesel locomotives are mainly employed. Table-5.13 shows numbers of motive power by type.

Table-5.13 Number of Motive Power by Type

	Steam Locomotive	Diesel Locomotive	Electric Unit	Total
1981	111	284	9	404
1982	123	250	9	382
1983	77	431	40	548
1984	54	506	64	624
1985	53	518	80	651

Source : RAILWAY STATISTICS DATA DAN INFORMASI SEKTOR PERHUBUNGAN.

(17) By a general policy, steam locomotives were almost replaced by diesel locomotives. As to the electric unit, electric rail car are utilized. Since the age of 40% of diesel locomotives are more than 20 years, replacement by the new one is of urgent need.

(18) As shown in Table-5.14, the passenger transport by railway records about 2.5 times increment in Jawa and about 1.7 times increment in Sumatera during the latest 10 years. The average annual growth rate corresponds to 10.6% for Jawa and 6.4% for Sumatera.

Table-5.14 Railway Transport Records

Year	J a w a		S u m a t e r a	
	Passenger (10^3)	Cargo (10^3 tons)	Passenger (10^3)	Cargo (10^3 tons)
1977	18,858	2,418	1,498	1,191
1978	27,175	3,050	2,007	1,261
1979	34,565	3,075	3,083	1,354
1980	36,519	2,398	3,322	1,840
1981	37,286	2,399	3,092	2,096
1982	38,396	2,165	2,925	2,157
1983	42,063	2,444	2,574	2,373
1984	43,321	3,121	2,648	3,078
1985	43,704	3,057	2,626	3,375
1986	46,788	3,555	2,614	3,920
Average Anual Increase Rate (%)	10.6	4.3	6.4	14.2

Source : P.J.K.A.

Similarly to the passenger transport, cargo transport also shows growing trend, that is; 1.5 times growth for Jawa, and 3.3 times growth for Sumatera in 10 years. Sumatera's cargo transport recorded a steady upward trend, while Jawa's up and down were repeated. The section where the maximum transport volume recorded is Jakarta-Cikampek of double track line.

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

5.04 INLAND WATER TRANSPORTATION

(20) Inland water transportation has been developed in Indonesia due to her geographical features, that is; abundance of great rivers, lakes and swamps, and difficulty in land access. Inland water transportation is under control of Directorate General of Land Transport. Numbers and volume of boats employed in inland water transport is tabulated below.

Table-5.15 Number and Volume of Boat

Region	No. of Ships	Total Volume of Ships (M3)	Average Volume of ship (M3)
Sumatera	42,059	680,157	16.2
Jawa & Bali	1,306	34,428	24.8
Nusa Tenggara	Nil	-	-
Kalimantan	40,364	848,994	21.0
Sulawesi	4,539	38,005	8.3
Maluku	215	N.A.	N.A.
Irian Jaya	543	2,745	5.0
Total	89026	1.602,329	18,0

(21) Sumatera and Kalimantan together own about 90% of the total inland water boat. In terms of volume of boat, Kalimantan occupies 50% of the total volume. The average boat size is 18 m^3. The boat size varies very widely depending on the region from 5 m^3 in Irian Jaya to 24.8 m^3 in Jawa & Bali. Such difference might be reflected by the channel conditions and demand magnitude.

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

(23) Transport volume by the inland water boat in 1984 is presented in Table-5.16. Passenger transport in Kalimantan is registered about 8 millions or 50% of the total, followed by Sumatera, 14%. While cargo transport both in Kalimantan and Sumatera amounts to about 2 millions ton each, corresponding to 88% of the total cargo transport.

Table-5.16 Transport Volume by Inland Water Boat

Region	Passenger	Cargo (1000 t)
Sumatera	2,190,666	1,936
Jawa & Bali	1,157,698	332
Nusa Tenggara	Nil	Nil
Kalimantan	8,391,996	2,066
Sulawesi	1,419,129	57
Maluku	1,306,722	117
Irian Jaya	1,299,803	14
Total	15,766,014	4,522

According to the statistics from 1981 to 1984 prepared by DGLC, both cargo and passenger transport fluctuates every year. Hence, it is difficult to forecast the future trend of demand.

5.05 FUTURE DEVELOPMENT PLAN

(24) The share of transportation, communication and tourism sector in the development budget of REPELITA-IV, is equivalent to 12.6% (Rp. 9,923 billion) of the total budget. Out of this share, the land transportation subsector occupies as much as 60% or Rp. 5,819 billion. The budget allocated to this sector, Rp. 5,818 billion is planned to apportion 73.7% to road & bridge, 25.8% to railway and 0.5% to inland water transportation.

(25) Target of REPELITA-IV in connection with the road and bridge comprises;

- Maintenance & Rehabilitation	97,777 km
- Support Works	120,515 km
- Road Betterment	18,205 km
- Bridge Betterment	50,000 m
- New Road Construction	1,478 km

The works to be carried out to attain the above target have been and will be progressed as harmonizing with other sectors of development of such as industry, agriculture, transmigration, etc. The roads within the production area, connecting the production area with the market and for induction of the development of transmigration area are placed priority in construction and improvement. The toll road is also planned to be constructed to cope with the rapid growth of traffic in and around the urban area.

(26) Target of the road traffic includes the reduction of traffic accident, promotion of inter and intra city bus services and advancement of pioneer transport. In connection with this, the road traffic facilities of 213-traffic signals, 72,000-traffic signs, 1,300 km-road markings, 122,200 m-guardrails and 63-vehicle testing centers are to be provided.

(27) Target of the railway transport is to attain the annual growth rate of 14% for passenger transport and 21% for cargo transport as detailed in Table-5.17.

Table-5.17 Target of Railway Transportation Service Level

YEAR	1984	1989
Passenger (Thousands)	60,693	67,332
Passenger (Million ton.km)	6,470	12,259
Freight (Thousands ton)	11,777	17,750
Freight (Million ton.km)	1,440	3,810

To achieve the above target, the improvement and reinforcement of the railway facilities are to be conducted including 4,020 km-railway track and 423-bridge rehabilitation and procurement of 2,000-passenger coaches, 10,599-freight cars, 127-electric rail cars and 207-diesel locomotives.

(28) Forecasting on the regional development and the area where any other transportation measures are not available, improvement of inland water transportation comprises 24-terminal rehabilitation, 22-terminal construction, 27-jetty rehabilitation, 33-jetty construction and 5,826-buoy procurement and installation for the navigation aids. In addition, 18-boat repair and 13-boat procurement are also included.

(29) In line with target of REPELITA-IV, the Priority List for Investment, 1986, prepared by the Government, covers items shown in Table-5.18 concerned to the land transportation.

Table-5.18 Priority List for Investment, 1986, Concerned to Land Transportation

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ROAD AND BRIDGES

* TOLL ROADS
  - North - South Link (Jakarta), 12.5 km.
  - Harbor Road (Jakarta), 22 km.
  - Grogol - Pluit (Jakarta), 7 km.
  - Outer Ring Roads (Jakarta), 54.1 km.
  - Tangerang - Merak (West Jawa), 75 km.
  - Surabaya - Gresik (East Jawa), 9 km.
  - Semarang Toll Road (Central Jawa), 17 km.
  - Medab - Binjai (North Sumatera), 24 km.
  - Cikampek - Padalarang (West Jawa), 60 km.
  - Cikampek - Cirebon (West Jawa), 130 km.
  - Surabaya - Mojokerto (East Jawa), 39 km.
  - Semarang - Bawen (Central Jawa), 21 km.
  - Yogyakarta - Solo (Central Jawa), 60 km.
  - Cirebon - Tegal (Central Jawa), 69 km.
  - Semarang - Batang (Central Jawa), 75 km.
  - Palembang Ring Road (South Sumatera), 9 km.
  - Padang By-pass (West Sumatera), 18 km.

ROAD TRAFFIC FACILITIES

- Inter-City Passenger Transport
  - Samarinda - Balikpapan - Banjarmasin
  - South Sulawesi - Southeast Sulawesi
  - South Sulawesi - Central Sulawesi
  - West Nusa Tenggara
  - East Nusa Tenggara
  - East Timor
- Tour Bus Transport
- Special Transport of Industrial Projects
- Heavy Container Transport
  - To serve the main harbor of Jakarta, Medan, Surabaya, Ujung Pandang
- Taxi Transport.

RAILWAY

- Repair and Maintenance of Railway Passenger Car

RIVER, LAKE FERRY TRANSPORTATION

- River Transportation, only in Central Kalimantan
