tion of navaids will evidently contribute to improvement in marine casualties.

If the marine casualties deriving from navaids would be prevented from their occurrence, effective consequences will be saving of human life, ships and cargoes.

6-4-1 Decrease in Human Casualties

The loss of human life caused by marine accidents recorded during the four years period of 1980 to 1983 are given in **Table 6-4-1/1** for Indonesian flag vessels (motorized only).

Table 6-4-1/1 Loss of Human Life caused by Marine Accidents

Unit: No. of Person

	1980	1981	1982	1983	Total	Annual Average	Person/ Accident
Human Loss	76	243	309	148	776	194	0.5

As seen above, the loss of human life during the past four years reached 776 giving annual average of 194, and the loss of 0.5 person/accident was recorded. Since the data on human casualties by kinds of accidents are unavailable, the human casualties caused by navaids-related accidents in relation to the total number are estimated as given below based on the ratio of 3.24% worked out for strandings out of the total number of accidents.

$$\frac{776}{4} \times 0.0324 = 6.2856 = 6.3 \text{ person/year}$$

Assuming that the present situations would continue for some years to come, an estimate may be made as given in **Table 6-4-1/2** on the human loss to be possibly caused

by navaids-related marine accidents during the coming five years.

Table 6-4-1/2 Estimates for Loss of Human Life to be possibly related to Navaids

Unit: Person

Annual Loss	Annual Growth	1984	1985	1986	1987	1988	Total
6.3	5.0%	6.6	6.9	7.3	7.7	8.0	36.6
	6.0%	6.7	7.1	7.5	8.0	8.4	37.6
	8.9%	6.9	7.5	8.1	8.9	9.6	41.0
	12.2%	7.1	7.9	8.9	10.0	11.2	45.0

Notes: Annual growth rates applied are the same as those given in **Table 6-4/3.**

The loss of human life estimated for the coming five years to be possibly related to aids to navigation (strandings) are:

36.6 persons at the GDP growth rate of 5% per year during REPELITA IV

37.6 persons at the growth rate of 6% for ocean-going vessels during REPELITA IV

41.0 persons at the growth rate of 8.9% for both ocean-going and domestic vessels during REPELITA IV

45.0 persons at the growth rate of 12.2% for domestic vessels during REPELITA IV.

6-4-2 Decrease in Cargo Casualties

The cargo casualties recorded during the four years period of 1980 to 1983 are as given below for Indonesian flag vessels (motorized ships only).

Table 6-4-2/1 Loss of Cargo by Marine Accidents

Unit: ton

	1980	1981	1982	1983	Total	Annual Average	Cargo/ Accident
Cargo Loss	5,854	6,419	11,624	13,649	37,546	9,387	24.4

As given below, the loss of cargos occurred during the four years period shows 37,546 tons in total and 9,387 tons in annual average, giving 24.4 tons per number of accidents.

When the same approach of an estimate as previously described is applied, the loss of cargoes related to navaids is estimated as follows:

$$\frac{37.546}{4} \times 0.0324 = 304.1 \text{ tons/year}$$

Therefore, if an assumption is made that the present situations would be maintained for the coming five years, estimates for the loss of cargoes to be related to navaids is as given below:

Table 6-4-2/2 Estimates for Loss of Cargoes related to Navaids

Unit: ton

Annual Loss	Annual growth	1984	1985	1986	1987	1988	Total
304.1	5%	319.3	335.3	352.0	369.6	388.1	1,764.4
	6%	322.3	341.7	362.2	383.9	407.0	1,817.1
	8.9%	331.2	360.6	392.7	427.7	465.8	1,978.0
	12.2%	341.2	382.8	429.5	481.9	540.7	2,176.2

Note: The anual growth rates applied are the same as those given in **Table 6-4/3.**

Estimated loss of cargoes to be possibly related to aids to navigation for the coming five years (strandings) are:

1,764.4 tons at the annual growth rate of GDP at 5% during REPELITA IV

1,817.1 tons at the annual growth rate of ocean-going vessels at 6% during REPELITA IV

1,978.0 tons at the annual growth rate of both ocean-going and domestic vessels at 8.9% during REPELITA IV

2,176.2 tons at the annual growth rate of domestic ships at 12.2% during REPELITA IV

However, it is not possible to make precise cost estimate for the loss of cargoes since the details of cargo items are unknown.

Following is estimated for reference, based on the date available in Statistik Indonesia 1982, on the per-ton cost:

$$\frac{\text{(Import in value) + (Export in value)}}{\text{(Import in volume) + (Export in volume)}} =$$

$$\frac{16{,}678.4 \times 10^6 + 19{,}885.0 \times 10^6}{22.822.8 \times 10^3 + 84{,}031.6 \times 10^3} = 342 \text{ (US\$/ton)}$$

When this figure of US$342 is applied to **Table 6-4-2/2**, the loss of cargoes in value is as given in **Table 6-4-2/3**.

Table 6-4-2/3 Loss of Cargoes, related to Navaids, in Value

Unit: US$

Annual Loss	Annual growth	1984	1985	1986	1987	1988	Total
104,002	5%	109,201	114,673	120,384	126,403	132,730	603,391
	6%	110,227	116,861	123,872	131,294	139,194	621,448
	8.9%	113,270	123,325	134,303	146,273	159,304	676,476
	12.2%	116,690	130,918	146,889	164,810	184,919	744,226

Estimates for the navaids-related loss of cargoes in value during the coming five years are:

US$603,391 at the annual growth rate of GDP at 5% during REPELITA IV

US$621,448 at the annual growth rate of ocean-going vessels at 6% during REPELITA IV

US$676,476 at the annual growth rate of both ocean-going and domestic vessels at 8.9% during REPELITA IV

US$744,226 at the annual growth rate of domestic vessels at 12.2% during REPELITA IV

6-4-3 Decrease in Loss of Ships

The number of accidents for Indonesian flag vessels (motorized only) to be related to aids to navigation is estimated at 12.5 ships per year (see Section 4-4).
An average type of ship in size estimated based on the data on marine accidents is considered to be 500 GT (= 750 DWT), which is applied for estimating the loss of ships in cost.

More than 50% of the total number of Indonesian flag vessels are old ones having the age of 15 years or

older, and an assumption is made here that the average age of ships would be 10 years since those old ships will be re-built.

The cost of newbuilding in Japan for this size of ship is estimated at US$1,304,348 (Japanese Yen 300 mil ÷ ¥230). The cost of 10-year old ship is estimated at 29% less than that of newbuilding according to the records seen in the market, i.e.

US$1,304,348 x 0.29 = US$378,261

As described above, there are a number of old Indonesian flag vessels, and the level of salvage engineering is considered to have not yet been developed high enough.

An assumption is, accordingly, made here that the ships to be involved in marine casualties would result in their total loss. This gives an annual estimate of the navaids-related loss of ships in value as follows:

Newbuilding ships: US$1,304,348 x 12.5 = US$16,304,350
10 years old ships: US$378,261 x 12.5 = US$4,728,263

Based on the costs given above, the estimates for the navaids-related loss of ships in value are made in **Table 6-4-3/1.**

Table 6-4-3/1 Estimates of Navaids-related (Strandings) Loss of Ships in value

Unit: US$x10^6

Ship's age	Annual Loss	Annual growth	1984	1985	1986	1987	1988	Total
new building ship	16.304350	5%	17.12	17.98	18.87	19.82	20.81	94.60
		6%	17.28	18.32	19.42	20.58	21.82	97.42
		8.9%	17.76	19.34	21.06	22.93	24.97	106.05
		12.2%	18.29	20.53	23.03	25.84	28.99	116.68
10 years old ship	4.728263	5%	4.96	5.21	5.47	5.75	6.03	27.43
		6%	5.01	5.31	5.63	5.97	6.33	28.25
		8.9%	5.15	5.61	6.11	6.65	7.24	30.75
		12.2%	5.31	5.95	6.68	7.49	8.41	33.84

Note: Annual growth rates applied are as same as those given in **Table 6-4/3.**

The estimates for navaids-related (strandings) loss of ships during the coming five years are:

For 10 years old ships:-

US$27.43 x 10^6 at the annual growth rate of GDP at 5% during REPELITA IV

US$28.25 x 10^6 at the annual growth rate of ocean-going vessels at 6% during REPELITA IV

US$30.75 x 10^6 at the annual growth rate of both ocean-going and domestic vessels at 8.9% during REPELITA IV

US$33.84 x 10^6 at the annual growth rate of domestic vessels at 12.2% during REPELITA IV

For newbuilding ships, the relevant figures are estimated respectively at:

US$ 94.60 x 10^6
US$ 97.42 x 10^6
US$106.05 x 10^6
US$116.68 x 10^6

The development of aids to navigation will enable to prevent the marine accidents to be possibly involved therewith from occurring, and thus the loss of life and property at sea will be minimized to a considerable extent. Among the marine casualties occurred other than strandings including collisions, some of them may be more or less related to aids to navigation, and the effect of decrease in loss of human life and property to be assessed by the navaids development will be improved.

Aids to navigation will also facilitate accurate positioning of ships, and even in case where marine accidents occur, they will make it possible to facilitate speedy and effective search and rescue operations.
In all, securing of navigation safety will further be achieved.

7. NEEDS FOR ADMINISTRATIVE AND MAINTENANCE SETUP

7. Needs for Administrative and Maintenance Setup

7-1 3rd Class District of Navigation

7-1-1 Present Situations

The present situations of maintenance and operation of aids to navigation in Indonesia are that the entire areas are covered by the total number of 24 Districts of Navigation. The length of coastlines per District of Navigation extends as long as 1,375 nautical miles, which are extremely long coverage allocated for a single field unit: This requires considerable number of days for maintenance of navaids, buoy installations, shift of lighthouse keepers, supply of spares and so on, and in addition delay in executing scheduled maintenance and supply of spares has been experienced due to adverse sea conditions. Those factors altogether have caused failures in the navaids performances.

In order to carry out quickest possible recovery of failures, maneuverable capability by service vessels and cars is vitally important, no doubt, together with spares and expert personnel to be provided. High speed boats and such means may meet the requirements of reaching defective navaids in the shortest time, but this may obviously be limited. Advisable solution in this context is to further establish field units, which are to be equipped with maneuverable capability: This will undoubtedly contribute to the execution of high density maintenance and repairs, to the improvement in operational performances of navaids, and to the quickest recovery from failures.

It is advisable due to the above reasons that 3rd Class Districts of Navigation be established for efficient execution of maintenance and operation of aids to navi-

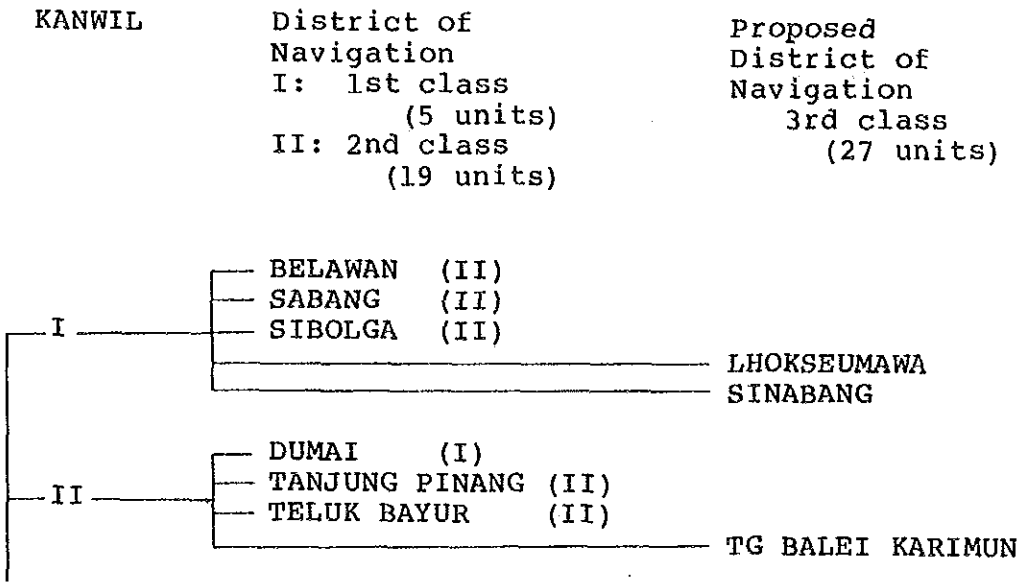
gation, supplementing the existing organizations of 1st and 2nd Class Districts of Navigation.

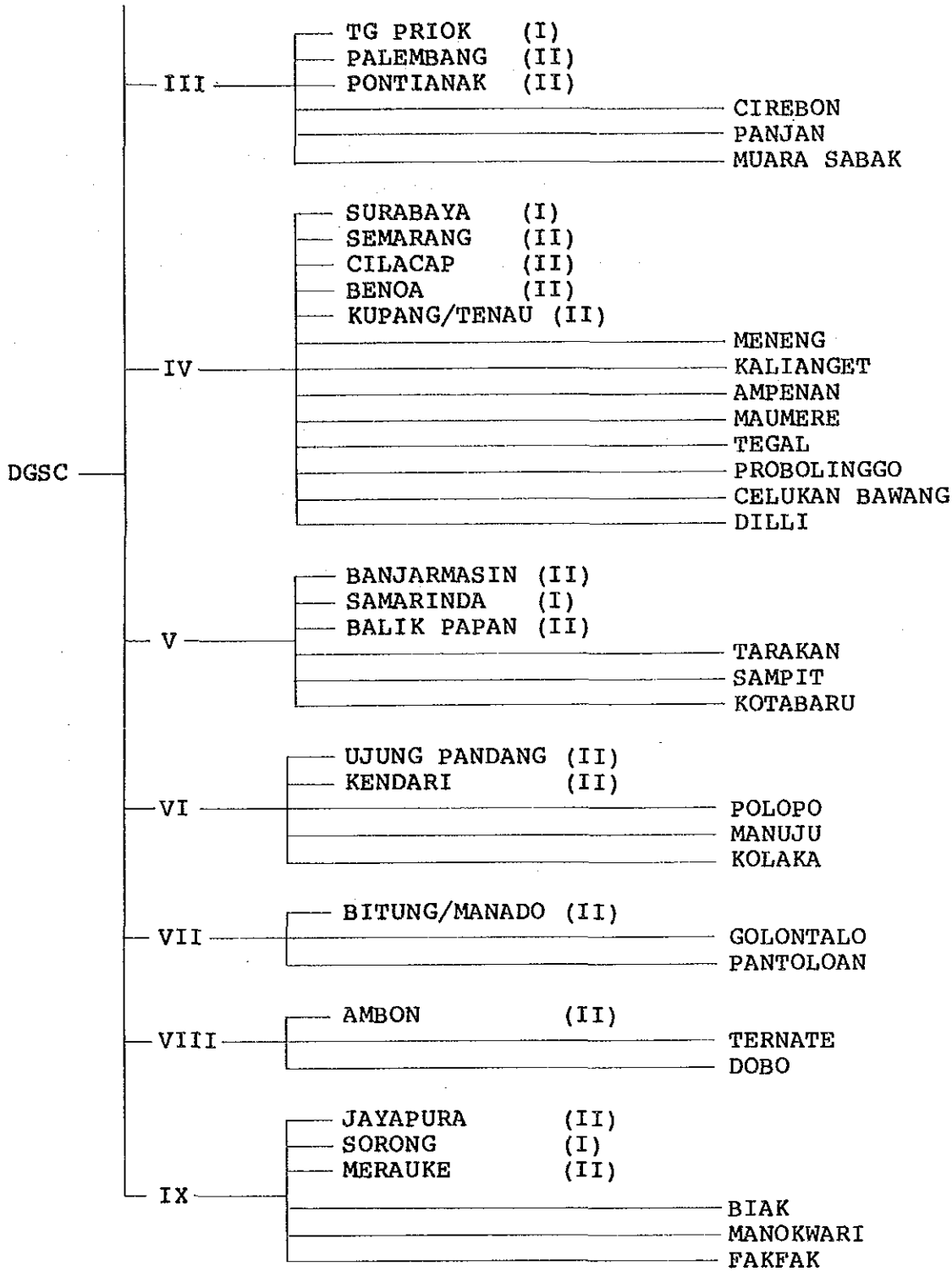
7-1-2 Establishment of 3rd Class Districts of Navigation

With an aim to examine the necessity of establishing 3rd Class Districts of Navigation, surveys were carried out by the second Field and Site Survey Groups at the relevant KANWIL's and Districts of Navigation and other field units. The outcome of survey finds it advisable to establish them. Note should, however, be made that there have been opinions, through the Field and Site Surveys, of necessity of improving the existing facilities and equipment, especially in terms of vessels, workshops, jetties, etc. in high priority. Due consideration should be made in this connection.

The proposed organizational setup of Districts of Navigation is given in **Fig. 7-1.**

Fig. 7-1 Proposed Organizational Setup of Districts of Navigation




DGSC
III
TG PRIOK (I)
PALEMBANG (II)
PONTIANAK (II)
CIREBON
PANJAN
MUARA SABAK
IV
SURABAYA (I)
SEMARANG (II)
CILACAP (II)
BENOA (II)
KUPANG/TENAU (II)
MENENG
KALIANGET
AMPENAN
MAUMERE
TEGAL
PROBOLINGGO
CELUKAN BAWANG
DILLI
V
BANJARMASIN (II)
SAMARINDA (I)
BALIK PAPAN (II)
TARAKAN
SAMPIT
KOTABARU
VI
UJUNG PANDANG (II)
KENDARI (II)
POLOPO
MANUJU
KOLAKA
VII
BITUNG/MANADO (II)
GOLONTALO
PANTOLOAN
VIII
AMBON (II)
TERNATE
DOBO
IX
JAYAPURA (II)
SORONG (I)
MERAUKE (II)
BIAK
MANOKWARI
FAKFAK

7-1-3 Operation Offices

The concept of establishing 3rd Class Districts of Navigation will produce the total number of 51 field organizations, and the length of coastlines per field unit will be 647 miles, which are still insufficient coverages from the viewpoint of carrying out efficient maintenance and operation, and need to be shortened. Rather ideal setup in terms of miles per field unit will be around 100 miles, and this will enable navaids failures to be recovered within 24 hours, thus improving navaids reliability to a great extent. However, this is considered rather impractical at this stage as more than 300 field units are to be required, and urgency of this implementation may not be reasonably justified.

For the above reasons, it is advised that Operation Offices be established at the main ports, currently under development or planned, to function as support and supplementary sub-field units. An Operation Office will organizationally belong to 1st, 2nd or 3rd Class District of Navigation and be placed under their control and administration: The operational functions of an Operation Office will cover the maintenance of navaids in limited and high density areas around its own geographical location, i.e. sharing the service coverages of 1st, 2nd and proposed 3rd Class.

The outline of Operation Office is as given below:

a) to function as support and supplementary sub-field unit of 1st, 2nd or proposed 3rd Class District of Navigation, and to assume limited area responsibility sharing

b) to be placed under the control of 1st, 2nd or proposed 3rd Class District of Navigation

c) to be located at;
   - the main ports, under development or planned, approximately 100 miles away from existing 1st, 2nd or proposed 3rd Class District of Navigation (near existing lighthouse or coast station).
   - the areas in favourable environment for living, where schools, hospitals and other establishments are located.

d) to cover the areas where one way travel in about five hours will be possible from Operation Office.

e) to be responsible for;
   - itinerary maintenance necessary for maintaining the operational functions of navaids
   - maintenance and operation of lighthouses
   - maintenance and operation of coast stations

f) to have the following facilities;
   - Office, living quarters
   - Small-type aids tender, 50 tons or less, speed 10 knots or over
   - Vehicle
   - Workshop
   - Jetty

7-2 Personnel Plan

(1) Present status of personnel

There is currently shortage in number of aids to navigation personnel including ships' crew in the local establishments of DGSC due mainly to their concentration in the central city of Jakarta because of the relevant old organizations and policy.

It is also said that the engineers having expertise knowledge are generally based in Jakarta and for this reason engineers travel everytime from Jakarta to local areas to carry out complicated repair works when troubles and accidents occur.

Shortage in number of ATN personnel and engineers has stagnated the operational activities of Districts of Navigation and furthermore created serious influence on maintaining the technical and operational performances of aids to navigation.

(2) Personnel plan for Short Term Plan

The aids to navigation to be developed in the Short Term Plan comprise 459 visual aids and 45 electronic aids.

The implementation of this plan will bring about acute problem of personnel shortage in Districts of Navigation and other relevant local establishments.

Especially in view of the current rapid progress in advanced technology applied to aids to navigation equipment, distributive re-allocation of expertise engineers to the local offices is an urgent matter. Personnel demands also exist for the electronic and

radio engineers and technicians who will be in charge of the maintenance of medium-wave radiobeacon and radar beacon stations.

New employment, recruitment and training of ATN personnel need to be considered.

Accordingly, the implementation of Short Term Plan necessitates increase in number of ATN personnel. The personnel plans for 1988/89 are given in **Table 7-2/1** and **Table 7-2/2** with the following points taken into account.

a) Shift for lighthouse keepers and lighthouse technicians is to be made every three months, and stand-by personnel are to be made available 1 for lighthouse keeper and 1.3 for lighthouse technician respectively for each lighthouse.

b) As regards the expertise engineers who will be in charge of maintenance of visual aids other than lighthouses, consideration is given to the shortening of scheduled maintenance intervals from six to three months, to the adoption of a complete replacement system for lighted and unlighted buoys. The calculation of work loads is made assuming that one visit of the scheduled maintenance will be carried out by one engineer. The method of calculation applied is same as used for the calculation of work loads for ATN vessels, Section 8-1; the total annual working days for one engineer are 240.

c) As regards the electronic and radio engineers and technicians who will be in charge of electronic aids to navigation, two expertise engineers and one technicians are to be assigned and staffed respectively at the relevant Districts of Navigation.

As described in **Table 7-2/1**, the personnel requirement after the completion of Short Term Plan shows that the following number of personnel will be required:

426 x	lighthouse keepers
101 x	lighthouse technicians
24 x	expertise engineers
60 x	electronic/radio engineers
Total 611	

d) As regards number of ships' crew, following are applied:

Type of Vessel	No. of* vessel	Crew/ vessel	No. of crew
Buoy tender	5	35	175
Supply vessel	2	35	70
Aids tender (100 tons)	8	12	96
Inspection boat	9	10	90
Survey vessel	1	30	30
Total	25		461

Notes: * See Section 8-1 No. of ATN vessels required.

As regards this ships' crew, the number of personnel to be involved in the scrapping plan (50 ships) by 1988/89 will exceed that to be required for the proposed new building (25 ships) of ships as given below:

Number of Ship Crew to Derive
from the Scrapping plan 476
Number of Ships' Crew to be Required
for the New buildings 461

Balance 15 persons

The balance of 15 crew given above should be recruited to the duties of maintenance and operation of navaids through necessary training.

Table 7-2/1 Personnel Plan

Kanwil	Navigasi	Class	Navaids to be established in Short Term Plan							Increased No. of ATN Vessel	Increase in No. of Personnel due to implementation of Short Term Plan					Remarks
			Light house	Light beacon	Harbor light	Light bouy	RLB	MF beacon	Racon		(1) Light house keeper	(2) Light house Technician	(3) Expertise Engineer	(4) Electronic/ Radio Engineer	(5) Ships crew	
I	Belawan	(II)	1	4	3	17	1				6	2	1	3		
	Sabang	(II)	4	4	3	16					24	6	1	3		
	Sibolga	(II)	3	5	1	4					18	4	1			
II	Dumai	(I)			1	10							1			4 x RLB's for Malacca. Singapore Straits
	Tg. Pinang	(II)	2	5		8	4	1	1		12	3	1	3		
	Tlk Bayur	(II)	2	2	1	2		2			12	3	1	3		
III	Tg. Priok	(I)	4	4	5	31	1	2	5		24	6	1	3		
	Palembang	(II)	4	5	1	6	1	1	2		24	6	1	3		
	Pontianak	(II)	3	2	1	10	1		4		18	4	1	3		
IV	Surabaya	(I)	5	4	3	20	1		5		30	7	1	3		
	Semarang	(II)		5	1	14	1		1				1	3		
	Cilacap	(II)		1	1	4							1	3		
	Benoa	(II)	7	5	2	10		1	2		42	10	1	3		
	Kupang/Tenau	(II)	6	4	1	4					36	8	1			

Kanwil	Navigasi	Class	Navaids to be established in Short Term Plan							Increased No. of ATN Vessel	Increase in No. of Personnel due to implementation of Short Term Plan					Remarks
			Light house	Light beacon	Harbor light	Light bouy	RLB	MF beacon	Racon		(1) Light house keeper	(2) Light house Technician	(3) Expertise Engineer	(4) Electronic/ Radio Engineer	(5) Ships crew	
V	Samarinda	(I)	2	4	3	5	1				12	3	1	3		
	Banjarmasin	(II)		4	2	10		3	3				1	3		
	Balikpapan	(II)	2		2	8			1		12	3	1	3		
VI	Ug. Pandang	(II)	6	6	4	20		1	4		36	8	1	3		
	Kendari	(II)	3	4	2	5		1			18	4	1	3		
VI	Manado/Bitung	(II)	8	5	3	14		2			48	11	1	3		
VIII	Ambon	(II)	6	6	2	11		3			36	8	1	3		
IX	Sorong	(I)	1	5	2	9	1				6	2	1	3		
	Jayapura	(II)	2	1	1	6					12	3	1			
	Merauke	(II)			1	5							1	3		Total
	Total		71	85	46	249	12	17	28		426	101	24	60		1,060

Notes: (1) Lighthouse keepers: 5 persons/unit + 1 person/unit (Standby)

(2) Lighthouse technicians: 1.3 persons/unit (standby)

(3) Expertise engineers:

The number of personnel is calculated based on increase in the work loads (scheduled maintenance), ie.

(A) + (B) + (C) + (D) + (E) + (F)/240 days

where,

(A) Lighthouse

3 persons x 2 days/unit x (number of new units) x 4 times/year (including cruising days)

(B) Light beacon

1 " x 2 1/2 " x (") x 4 " (")

(C) Lighted buoy

1 " x 1/2 " x (") x 4 " (")

(D) Harbour light

1 " x 1 " x (") x 4 " (excluding leading lights, pier lights and cruising days)

(E) Small buoy

1 " x 1 " x (") x 2 " (including cruising days)

(F) Day mark

1 " x 1 1/2 " x (") x 2 " (")

(4) Electronic/radio engineers:

3 persons are to be staffed at the Districts of Navigation concerned.

(5) Ships crew

See Section 7-2, (2), d)

(3) Personnel treatment and living quarters

As described in (2) above, the shortage of ATN personnel both at present and after the implementation of Short Term Plan needs to be improved not only through the new employment, recruitment and provision of personnel training but also through such rationalization as automatization and remote monitoring of aids to navigation.

With regard to the ATN personnel centralized in Jakarta, it is necessary to distribute equally to each District of Navigation in proportion to the number of aids to navigation, under their own control. **Table 7-2/2** gives the present status versus the appropriate re-allocation personnel plan for aids to navigation.

The re-allocation and equal distribution of ATN personnel will result in shortage in housing facilities in local areas, where living standards and conditions with respect to prices of commodities, medical fee, fee for education and so forth are behind those of the central city. It will, therefore, be necessary to build additional housing facilities for the personnel and to improve personnel treatment through provision of special and necessary allowances.

Acquisition of necessary budget for housing facilities is one of the vital factors to facilitate the implementation of personnel plan, and in other words, that of the total development plan.

Table 7-2/3 shows the present status of shortage in housing facilities for ATN personnel surveyed at the eleven of twenty-four Districts of Navigation; approximately 62% of the total accommodations are on lease and

government-owned houses. Considerable number of housing facilities is necessary to be built since even the existing number is still in shortage and future increase in number of personnel requires additional accommodations.

Table 7-2/2 ATN Personnel Plan
- Status Quo and Appropriate Assignment -

(Unit: No. of person)

KANWIL	District of Navigation	Class	Status Quo (1984)		Appropriate* Assignment		Difference	
			LH	LT	LH	LT	LH	LT
I	Belawan	(II)	34	6	15	7	+19	-1
	Sabang	(II)	12	6	20	10	-8	-4
	Sibolga	(II)	5	4	5	3	0	+1
II	Dumai	(I)	28	22	10	5	+18	+17
	Tg. Pinang	(II)	76	26	95	44	-19	-18
	Tlk. Bayur	(II)	49	23	45	21	+4	+2
III	Tg. Priok	(I)	241	71	145	67	+96	+4
	Palembang	(II)	18	8		0	+18	+8
	Pontianak	(II)	6	4		0	+6	+4
IV	Surabaya	(I)	61	35	50	23	+11	+12
	Semarang	(II)	20	9	35	17	-15	-8
	Cilacap	(II)	7	5	10	5	-3	0
	Benoa	(II)	24	10	45	21	-21	-11
	Kupang/Tenau	(II)	47	8	50	23	-3	-15
V	Samarinda	(I)	16	10	10	5	+6	+5
	Banjarmasin	(II)	44	12	30	14	+14	-2
	Balikpapan	(II)	2	1	5	3	-3	-2
VI	Ug. Pandang	(II)	56	33	55	26	+1	+7
	Kendari	(II)	4	4	5	3	-1	+1
VII	Menado/Bitung	(II)	32	7	60	28	-28	-21
VIII	Ambon	(II)	24	13	20	10	+4	+3

(Unit: No. of person)

KANWIL	District of Navigation	Class	Status Quo (1984)		Appropriate* Assignment		Difference	
			LH	LT	LH	LT	LH	LT
IX	Sorong	(I)	18	18	20	10	-2	+8
	Jayapura	(II)	6	4	10	5	-4	-1
	Merauke	(II)	10	1	5	3	+5	-2
Total			840	340	745	353	+95	-13

Notes: * LH (Light House Keeper) = 4 person/unit + 1 person (standby)/unit x No. of unit
LT (Light House Technician) = 1 person/unit + 1.3 persons (standby/unit) x No. of unit

Source: Data obtained by JICA Survey Team, during the 2nd Survey carried out in 1984

Table 7-2/3 Present Status of Housing Facilities for ATN Personnel (Partial Data)

KANWIL	District of Navigation	Class	Own House	Rental House	Government House	Others	Total
I	Belawan	(II)	4	25	53	66	148
	Sabang	(II)	4		34	29	67
	Sibolga	(II)			13		13
II	Dumai	(I)	3	120	70		193
	Tg. Pinang	(II)					
	Tlk. Bayur	(II)					
III	Tg. Priok	(I)					
	Palembang	(II)					
	Pontianak	(II)					
IV	Surabaya	(I)			86	262	348
	Semarang	(II)					
	Cilacap	(II)					
	Benoa	(II)					
	Kupang/Tenau	(II)					
V	Samarinda	(I)					
	Banjarmasin	(II)	6	10	21	86	123
	Balikpapan	(II)	16		9		25
VI	Ug. Pandang	(II)		145	55	4	204
	Kendari	(II)					
VII	Menado/Bitung	(II)	23	32	74	27	156
VIII	Ambon	(II)	16	21	69	26	132

KANWIL	District of Navigation	Class	Own House	Rental House	Government House	Others	Total
IX	Sorong Jayapura Merauke	(I) (II) (II)	15	26	85		126
	Total		87	379	569	500	1,535

Source: Data obtained by JICA Survey Team during the 2nd survey carried out in 1984

(4) Long Term View for Training of Personnel

In order to satisfy the long term requirement for ATN personnel, it is most desirable that educational and training facilities will be established in future for the personnel to be newly employed for maintenance and operation of aids to navigation, covering the wide areas of outlines of maritime affairs, meteorology and oceanography, electrical and electronic engineering and engines as well as designing, construction and management of all kinds of aids to navigation.

7-3 Maintenance of Buoys

7-3-1 Outline of the System

The performances of buoys installed at sea to mark channels and routes, navigation dangers fated to deteriorate, as time passes by, due to colour weathering, rust and corrosion on buoy body, tear and wear of mooring, malfunction of light device and so on. Maintaining a certain level of the functional performances of buoys is an essential service to be performed through regular checkings and repairs in order to secure the safety of navigation.

The sea conditions, where buoys are installed, greatly affect the degree of deterioration in colour painted on buoys and tear and wear of moorings.

General overall estimation has shown that bi-yearly maintenance in average for buoys will be sufficient to maintain the standard performances. However, there is a case where annual maintenance is required for those installed at such locations that adverse weather conditions, fast current, rocky or sandy bottom conditions are available.

While on the other hand, the maintenance intervals of 2 - 4 years may be conceivable within ports, small bays or calm waters. Since majority of the water areas under consideration of this Study seemingly falls in the latter case, a plan is made that every two year replacement will be carried out for buoys: a complete set of either light buoy or unlight buoy will be replaced every two years by a buoy tender including light device, power source, mooring and sinker. **Fig. 7-3-1** shows flow of the process.

Any complete set of buoys wholly removed is to be taken ashore to deliver back to the relevant buoy base for repair and maintenance. This facilitates to carry out the thorough checkings of buoys, which are not possible for their on board repair. Accordingly, the reliability of operational performances of buoys will be remarkably improved along with shortenings of the time required on board for the maintenance works involving risky factor.

Further advantages are decrease in the number of failures, prolonging of their life time and so on.

It is expected that deployment of this system will result in at least doubling the present life time of 7 -10 years for buoys.

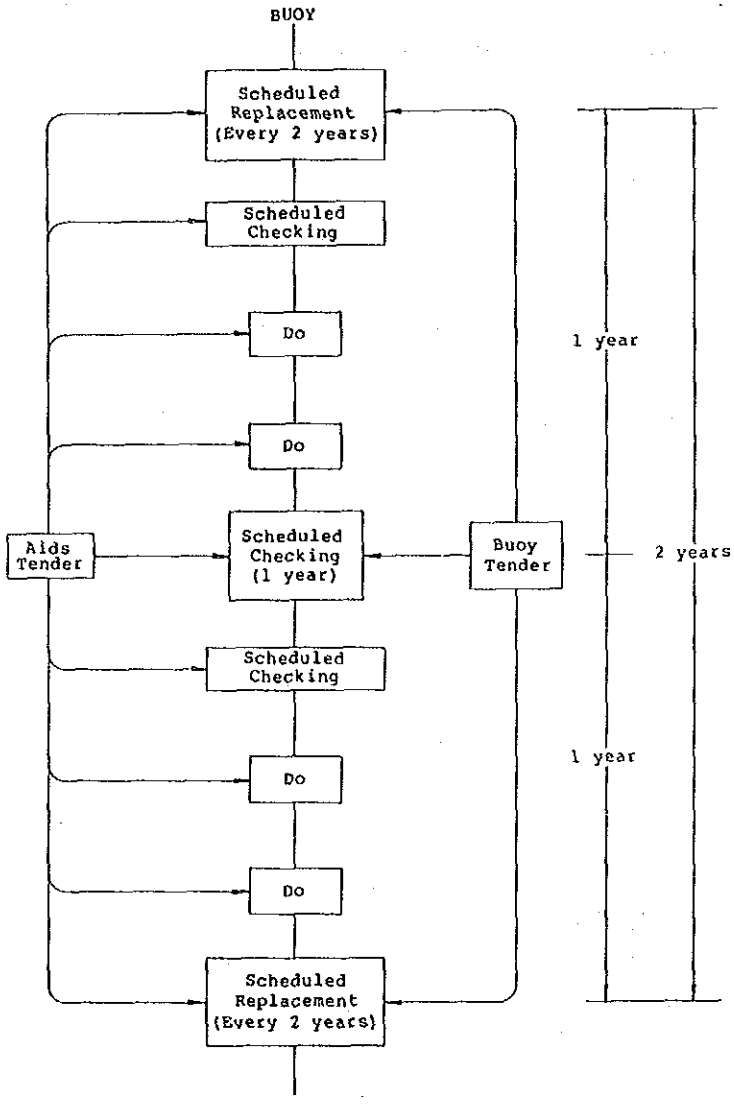


Fig. 7-3-1 Buoy Maintenance System
- Scheduled Replacement of Buoys -

7-3-2 Maintenance of Buoys at Base

A complete set of buoy unloaded will be checked and put into the thorough checking at buoy base. Any torn and worn parts will be replaced by new ones to be ready for next rotation of the buoy loading. **Fig. 7-3-2** shows the process of works to be carried out.

(1) Buoy Body

The light and power devices and other parts should be dismantled from a buoy, and if necessary, the tower should also be removed for clearing up of extraneous things.

Any damages, tear and wear and malfunction parts found after overall checkings shall be repaired together with rust clearing by sand blast and painting thereafter. Careful painting should be carried out including anti-rust process according to the buoy painting procedures pre-established in terms of number of times, drying up period, etc.

For day marks, the purpose of forthcoming installation may be taken into account, and modification will be required for possible co-use for either electrical or gas application in the future.

(2) Mooring

Any damages and torn and worn should be replaced through overall checking, and also necessary quantity of chains should be retained for immediate use.

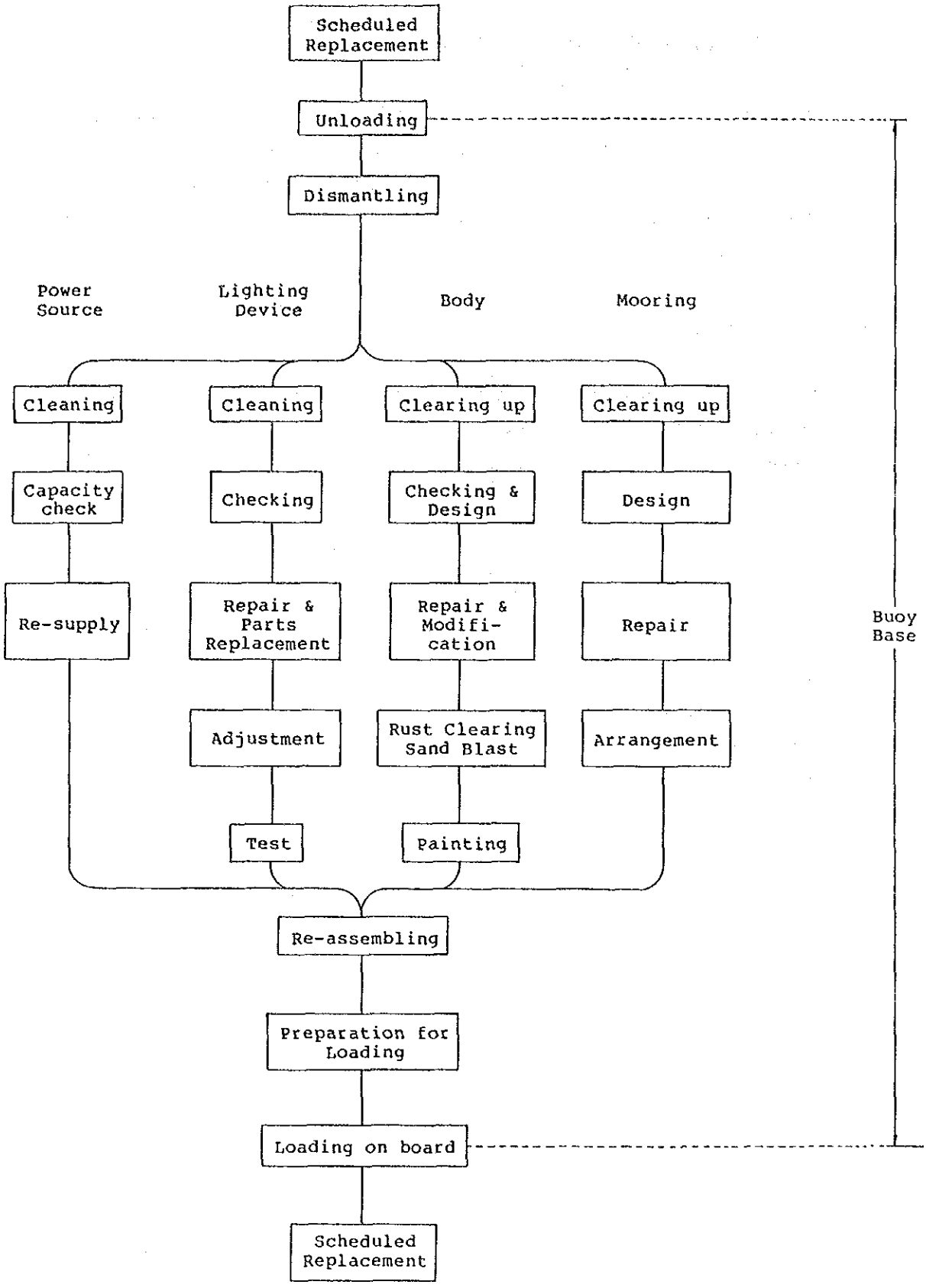


Fig. 7-3-2 Process of Buoy Maintenance Works

(3) Sinker

Any damages, tear and wear should be repaired through overall checking.

(4) Light Device

Checking, adjustment and performance tests shall be made, and any repair needed should be carried out.

(5) Power Source

Checking shall be made for batteries, acetylene and propane gas and their cylinders.

(6) Top Mark

Checking and repair shall be made to meet the necessary requirements.

7-3-3 Facilities

The necessary maintenance and repairs described above are to be carried out at buoy bases. The facilities to be installed at a buoy base are given below, and the outline is described in **Fig. 7-3-3.**

(1) Office

The office should better be located on the second floor to have an overall view over the base, and the first floor space to be used for garage, etc.

(2) Power Supply Room

Power distribution is to be made for machinery, cranes, office room, etc., and battery charging is also carried out.

(3) Workshop

Production and repairs of structural part of buoy body are to be made using necessary machines installed together with other relevant works.

(4) Equipment Test Room

The performance tests and adjustment to be made for light devices and others.

(5) Storage

The materials and parts other than open storage items are to be kept, and gas cylinders are also kept in sectioned areas.

(6) Jig crane

The crane is to be used for loading and unloading of buoys onboard buoy tender.

(7) Open Workshop for Buoy

Outdoor checking and repairs are to be carried including rust clearing, painting and other necessary works.

(8) Work Equipment Storage

Equipment for maintenance and repairs of buoys, chains are to be stored.

(9) Heavy Duty Machines

Truck cranes, fork lifts and such are to be used for carriage of heavy duty machines like sinkers.

(10) Winches

Winches are to be used for stretching chairs out for their checking at the open storage.

(11) Jetty for Buoy Base

7-3-4 Spare Buoys and Materials and their Quantity Required

In order to achieve the efficient operation of regular rotation of buoy replacement and to restore any possible failure of buoys, spare buoys and materials are to be retained. The spare buoys should be in a complete form comprising body, light device, power source, mooring and sinker. In addition to these, spare parts and materials are also to be prepared.

The quantity required for each item should be specified in accordance with the number of days needed for maintenance and repairs, annual rotation requirement, capability of buoy tender, life time, etc.

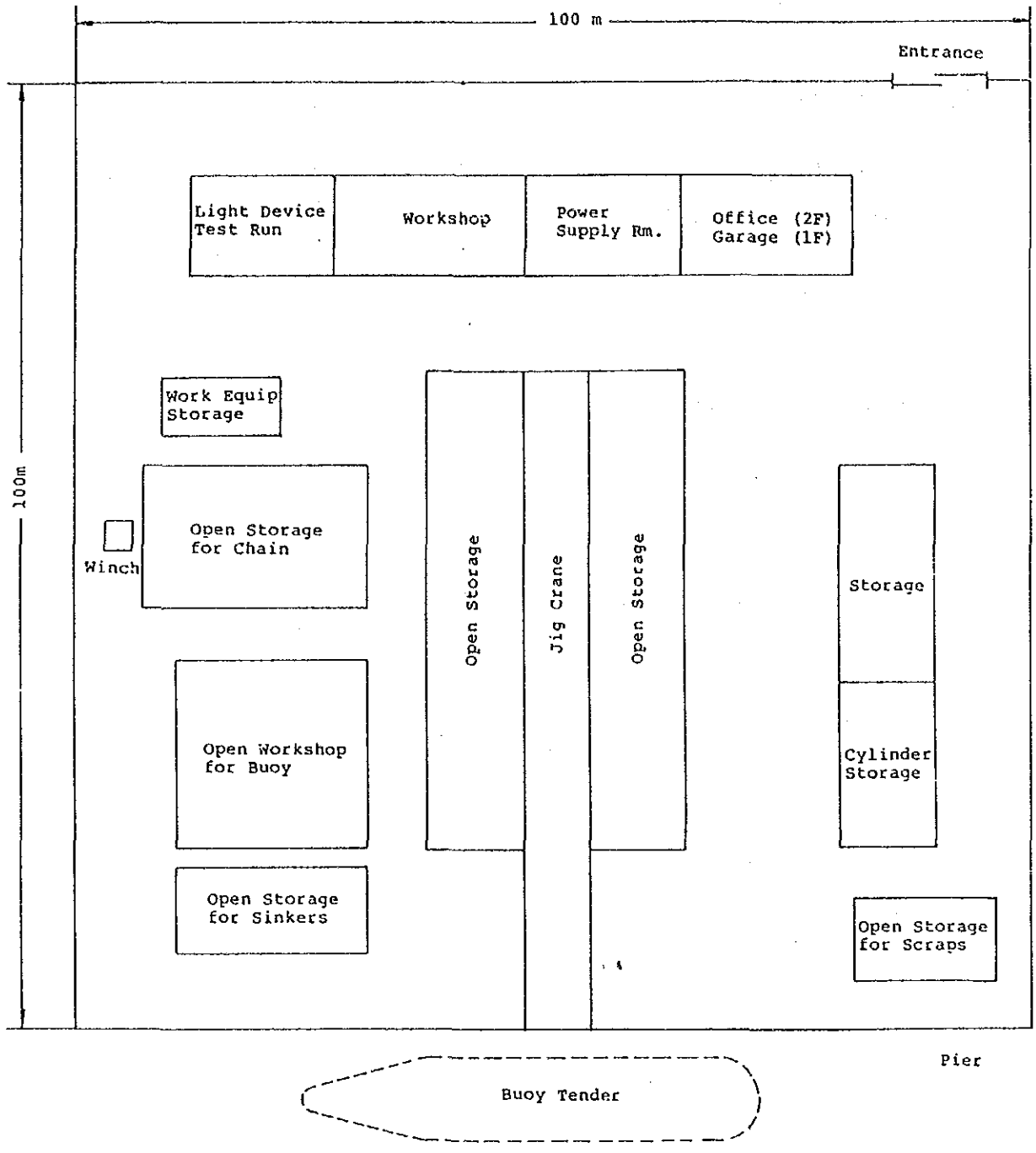


Fig. 7-3-3 Site Plan for Buoy Base
(for 25 - 30 spare buoys)

(1) Spare Quantity

The quantity of spares is specified and estimated as given below according to the base, type of buoy and classification of use.

For rotation:	Spares required for regular replacement
For emergency:	Spares required for accidents
For adjustment:	Spares for efficient and smooth operation of spare rotation with the lifetime taken into account.

a) Quantity for rotation

Number of buoys for rotation
= (Number of buoys installed within the covering area)
x 1/(Rotation Period) ..... (A)

(A) above applies to "Once-per-year" service, and in case of "twice-per-year" service, (A) is given as (A) x 1/2.

If when the rotation services would be frequently carried out, then the rotation would be dependent on the period required for buoy maintenance and repairs at the bases.

Assuming that the period required for maintenance and repairs is 3 months per buoy,

Rotation rate

$$= \frac{12 \text{ months}}{\text{(Period required for Maintenance and Repair)}}$$

$$= \frac{12 \text{ months}}{3 \text{ months}} = 4$$

Accordingly,

Quantity required for rotation
= (Number of buoys installed within the coverage area) x 1/(Rotation Period of Year) x 1/(Rotation rate)

or

Quantity for rotation
= (Number of buoys installed within the coverage area) x 1/(Rotation period of year) x 1/(Number of Service to be provided)

b) The number of buoys prepared for emergency use is assumed to be 2% of the number installed.

c) The number of buoys prepared for adjustment is assumed to be 5% of the number installed. Otherwise, the total of 7% will be prepared for emergency and adjustment.

The individual number required is calculated by multiplying the buoys installed by the above percentage, and any fractions are disregarded.

Total number of spares
= (Rotation Qty) + (Emergency Qty)
+ (Adjustment Qty)

Note should be made that the total number of spares consists each of complete set. In case where the total number exceeds that installed, the latter should control.

(2) Other Spares and their Quantity

In addition to complete sets of spare buoys, other spares should be prepared according to the types, specifications and classifications of buoys installed. The actual allocation will be made to the bases and other Districts of Navigation.

Spare Item	Qty (Equivalent to following)
(a) Lanterns	7% of the total buoys installed
(b) Flashers	7% "
(c) Batteries *	10% "
(d) Gas cylinders *	7%
(e) Chains Plate	10% "
(f) Three Eye Plate	10% "
(g) Swivel Pieces	10% "
(h) Joining shackles	25% "
(i) Sinker	5% "
(j) Others	

Notes: * Calculation should be made on the basis of their consumption and rotation intervals.

7-3-5 Regular Checking

Checking should be carried out for the buoys installed on regular basis according to the following:

(1) Regular Checking by Buoy Tenders

Regular checking should be carried out by buoy tenders for inspection of painting, conditions of mooring and so on, and re-painting and necessary replacement will be carried out, when necessary.

For buoys, installed especially at the areas of fast current, sunken reef and rocks, should be inspected on annual basis.

(2) Checking by Watch Boats

Re-supply or re-fueling is to be carried out by watch boats 2 - 4 times a year together with checking of light devices.

7-3-6 Model Study of Buoy Base

A model study is made specifically for the three buoy bases located at Dumai, Surabaya and Sorong, out of the total of five bases constituting the buoy maintenance system in Indonesia, on the work load of buoy tenders, open storage and spares for buoys and other necessary items.

The total number of buoys to be installed by 1988/89 will consist of the existing number (non property buoys are to be excluded) plus the 249 buoys, which are planned for installation in the Short Term Plan, and they will be allocated according to the four Gateway Policy. An estimation is made that the number of small buoys will remain as it is without any increase.

(1) Service Area of Each Buoy Base and Estimated Number of Installations

The service areas covered by each of the three buoys bases and the estimated number of buoys in 1988/89 are given in **Table 7-3-6/1.**

(2) Buoy Open Storage

In order to ensure smooth operation of buoy tenders and buoy maintenance works, buoy open storages will be located respectively at each District of Navigation, given in **Table 7-3-6/1.**

These areas are either already completed or planned for the development in the Long Term and Short Term Plans and Long Term Plan.

(3) Number of Spares

The number of spare buoys and necessary spares required for each buoy base and open storage is estimated according to the standards for calculation set forth in Section 7-3-4 and given in **Table 7-3-6/2.**

(4) Annual Working Days by Buoy Tenders

Buoy tenders are allocated to 1st Class Districts of Navigation, which have buoy bases, to carry out maintenance of light beacons, RLB's, lighted buoys, small buoys and day marks installed in their respective coverages.

Table 7-3-6/1 Service Areas of Districts of Navigation Covered by Each Buoy Base and Estimated Number of Buoys in 1988/89
- Model Study -

Buoy Base	District of Navigation	Distance from Buoy Base (N.M)	Estimated No. of Buoys	
			Light Buoy	Small Buoy
Dumai	Tg. Pinang	225	19	53
	Belawan	241	22	29
	Sabang	459	15	23
	Dumai	0	35	7
	Sub Total	-	91	112
Surabaya	Semarang	189	9	3
	Benoa	300	7	13
	Cilacap	645	10	23
	Kupang	697	5	0
	Ug. Pandang	450	19	6
	Kendari	770	2	0
	Surabaya	0	29	19
	Sub Total	-	81	64
Sorong	Jayapura	626	5	18
	Ambon	360	7	18
	Merauke	824	5	1
	Sorong	0	16	29
	Sub Total	-	33	66

Notes: The number of non-property buoys is excluded.

Table 7-3-6/2 Spare list for buoy maintenance

- Model Study -

Place / Spares Item	Buoy base and open storage																Remarks
	Dumai	Tg. Pinang	Belawan	Sabang	Surabaya	Semarang	Benoa	Cilacap	Kupang	Ug. Pandang	Kendari	Sorong	Jayapura	Anbon	Merauke	Total	
Light Buoy	8	7	8	6	5	4	3	4	2	7	1	4	2	3	2	66	Complete set with mooring equipment
Small Buoy	2	18	11	8	5	1	5	8	0	3	0	6	7	7	1	82	ditto
Lantern	3	2	2	2	3	1	1	1	1	2	1	2	1	1	1	24	Complete set with flasher
Flasher	3	2	2	2	3	1	1	1	1	2	1	2	1	1	1	24	
Batteries	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	6 pcs 1 set
Gas cylinder	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	17	4 pcs 1 set
Chain for L.B	4	2	3	2	3	1	1	1	1	2	1	3	1	1	1	27	With shackle, 3 eyes piece and swivel
Chain for U.L.B	1	6	3	3	2	1	2	3	0	1	0	3	2	2	1	30	ditto
Sinker	4	5	4	3	4	2	3	3	1	3	1	4	2	2	1	42	1 ton cast iron sinker

This study is to discuss the maintenance and checking of lighted buoys and small buoys.

A buoy tender will make two voyages in principle each to the respective Districts of Navigation within its service area, and carry out scheduled buoy replacement works, and maintenance and checking of non-replacement buoys.

Calculation is made for the work loads of buoy tenders belonging to each 1st Class District of Navigation. Since the work load calculation for other types of navaids is made in Section 8-1, Aids to Navigation Service Vessels, work load estimation in this Section deals only with the maintenance and checking of buoys.

Buoy maintenance and checking are also to be carried out by aids tender, and therefore, work load calculation is made for them in (5) below.

The conditions on which estimation is based for buoy tenders are as follows:

Speed of buoy tenders	:	10 knots
Buoy loading capacity	:	6 buoys
Number of days required for mobilization	:	5 days
Number of buoys to be replaced per day	:	3 buoys
Total replacement cycle	:	2 years

The annual working days of a buoy tender for lighted buoys are given below:

$$B/T = \frac{1}{2}\left\{\left(\frac{(\ )\ \text{units}}{6} \times \frac{(\text{Distance}) \times 2}{10\ \text{knots} \times 24\text{H}}\right) + \left(\frac{(\ )\ \text{units}}{6} \times 5\ \text{days}\right) + \left(\frac{(\ )\ \text{units}}{3}\right)\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(A)}$$

The number of voyages by a buoy tender to the Districts of Navigation, which have buoy open storage facilities, is twice, and accordingly the above equation is given as follows:

$$B/T = \frac{1}{2}\left\{\left(2\ \text{times/Yr} \times \frac{(\text{Distance}) \times 2}{10\ \text{knots} \times 24\text{H}}\right) + (2\ \text{times/Yr} \times 5\ \text{days}) + \left(\frac{(\ )\ \text{units}}{3}\right)\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(A)}'$$

The total replacement cycle for buoys in once every two years. However, a buoy tender will make two voyages to each District of Navigation with a open storage located. Therefore, maintenance for the non-replaced buoys is to be carried out during this period. The work load to be required for the works is given below:

$$B/T = (\ )\ \text{units} \times \frac{3}{4} \times \frac{1}{4}\ \text{days/unit} \times 2\ \text{times/Yr}. \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(B)}$$

The maintenance for small buoys will be carried out by both buoy tender and aids tender: 35% of the total work load will be undertaken by buoy tender and the rest of 65% by aids tender. Therefore, the work load by buoy tender is given as follows:

B/T = 2 times/Yr x 1 day/unit x ( ) units x 35%
..... (C)

Accordingly, the total of either (A) or (A)' plus (B) and (C) gives the annual working days for a buoy tender.

The work load (working days) of a buoy tender for buoy maintenance is given below respectively for Dumai, Surabaya and Sorong:

Table 7-3-6/3 Work Load of Buoy Tender for Buoy Maintenance - Model Study -

(Unit: No. of Days)

Work Load / Buoy Base	Work load for light buoy	Work load for small buoy	Total work load
Dumai	92	81	173
Surabaya	117	49	166
Sorong	58	48	106

(5) Annual working Days for Aids Tender

Aids tenders are allocated to the individual Districts of Navigation for the maintenance and checking of lighthouses, light beacons, RLB's, day marks, MF radio-beacons, Racons, and buoys as well as for various surveys and measurements (see Section 8-1, Aids to Navigation Service Vessels for the total work loads).

In this Section, the work load calculation is limited only to buoy maintenance.

Maintenance for lighted buoys by an aids tender is given below:

$$A/T = 4 \text{ times/Yr.} \times \frac{1}{2} \text{ day/unit} \times (\ ) \text{ units} \quad \ldots\ldots \text{(D)}$$

That for small buoys is:

$$A/T = 4 \text{ times/Yr.} \times 1 \text{ day/unit} \times (\ ) \text{ units} \times 65\% \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(E)}$$

The work load for each District of Navigation is calculated by adding (E) to (D) above, and the result is given in **Table 7-3-6/4.**

Table 7-3-6/4 Work Load of Aids Tender
for Buoy Maintenance - Model Study -

(Unit: No. of Days)

Work Load / Buoy Base	Work load for light buoy	Work load for small buoy	Total work load
Tg. Pinang	38	138	176
Belawan	44	76	120
Sabang	30	60	90
Dumai	70	19	89
Semarang	18	8	26
Benoa	14	34	48
Cilacap	20	60	80
Kupang	10	0	10
Ug. Pandang	38	16	54
Kendari	4	0	4
Surabaya	58	50	108
Jayapura	10	47	57
Ambon	14	47	61
Merauke	10	3	13
Sorong	32	76	108

7-3-7 Advantages to be Introduced by the Total Replacement System for Buoys

(1) The precise checkings and maintenance for buoys, which

can not be sufficiently performed onboard at sea, may be carried out at buoy bases for the total structures of buoys unloaded through the whole replacement. Especially, prolongation in lifetime of the steel iron-make body will be possible through clearing-up using the sand blast method followed by the complete ground painting.

Maintenance of buoys at the bases also makes it possible to follow the prescribed schedules on the number of painting works and the drying hours left afterwards, and thus near-complete painting may be carried out. Following the practice described above will possibly enable the current lifetime of buoys to at least double.

(2) Thorough checking for the mooring and the associated parts and precise measurement for their tear and wear will be carried out at the base together with the necessary clearing up and replacement of parts. This leads to the prevention of washing away or sinking of buoys, which results in improvement in the reliability.

(3) The total replacement system produces reduction of the working hours to be spent for handling the heavy-duty materials on board ship under rolling and pitching conditions. This acts as a useful and important factor from the view point of safety operation.

(4) Through pre-scheduling of the replacement cycle for buoys, the mobilization of buoy tenders and their operations will be effectively planned.

8. ADVICES/SUGGESTIONS

8. Advices/Suggestions

8-1 Aids to Navigation Service Vessels (ATN Vessels)

(1) Present situations

There are presently 91 ATN service vessels, 14 out of which are less than ten years old. Because of a number of old ships, some of them have engine troubles while some others are in dockyards beyond the period normally required, a number of them are presently laid in dockyards. These facts have caused delay in conducting maintenance services, and resulted in causing lights off troubles.

ATN vessels play an extremely important role in maintaining the performances of aids to navigation.
Along with the future development plan for aids to navigation, new building of ATN ships must be implemented together with rebuilding of the aged vessels.

In order to effectuate more favourable operational performances of the vessels, the annual working days for them except the inspection boats will be increased from 240 to 300 days.

(2) Development of ATN vessels after the Short Term Plan

The requirement for number of ATN vessels in 1988/89 will be affected by the following factors.

Deployment of the biannual total replacement system for buoys including small buoys will result in an increase in the number of buoy tenders.

As regards aids tenders and other ATN vessels, however,

the number of such vessels to be required will increase in substance although their total number listed in **Table 8-1/1** gives negative value due to the following reasons, when the factual situations that considerable number of them are in unusable conditionswould be taken into account.

(a) Increase in work loads due to the implementation of visual and electronic aids to navigation included in the Short Term Plan.

(b) Shortening of intervals for scheduled itinerary maintenance periods (from 6 months to 3 months)

(3) Standards for work load of ATN vessels

The standard values for work load of ATN vessels may not be easily calculated since it involves a number of complex factors such as locations and types of navaids, etc.

For this reason, consideration has been paid to the data given in the Indonesian Short Term Development Plan (see (4) below), to the total replacement system for buoys previously described, in this study of the Short Term Plan and to shortening in the intervals of itinerary maintenance periods, and thus the standard values are decided.

(4) Work load by type of ATN vessels (Reference has been made to the data given in the Short Term Development Plan for Aids to Navigation and Maritime Telecommunication System, DGSC August 1983).

1) Contents of Works

a) Buoy tender

Installation and replacement of buoys.
Maintenance of lighted beacons, RLB's, lighted buoys and radar beacons.

b) Supply vessel

Shift of lighthouse keepers, supply of goods to lighthouses, supply of gas cylinders, batteries, etc.

c) Aids Tender

Assisting buoy tender and supply vessel in performing maintenance of aids to navigation which are situated close to the base.

d) Inspection boat

Inspection of visual aids to navigation and repair of minor damages.

e) Survey vessel

Measurement of the light illuminating power.
Evaluation and tests of MF radiobeacon stations and radar beacons. Engineering survey for construction/installation of aids to navigation.
Survey of sea banks, sea lanes where the depth is still in doubt, in connection with the planning of installing aids to navigation.

f) Survey Craft

To perform navigational survey works in limited coastal area and assist survey vessel.

g) Pile pontoon

An aid or platform to execute large scale maintenance works at offshore lighthouses, RLB's.
An aid to install pile drive for building temporary structure at sea, etc.

2) Number of visual aids to be applied for calculation of work load.

Item / Type of ATN	No. of ATN as of March 1984	No. of ATN to be increased in Short Term Plan	Total Number ATN by 1988/1989
Lighthouse (on land)	149	69	218
Lighthouse (off shore)	0	2	
Lightbeacon	350*	85*	435
R.L.B.	2	12**	14
Lighted buoy	205	249	454
Small buoy	415	0	415
Day mark	572	0	572
MF radiobeacon	0	35#	35
Racon	3	28	31

Notes: 1) Non-property navaids are excluded.
Light Beacon: 436- 86=350 units
Light Buoy : 342-137=205 units
2) * excludes the number of harbour lights
3) ** includes 4 units for Malacca and Singapore Straits
4) # 18 out of 35 are on-going.

The above number is to be applied to ( ) of the equations given in 3) hereunder for the calculation of work loads.

3) Equation of work load

(a) Lighthouse

S/V: 12 times/year x 2 days/unit
x ( ) units x 34%
A/T: 12 times/year x 2 days/unit
x ( ) units x 66%

(b) Transportation of acetylene gas

S/V: 2 times/year x 14 days/place
x 5 places

(c) Maintenance of light beacon and R.L.B.

B/T: 4 times/year x 2 1/2 days/unit
x ( ) units x 46%
A/T: 4 times/year x 2 1/2 days/unit
x ( ) units x 54%

Overhaul of R.L.B

B/T: 1/2 times/year x 30 days/unit
x ( ) units

(d) Maintenance of lighted buoys

$$\text{B/T: } \frac{1}{2}\left\{\left(\frac{(\quad)\text{ units}}{6} \times \frac{\text{distance x 2 times}}{\text{10 knots x 24 hours}}\right) + \left(\frac{(\quad)\text{ units}}{6} \times 5\text{ days}\right) + \left(\frac{(\quad)\text{ units}}{3}\right)\right\}$$

A/T: (4 times/year x 1/2 days/unit) x ( ) units

Maintenance of non-replaced buoys

B/T: ( ) units x $\frac{3}{4}$ x $\frac{1 \text{ day}}{4 \text{ units}}$ x 2 times/year

= ( ) units x $\frac{3}{8}$

(e) Maintenance of small buoys

B/T: 2 times/year x 1 day/unit
x ( ) units x 35%
A/T: 2 times/year x 1 day/unit
x ( ) units x 65%

(f) Maintenance of day marks

B/T: 2 times/year x 1 1/2 days/unit
x ( ) units x 30%
A/T: 2 times/year x 1 1/2 days/unit
x ( ) units x 70%

(g) Maintenance of MF radiobeacons and racons

A/T MF = 4 times/year x 3 days x ( ) stations
Racon = 4 times/year x 1 1/2 days x ( ) stations

(h) Inspection of aids to navigation

I/B : $\frac{\text{Distance x 2 times}}{\text{15 knots x 24 hours}}$ x $\frac{365}{3}$ days x 240 days/year*

Note: *Annual working days for I/B are 240.

(i) Measurement and Evaluation and Tests of aids to navigation

Measurement of light illuminating power
Y/V : ( ) unit x (3 + 3) days
x 1 time/5 years
Evaluation and tests of MF radiobeacons

Y/V : ( ) stations x (3 + 3) days
x 1 time/ year

Notes: Evaluationand tests for racons are to be carried out simultaneously with measurement of illuminating power and MF radiobeaconds.

Notes: S/V: Supply Vessel
A/T: Aids Tender
B/T: Buoy Tender
I/B: Inspection Boat
Y/V: Survey Vessel

4) Calculation of work load

a) B/T

Light beacons and RLB : 4 x 2 1/2 x 449 x 0.46 = 2,065.4 days

RLB Overhaul : 1/2 x 30 x 14 = 210 days

Lighted buoys : $1/2\left\{\left(\frac{454}{6} \times \frac{240 \times 2}{240}\right) + \left(\frac{454}{6} \times 5\right) + \frac{454}{3}\right\}$ = 340.4 days

Non replaced buoys : 454 x 3/8 = 170.2 days

Small buoys : 2 x 1 x 415 x 0.35 = 290.5 days

Day marks : 2 x 1 1/2 x 572 x 0.30 = 514.8 days

Total 3,591.3 days

Number of vessels required = $\frac{3,591.3}{300}$ = 11.9
≒ 12 units

b) S/V

Lighthouses : 12 x 2 x 220 x 0.34
= 1,795.2 days

Gas distribution : 2 x 14 x 5 = 140 days

Total = 1,935.2 days

Number of vessels required = $\frac{1,935.2}{300}$ = 6.4
≒ 7 units

c) A/T

Lighthouses : 12 x 2 x 220 x 0.66
= 3,484.8 days

Light beacons : 4 x 2 1/2 x 449 x 0.54
= 2,424.6 days

Lighted buoys : 4 x 1/2 x 454 = 908 days

Small buoys : 2 x 1 x 415 x 0.65
= 539.5 days

Day marks : 2 x 1 1/2 x 572 x 0.7
= 1,201.2 days

MF radio-beacons : 4 x 3 x 35 = 420 days

Racon : 4 x 1 1/2 x 31 =
186 days

Total = 9,164.1 days

Number of vessels required = $\frac{9,164.1}{300}$ = 30.5
≒ 31 units

d) I/B

Dumai: $\frac{240 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.68 \fallingdotseq 1$

Belawan: $\frac{120 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.34 \fallingdotseq 1$

Tg. Pinang: $\frac{120 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.34 \fallingdotseq 1$

Palembang: $\frac{200 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.56 \fallingdotseq 1$

Tg. Priok: $\frac{60 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.17 \fallingdotseq 1$

Surabaya: $\frac{60 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.17 \fallingdotseq 1$

Ug. Pandang: $\frac{60 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.17 \fallingdotseq 1$

Samarinda: $\frac{60 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.17 \fallingdotseq 1$

Sorong: $\frac{60 \times 2}{15 \times 24} \times \frac{365}{3} \div 240 = 0.17 \fallingdotseq 1$

Total 9 units

e) Y/V

Measurement of the light illuminating power

: 220 x (3 + 3) x 1/5 years

= 264 days

Evaluation and tests of MF radiobeacons

: 35 x (3 + 3) x 1/1 year

= 210 days

Engineering survey and other surveys

= 150 days

Total = 624 days

Number of Vessels Required = $\frac{624}{300}$ = 2.08

$\fallingdotseq$ 2 units

(5) Number of ATN Vessels Required

The number of ATN vessels required in 1988/1989, calculated based on the work load plus the utilization of four units of Survey Crafts to assist Survey Vessels and the urgency to install two more units of Pile Pontoon in Dumai and Sorong, is summarized as shown in **Table 8-1/1.**

However, the necessary of means to cope with ATN maintenance efficiently within ports limit and its vicinity for all Districts of Navigation such as workboats have not been yet calculated.

The number required in 1988/1989 has incorporated the scrapping plan in its estimation.

Table 8-1/1 Number of ATN Vessels Required in 1988/89 Based on Work Load

No.	Item / Type of Vessel	No. of Vessels			Total No. of Vessels Required in 1988/89	No. of Vessels Required to be built by 1988/89
		Existing	Scrap By 1988/89	Balance in 1988/89		
1	Buoy Tender	7	0	7	12	5
2	Supply Vessel	6	1	5	7	2
3	Aids Tender	50	27	23	31	8
4	Inspection Boat	22	22	0	9	9
5	Survey Vessel	1*	0	1	2	1
6	Survey Craft	4	0	4	4	0
7	Pile Pontoon	1	0	1	3	2
Total		91	50	41	68	27

Note: * "BIMASAKTI" belonging to Tg. Priok, built in 1984.

(6) Cost Estimation

The costs for newly building the vessels are estimated in **Table 8-1/2.**

The estimation is made on an approximate basis and based on the current cost quotation and no reference has been made to future cost escalation.

The estimation includes necessary onboard installations required for carrying out the relevant works assigned.

However, it does not include such other associated costs as training, consulting, etc.

Table 8-1/2 Cost Estimation for New Buildings of ATN Vessels

(Unit: US$ x 1,000)

No.	Type of Vessels	No. of Vessels	Unit Cost	Total Cost
1	Buoy Tender	5	6,500	32,500
2	Supply Vessel	2	5,500	11,000
3	Aids Tender	8	1,100	8,800
4	Inspection Boat	9	650	5,850
5	Survey Vessel	1	9,000	9,000
6	Pile Pontoon	2	40	80
	Total	27		67,230

8-2 Training of Personnel

8-2-1 Establishment of Training Facilities

(1) Establishment of Training Facilities

Even though there are a number of lighted aids to navigation utilizing gas for their energy source, many of harbour and coastal lights use modern types of sources like solar cell and engine generators.

Development and improvement plan for aids to navigation include the automated equipment incorporating modern electric and electronics technology into the new installations, and high technology into the improvement of existing navaids from the viewpoint of rationalization in maintenance, improvement of reliability, automated and unattended operation.

In order to cope with further development of navaids and the modernization of equipment and facilities, it is vitally important to urgently proceed with planning for the training of maintenance personnel.

The status quo of personnel currently engaging in aids to navigation in Indonesia is as given in **Table 8-2-1/1** (The personnel for ATN vessels are not included in this sub-section).

Table 8-2-1/1 Navaids Personnel in Indonesia as of End of 1980

	Number of Personnel	Remarks
Engineers & Technicians	205	19.3%
Maintenance	857	80.7%
Total	1,062	

(Source: SEATAC)

Reference may be made as shown in **Table 8-2-1/2** to the present status of navaids personnel in Japanese Maritime Safety Agency, although the classifications are different:

Table 8-2-1/2 Navaids Personnel in Japan as of April, 1984

Item / Place	Management	Administration	Engineers	Maintenance	Total
Central HQ Regional HQ	51	91	188	41	371
Navaids office	258	-	575	172	1,005
Total	309 (22.5%)	91 (6.6%)	763 (55.4%)	213 (15.5%)	1,376 (100%)

Notes:

(1) Management personnel are those who are entitled to receive the management allowance, i.e. Director Generals and Directors of Central Headquarters, Directors of Regional Headquarters, Chief of Navaids Office, etc.

(2) Administration personnel are those who are in charge of administration except those of management.

(3) Engineers are those who are qualified to be in charge of technical services like radio engineers, radio operators, etc.

(4) Maintenance personnel are those who are in charge of technical services but not qualified.

This may indicate the shortage of engineers in Indonesia. The site survey carried out by the Study Team showed that the maintenance system in Indonesia for a lighthouse manned by five personnel, for example, comprises one each for engine generator and lighting equipment and three for watch-keeping. It can be said that the sub-divided responsibility for each personnel for maintenance and operation of the navaids remotely located, where support by other personnel is immediately unavailable, may lack versatility in coping with any possible failure of lights. The routine maintenance for navaids should be carried out by the own personnel, and therefore rather all mighty capability is preferably required for each personnel.

This involves the managemental aspect of transfer and shift of personnel, who have to be located remotely or in isolated islands.

The subjects of expertise to be covered during the course of training for navaids personnel are the outline of maritime affairs, meteorology and oceanography, electrical and electronic engineering, engine generators, and navigation aids systems and equipment and their designs and construction, administration and management and so forth. As such, the areas to be covered are extensive and substantial.

It is accordingly recommended that educational facilities or training school be establilshed for the intensive training of aids to navigation experts as Japanese Maritime Safety Agency and U.S. Coast Guards have been doing so.

Introduction is made hereunder and in **APPENDIX-28** of the outline of the Maritime Safety School which is the educational facilities providing the personnel employed as MSA's officials with the expertise knowledge and training required to perform their duties in carrying out the navaids services.

The number of personnel graduated from the School is given in **Table 8-2-1/3** making reference to the total number.

Table 8-2-1/3 No. of Personnel Graduated from Maritime Safety School and the Ratio over the Total No. of Navaids Personnel, MSA as of April 1984/Aids to Navigation

	Number of Personnel	Remarks
Graduated from MS School	813	59.1%
Others	563	40.9%
Total	1,376	

The curriculum of MSA's course is given in **Table 8-2-1/5.**

Table 8-2-1/4 Assignment of Personnel Graduated from MS School as of April, 1984/Aids to Navigation

Item / Place	Manage-ment	Adminis-tration	Engineers	Main-tenance	Total
Central & Regional HQ	24	61	127	-	212
Navaids office	185	-	291	125	601
Total	209	61	418	125	813

As shown in **Table 8-2-1/4**, they have been taking important role not only in the field maintenance and operation of aids to navigation but also in planning, designing, construction and management fields.

(2) Necessity of Establishing Training Facilities

In order to cope with further introduction of electronic navigation aids systems, modernization of visual aids and the automated/unattended operation in the future, and with the resultant introduction of state-of-art equipment and facilities, training of personnel to be in charge of the maintenance and operation is in urgent need in Indonesia.

It is accordingly recommended that a training center be established in order to implement training programs of the basic theories of various equipment and systems as well as to expand the training for the field equipment operation.

It is further recommended that due consideration be given to set up educational facilities like the Maritime

Safety School introduced above, and that the center be organizationally incorporated into the school at the time of its establishment to provide the two different levels of courses, i.e. the main course which educates and trains key personnel in the navaids services, and the equipment training course which provides the knowledges required for newly deployed hardwares.

(3) Ranking System

General reference is made in **Fig. 8-2-1** to the ranking system applied in the Maritime Safety Agency for the personnel who graduated from the navigation aids course of Maritime Safety School and are now in charge of the services.

It can no doubt be said that there are cases where the actual situations may differ from the quoted case due to the individuals' capabilities. However, as they acquire the expertise experiences, access is open for them to be in charge of the planning field at the Central and Regional Headquarters.

The training for aids to navigation personnel in the U.S. Coast Guard is annexed in **APPENDIX-20.**

Table 8-2-1/5 Curriculum for Aids to Navigation Course
Maritime Safety School

Subjects	Hours
Laws and Regulations	20
Maritime Safety	10
Outline of Navaids Services	10
Maritime Affairs	55
English Language	80
Human Sociology	120
Mathematics	120
Physics	60
Chemistry	20
Engine	100
Electronics	750
Radio Engineering	400
Radio Operation	120
Navaids Equipment	540
Management for Navaids	120
Experiment	265
Training	175
Meteorology/Oceanography	40
Total	3,015

Qualification etc.

2nd Class Radio Engineer Certificate
4th Class Ship Licence
Driving Licence

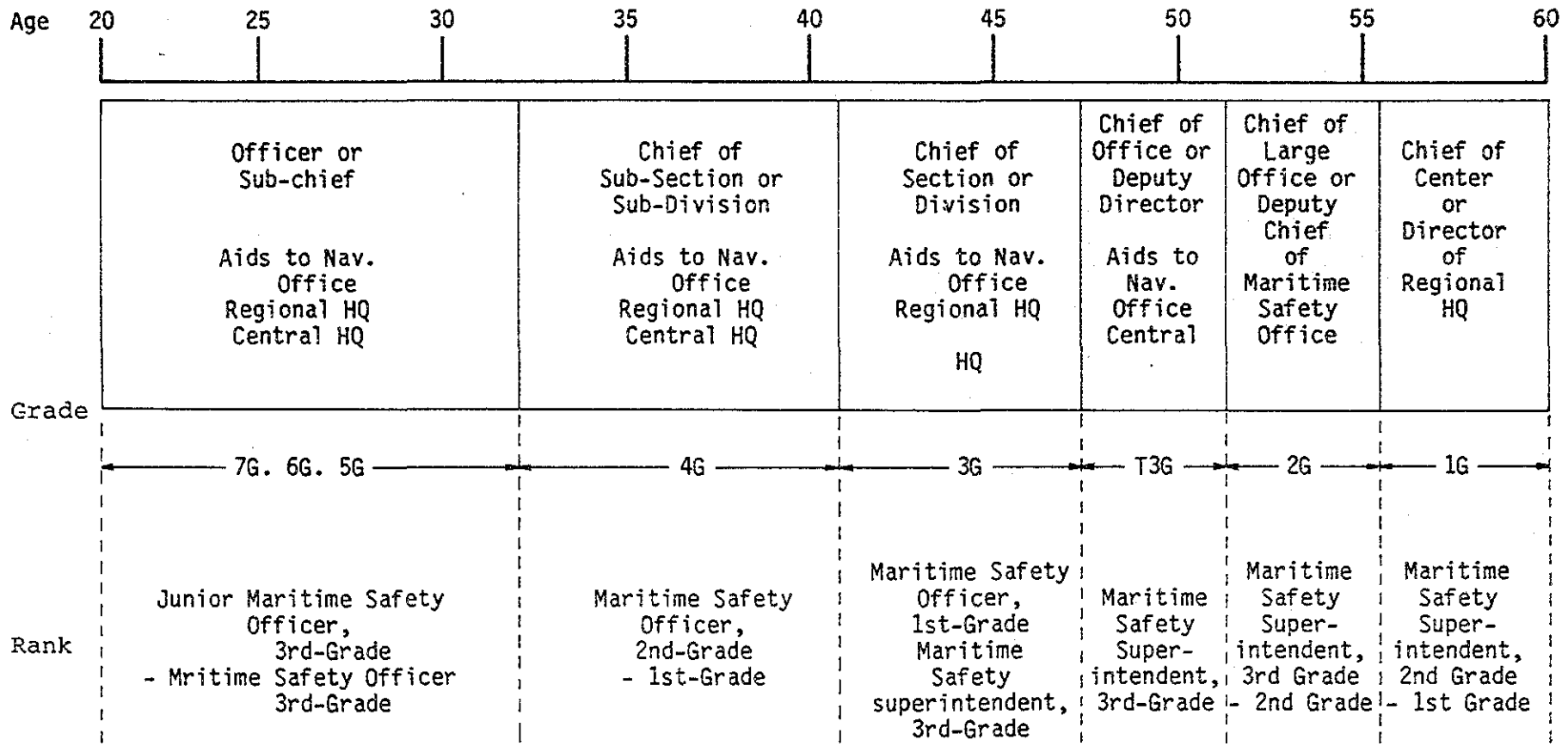


Fig. 8-2-1 Ranking System/Assignment Model of Personnel Graduated from Maritime Safety School (Aids to Navigation)

8-2-2 Training of Personnel

In order to satisfy the personnel requirements of the total number of 611 (excluding ships' crew) needed for the maintenance of aids to navigation to be developed by 1988/89 (ref. **Table 7-2/1**), the minimum number of about 60 personnel should be provided training courses every year.

To cope with the personnel demands at least on a provisional basis, it is necessary to carry out appropriate training providing trainees with technical knowledge on the basic and practical theories required for operation and maintenance of aids to navigation, in addition to efficient running of the training courses currently available in DGSC.

Modern types of aids to navigation including visual aids use rather high technology of electronics these days, and it may, therefore, be suggested that new employment be made for those graduated from radio engineering schools.

It is also recommended appropriate arrangements be made that the personnel currently in service be given proper opportunities of acquiring necessary qualifications and relevant certificates.

(1) Overseas training

Overseas training is to be carried out for DGSG personnel at appropriate facilities available overseas.

Those who will receive the training will engage in the maintenance and operation of equipment as well as in the planning and management field in future, and also transfer their expertise knowledge acquired to other personnel at field after they return to the country. Some of those who will have completed the overseas training will be instructors at the training establishments.

i) Training period: 3 months

ii) Subjects of training:
- Basic Theory
- Aids to Navigation Systems
- Planning of Aids to Navigation
- Management of Aids to Navigation
- Maintenance and Operation of Aids to Navigation
- Maritime Affairs

iii) Number of trainees

(a) Visual aids to navigation

From Districts of Navigation:
2 persons x 24 units = 48 persons
Those who will be instructors for domestic training at training center: 2 persons

(b) Electronic aids to navigation

From Districts of Navigation:
2 persons x 24 units = 48 persons

Those who will be instructors for domestic training at training center: 2 persons

iv) Cost Estimation for Overseas Training

Table 8-2-2 Cost Estimation for Overseas Training

(Unit: US$)

	Unit Cost	Visual Aids		Electronic Aids		Total
		Qty	Cost	Qty	Cost	
Return Air Fare (JKT-TKO)	(¥353,300) $1,536	48P x	73,728	48P x	73,728	147,456
Daily Allowance & Accommodation	(¥ 20,000) $ 87	48P x 90 days	375,840	48P x 90 days	375,840	751,680
Domestic Travelling Fee	(¥100,000) $ 435	48 P	20,880	48 P	20,880	41,760
Training Texts and Materials	(¥100,000) $ 435	48P	20,880	48P	20,880	41,760
Instructor's Fee	(¥ 60,000) $ 260	2P x 90 days	46,800	2P x 90 days	46,800	93,600
Total			538,128		538,128	1,076,256

(2) Domestic training

The training courses for ATN personnel currently available in DGSC are as described in Section 2-3-4.

The personnel who will participate in the training courses for maintenance and operation of new systems and establishment of navaids should preferably be those who will have completed the ATN technician course and radio officer course.

- Visual aids to navigation course

  Number of trainees: 10
  Period of training: 3 months
  Subjects of training: To be in conformity with **Fig. 8-2-2/1**

- Electronic aids to navigation course

  Number of trainees: 10
  Period of training: 3 months
  Subjects of training: To be in conformity with **Fig. 8-2-2/2**

The instruction materials should include a complete set of equipment, measuring instruments, receivers and other necessary items.

Table 8-2-2/1 Curriculum for Visual Aids Training Course

1)	Aids to navigation and outline of equipment and devices	70 hours
2)	Theory and practice of control unit for lighting equipment	80 hours
3)	Theory and practice of batteries (lead and air)	24 hours
4)	Theory and practice of solar cells	12 hours
5)	Theory and practice of wave activated generator	12 hours
6)	Theory and practice of automatic control equipment	62 hours
7)	Theory and practice of engine generator	20 hours
8)	Theory and practice of buoy mooring	20 hours
	Total	300 hours (including 230 hours for factory training)

Table 8-2-2/2 Curriculum for Electronic Aids to Navigation

1)	Electronic aids to navigation and outline of equipment	60 hours
2)	Medium-wave radiobeacon equipment - Theory and practice on equipment -	70 "
3)	Radar beacon equipment - Theory and practice on equipment -	40 "
4)	Remote control and monitoring equipment - Theory and practice on equipment -	50 "
5)	Power supply equipment	40 "
6)	Trouble shooting	30 "
7)	Evaluation tests	10 "
	Total	300 hours

(3) At-Site Training by Technical Experts from Overseas

In order to carry out successful operation and maintenance of the navaids systems contained in this study, it is advisable that at-site training be provided by technical experts from overseas for the navaids personnel to engage in the services, immediately after their implementation, concerning the expertise on field adjustment, checking and maintenance procedures of the systems and equipment to be newly introduced.

This kind of supplementary expertise training will be extremely useful to convince the navaids personnel at sites with their technical and operational skills.

The technical experts from overseas may also be instructors for domestic training courses when required.

a) Number of technical experts : 2 consisting of 1 each for visual and for electronic navaids.

b) Period of despatch : 1 year each

c) Training items : Equipment configuration
Practical field maintenance for facilities and equipment
Field measurements and adjustment

8-2-3 Training for Crew of Aids to Navigation Service Vessels

In order to carry out the maintenance service safely and efficiently, it is necessary for crew onboard aids to navigation service vessels to be familiar with the navaids service, and to endeavour to acquire technical skills and general knowledge on aids to navigation as a whole.

Since they engage in the installation, maintenance and repair works onboard buoy tenders for buoys, and onboard inspection boats and aids tenders for such works as replacement of batteries, gas cylinders and so on.

For this purpose, navaids training should be carried out at an appropriate time not only for newly recruited personnel but also for the crew.

The training items will be as follows:

(1) Training for navaids in general

(a) Type of navaids and their operational functions

(b) Type of light and energy sources, and lighting device, and their features

(c) Maintenance setup for navaids

(d) Outline of logistic support, buoy laying, itinerary maintenance

(e) Mechanical structure and performances of at-sea navaids, and influence thereupon by meteorological and oceanographic conditions.

(2) Field training

(a) Bearing measurement, positioning

(b) Crane operation, replacement of buoys and gas cylinders

(c) Welding and cutting of iron materials and structures

The training method and materials required are as given below:

(A) Training method

Training for navaids in general:

This training will be carried out at 1st Class Districts of Navigation both by the experts from relevant KANWIL and by skilled personnel from the Districts of Navigation.

Field training:

The field training will be carried out at 1st Class Districts of Navigation by skilled experts from aids to navigation service vessels and buoy bases.

(B) Training materials

The training materials, main items of which are given below, are to be made available from the spares held and workshop installations of Districts of Navigation.

Lighting equipment, various types
Energy source equipment, various types
Sextant and compass

Electronic positioning equipment
Cranes
Buoys
Welding machines, cutters
Other necessary devices and materials.

8-2-4 Relations with Personnel Training Facilities to be Developed in Future

It is most desirable that educational and training facilities will be established in future for the personnel who will engage in the maintenance and operation of aids to navigation, covering the extensive areas concerned.

When the educational and training facilities will have been established, the various training courses previously stated will be incorporated into the facilities.

8-3 Management, Maintenance and Operation of Aids to Navigation

8-3-1 Present Status of Aids to Navigation

Among the visual aids to navigation currently in service, lighthouses are generally in good service conditions while a number of such troubles as lights-off, destructions, drift away, etc. are seen in light beacons, lighted buoys and unlighted buoys.

The major causes of those troubles may be:

a) Shortage of supply of spares
b) Lack of maintenance due to long interval (six months) of itinerary maintenance.
c) Prolongment of scheduled maintenance period due to the wide service coverage allocated to each District of Navigation.
d) Insufficient maneuverability of ATN vessels due to their old age.
e) Shortage of supply of acetylene gas.

Any troubles and malfunctions of aids to navigation may cause serious consequences directly involving possible loss of life and property at sea. Earliest possible recovery of troubles falls in the prime responsibility of ATN personnel.

The electronic aids to navigation in Indonesia are still in the initial implementation stage. However, the same principle of maintenance approach applies in order to secure the operational performances and reliability and to provide users with the adequate services as aids to navigation.

Following proposes consideration for the countermea-

sures preventing occurrence of troubles and the achievement of their earliest possible recovery.

8-3-2 Suggestions on Reinforcement and Improvement of Management and Operation Setup

(1) Establishment of Maintenance/Checking Standards and Spares

1) Maintenance standards for equipment and facilities (standards for scheduled and emergency maintenance and checking) should be established.

2) Checking standards for individual equipment (Detailed checking and operational procedures for individual equipment) should be established.

3) Supply of Spares

The locally procurable spares and power sources required for maintaining the operational performances of visual aids to navigation should always be kept in ex-stock at Districts of Navigation, and a centralized system of procurement and supply should be implemented for the imported materials and other main items of spares.

For the execution of repairs and scheduled maintenance, each District of Navigation should be equipped with a complete set of measuring and checking instruments and test benches to be ready for carrying out immediate recovery of failures.

a) Establishment of standards for spares stock

Number of standard spares is to be decided taking into account the trouble occurrence rate for individual power sources, equipment, and parts and components as well as the period

required for their procurement. Standards for supply of spares should be established.

b) Supply of Spares

Scheduled supply of spares is to be carried out to meet the established number of spares to be kept at Districts of Navigation. Especially, the supply of gas and other power sources, which may directly involve serious marine casualties, should be dealt with the highest priority.

c) Spare equipment

The existing workshop facilities of Districts of Navigation should be expanded in both capability and performances to have installations of spare sets of the main equipment and units to be in use in their respective territories so that necessary repairs and adjustment may be carried out.

This will overcome emergency troubles and increase the reliability of aids to navigation.

4) Instruction manuals for equipment and facilities (acquiring technical knowledge on operational principle, structures and performance of each equipment, as well as on operational procedures) should be prepared.

For this purpose, following should be made:

i) Records of checking made for individual aids to navigation (scheduled replacement of tear and wear items, arrangements for maintaining continuity of periodical scheduled maintenance and checking).

ii) Records of trouble occurrence and analysis thereof (countermeasures for trouble recovery and prevention of troubles).

(2) Shortening in itinerary maintenance intervals

The scheduled maintenance interval currently in practice for visual aids is every six months, which is insufficient to maintain the operational performances of aids to navigation and their equipment and facilities.

There is necessity to establish shortened maintenance intervals taking due consideration of type of navaids and power sources, important spare parts, maritime traffic and other relevant factors. However, a three months interval is aimed at being achieved for the time being. This will solidify the maintenance services for ATN equipment and may bring about decrease in number of marine accidents.

Emergency maintenance should also be conducted for immediate recovery in case of such serious troubles as lights off, etc.

(3) Improvement in Organizational Setup and Facilities installed at Districts of Navigation

The service coverages currently implemented are considerably wide and need to reinforce the existing setup through establishment of additional field units since adequate services may not be carried out due to various restrictions put on maneuverability of vessels and vehicles and to environmental conditions as well.

Necessity has been realized during the field and site surveys to establish 3rd Class Districts of Navigation as proposed in Section 7-1, and no doubt, to reinforce and improve the existing facilities installed at Districts of Navigation.

(4) Arrangement for monitoring of aids to navigation

It presently takes a few weeks for the Districts of Navigation concerned to find out occurrence of failures and troubles occurred on ATN. It is obviously a great problem from the viewpoints of earliest recovery and issuing notices to mariner to that effect.
Arrangement for monitoring navaids should be made through the following approaches as a step to take for the resolution of problems.

1) Watch by inspection boat

Reinforcement needs to be made in carrying out watch for operational functions of aids to navigation installed in important ports, straits and narrow channels. Especially, shift in position or drift away of buoys and such accidents must be found as soon as possible, and necessary countermeasures should be taken within the shortest possible time for earliest recovery.

For this purpose, the Districts of Navigation covering these areas will be equipped with Inspection Boats to perform regular watch over the navaids.

2) Local assistants to lighthouse keepers

a) Visual aids visible from onshore

Civil servants or inhabitants locally live in the vicinity of navaids will be appointed as assistants to lighthouse keepers to carry out the daily check-ups of lights, and immediate report is to be made to the Districts of Navigation concerned in case of troubles by telephone or such. The assistants are to be paid.

b) Notices from ships at sea

The daily users of navaids like shipping and fishing sectors are to instantly report on any troubles of navaids to the Districts of Navigation concerned through coastal radio stations.

3) Alarming devices

Alarming devices should be fitted on navaids installed at ports and other places so that their operating status may be remotely monitored.

8-4 Distribution Plan for Medium-wave Radiobeacon Receivers

8-4-1 General

The advantages that users may obtain from the use of medium-wave radiobeacons are the positioning of their vessels and thus efficient navigation directing to their destinations. Also the use of radiobeacon will lead the users to avoid such dangerous points as sunken reef, etc. and other hazardous areas.
Fishermen may also have other advantages of directing straight to fishing grounds and of recording the rich fishing grounds on charts, which enables them to have repeatability for efficient fishing operations. These will attract users in a way of their potential use of radiobeacons, which will bring about some economical benefit.

8-4-2 Distribution Plan and Method

(1) Subsidiary system

Comparatively small types of vessels, for which economical burden is considered somewhat to be high, should be subsidized for their purchase of the receivers from the standpoints of prevention of marine accidents and activation of fishery.
It is, therefore, advisable that a subsidizing or loan system be adopted for possible expansion of users.

(2) Propaganda and its method

Propaganda activities for cultivating potential users should be carried out through such organized user bodies as shipowners association, fishery association, etc.
The following may need to be practiced.

1) Preparation of leaflet

Leaflets should be prepared describing the advantages of radiobeacon, how to use, receiver price (including subsidizing amount), service coverages including future expansion plans and contacts at the time of troubles for their distribution to potential users through various associations and bodies.
Training courses should also held.

2) Propaganda by visual means

Photo slides should be prepared detailing with the use of radiobeacon receiver for free distribution to various associations and bodies, which will provide potential users with opportunities of being aware of the effectiveness of radiobeacon.

(3) Systematic propaganda

Propaganda for possible user expansion needs to be carried out systematically through the existing organization of DGSC; i.e. Districts of Navigation, through which various bodies concerned with maritime activities are notified of necessary aspects of both use and maintenance.
Feed-back may also become possible for users in case of receiver troubles, and thus users may be free from psychological unrest.

9. OTHERS

9. Others

9-1 Matters Concerned

9-1-1 Maritime Occupational Health

The necessity of establishing healthy working conditions is the very basic and fundamental requirements, especially in such risky and hazardous environments as isolated islands, on board ships and so on.
The present status and future programs of the Sub Directorate of Maritime Occupational Health, responsible for maritime health sector, are described. The existing system in this sector in the Maritime Safety Agency, Department of Japanese Government is also described for reference as their working environments may fall into similar classification.

(1) Sub Directorate of Maritime Occupational Health

1) General

a) In the Directorate General of Sea Communication, the Directorate of Navigation has the largest number of personnel and the scope of work in the field of navigation has the most and diversification.

Realizing the geographical position and the social standards in Indonesia, especially in the sub sector of the Sea Communication, needs exist for safety of navigation for sea traffic. Many working locations are isolated places and very risky too, such as lighthouses, ships, radio stations, gas plants, etc. All those hazardous tasks in isolated locations must be done by personnel with certain qualifications.

It is hoped that the duties in those risky and isolated locations will be done in a good manner and continuously. This situation requires the necessity of healthy personnel as well as healthy working environments, and this makes the role of the Maritime Occupational Health (MOH) very important.

b) The scope of MOH

1). To ensure personnel with certain health qualifications.

2). To provide standards for an acceptable working environment according to regulations concerning safety and health.

c) The purpose of MOH

1). To select personnel according to certain criterion of Physical Health and Psychological means.

2). To provide measures for protection of personnel working in the field of navigation such as safe working conditions, excessive noise, dust, isolation, etc.

2) Job Specification

Job specification for the field of navigation, consisting of: sea farers; lighthouse watchmen; marconists; people working in the gas plant and dockyards, should be regarded as guidance to recommend certain procedures and programmes to accommodate 1) b) and c) above.

3) Mission of Sub Directorate of MOH

a) To compile all kinds of regulations and regulations concerning safety and health especially occupational health which can be implemented in the field of navigation. If need be, new regulations have to be introduced.

b) To prevent the occurrence of hazardous exposures which might injure the personnel.

c) Giving counselling and health education.

d) Giving first aid to minimize disability.

e) Giving instructions pertaining to safety, sanitation and working environment.

f) Maintaining all medical records of personnel working in the field of navigation.

g) Checking regularly, to detect at an early stage all kinds of stress producing agents which must be controlled effectively (survey of working environment).

4) Facilities

At this moment, there is one Occupational Health Laboratory under construction in Jakarta, which is planned to be ready in mid-1985. To be able to develop and expand necessary establishments, plans should be made so as for each 1st Class District of Navigation to have an Occupational Health Laboratory.
Present status of the Laboratory facilities and some test facilities is given **APPENDIX-30.**

5) Programmes

a) To set up an Occupational Medical Center or a Laboratory to back up all kinds of investigation pertaining to the health of personnel, the working environment, to measure all kinds of hazardous agents.

b) The Laboratory should be able to fulfill the mission of Sub Directorate of MOH. Therefore all kinds of up-to-date and sophisticated equipment should be obtained (Measuring and Diagnostic instruments).

c) To recruit and train personnel (Medical, Paramedical and Administration) to manage and utilize the Laboratory optimally.

d) To set up modus operandi to stimulate and promote people working in the MOH, so that they will be motivated to do their utmost (material /financial/incentives have to be considered).

e) To set up programmes, to check the health of the personnel regularly and to treat and cure personnel who suffer from occupational deseases.

f) To synchronize the working programmes of the Laboratory with the needs arise due to the advancement of technology in the field of navigation.

g) During service, to monitor and evaluate the work being done by MOH and a good system in reporting.

h) Research to obtain a better system in organizing the health and safety activities.

The Develipment Plan of Maritime Occupational Health Laboratory is given in **APPENDIX-31.**

6) Assessment and Evaluation

Criterion for assessment and standardization for evaluation must be made, so that progress in working out the Mission of MOH can be measured.

(2) Health and Security Arrangement in Maritime Safety Agency

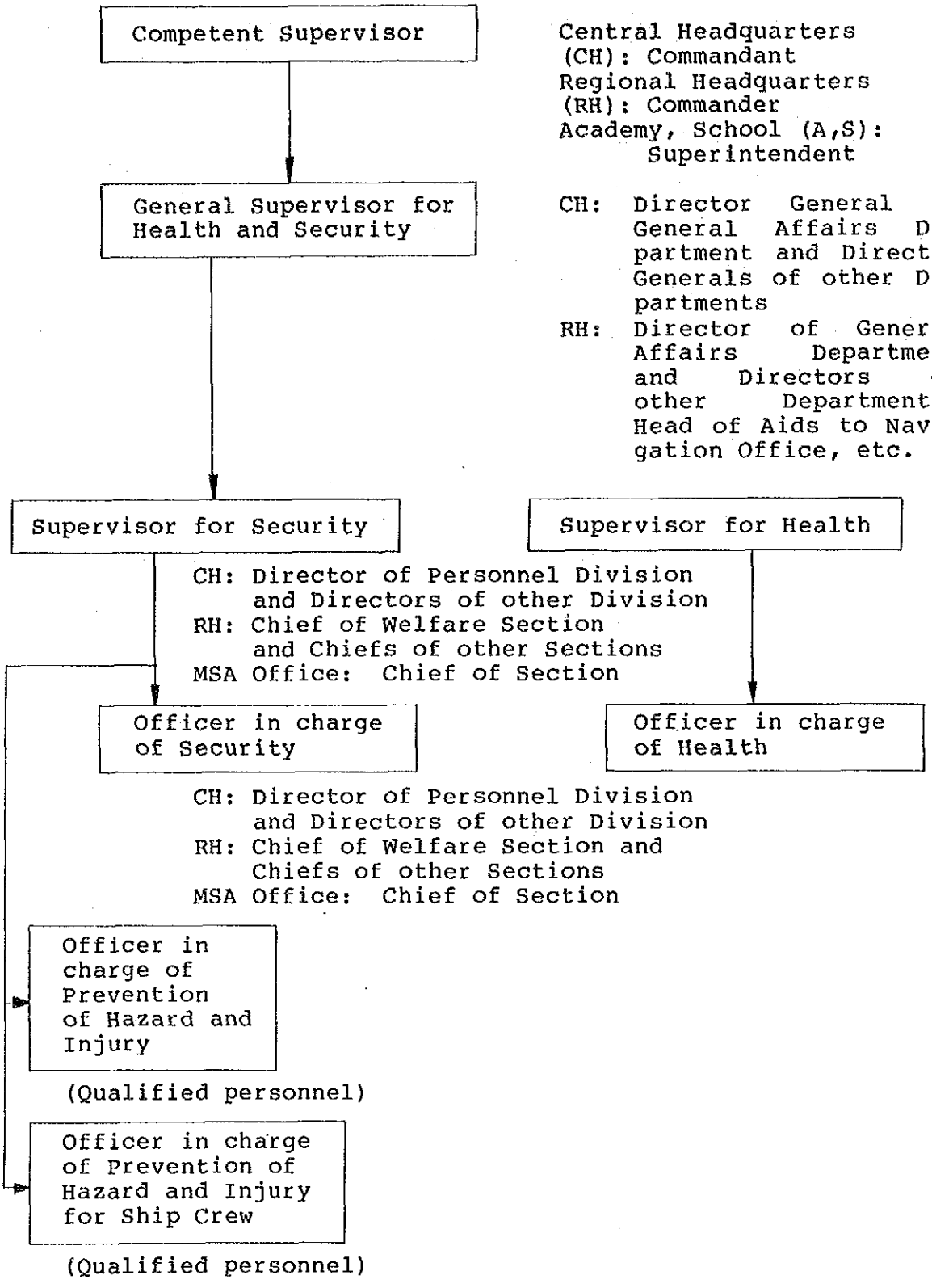
1) General

The National Public Service Law provides its basis for health of the national public service personnel, and the National Personnel Authority, which is responsible for work conditions and for improvement of personnel administration, enacts the provisions as given below:

- Personnel insurance and holding of their security
- Preventing personnel for radioactivity casualties
- Basic standards for personnel recreation
- Health and welfare for female and juvenile personnel
- Special provisions for health and security of ship crew

With regard to the personnel with the Maritime Safety Agency, the Maritime Safety Agency Health and Security Regulations are applied supplementing the National Personnel Authority Regulations more in detail and practicality, in addition to the laws and regulations stated above.

Summary of the regulations applied to MSA personnel is given hereunder.


Competent Supervisor
Central Headquarters (CH): Commandant
Regional Headquarters (RH): Commander
Academy, School (A,S): Superintendent
General Supervisor for Health and Security
CH: Director General of General Affairs Department and Director Generals of other Departments
RH: Director of General Affairs Department and Directors of other Departments, Head of Aids to Navigation Office, etc.
Supervisor for Security
Supervisor for Health
CH: Director of Personnel Division and Directors of other Division
RH: Chief of Welfare Section and Chiefs of other Sections
MSA Office: Chief of Section
Officer in charge of Security
Officer in charge of Health
CH: Director of Personnel Division and Directors of other Division
RH: Chief of Welfare Section and Chiefs of other Sections
MSA Office: Chief of Section
Officer in charge of Prevention of Hazard and Injury
(Qualified personnel)
Officer in charge of Prevention of Hazard and Injury for Ship Crew
(Qualified personnel)

2) Summary of Health and Security Arrangement for MSA personnel

a) Administrative arrangement for health and security

The administrative arrangement for health and security of the Maritime Safety Agency personnel is as shown below:

b) Health and Security Officer in charge of Field Experiments

Health Officer or Security Officer is specifically appointed in case of execution of field experiments in which more than 10 personnel in a group deal with explosive items, or poisonous gas may be produced, and as such.

c) Health Doctor

In order to provide guidance for health, a medical doctor is appointed as Health Doctor each for the Central and Regional Headquarters Maritime Safety Academy and other local organizations as well as MSA's vessels.

d) Chief Officer in Charge of Prevention of Danger

The Commandant shall provide security measures through appointment of Chief Officer for Prevention of Danger, who has acquired the expertise knowledge and skill, at workshops, with which a certain level of capacities of boilers, compressed vessels and such danagerous devices are equipped.

e) Officer in Charge of Fire Prevention

The Commandant shall appoint an Officer in

Charge of Fire Prevention for each unit of establishments.

f) Health Security Conference

The General Supervisors for Health and Security shall convene at least one conference every year to exchange views with the personnel within each organization in order to secure their health and to promote their welfare.

g) Health Education

The Commandant shall provide necessary health education to the personnel upon their employment.

3) Summary of Standards for Maintaining Health

The detailed standards are defined for maintaining health of the personnel. Following are their summary.

a) Work Environment

The Commandant shall take necessary measures for ventilation, illumination, temperature and moisture control, cleaning, prevention of contagious disease, and so on in the offices and other working environment.

b) Hazardous Services

The Commandant shall take necessary measures for protecting the personnel, engaged in certain hazardous services (places where lead, mercury, noise and other hazardous environment are to be produced, and services dealing with hazardous chemical substances), from any harms to their health.

c) Limitation in Continuous Works

The Commandant shall take necessary measures in limiting the uninterrupted continuous operation for diving and other works, which may be hazardous to personnel health.

d) Consideration for Middle-to-old-aged Personnel

The Commandant shall pay consideration to both physical and mental health of middle-to-old aged personnel, especially to those who require special attention in maintaining their health, at the time of allocating their tasks.

e) Medical Examination

The Commandant shall carry out physical examination by medical doctor for the personnel upon their employment, and for those who are to engage in the tasks dealing with lead, mercury and other hazardous substances. In the latter case, certain checking items shall be examined.

f) Health Check-up

i) Regular Health Check-up
The Commandant shall carry out health check-up once a year for general external examination, respiratory organ, circulation system, digestive organ, liver, etc.

ii) Special Regular Health Check-up
The personnel who engage in the work possibly involving radio-activity, diving and other tasks dealing with hazardous substances shall have special health check-up either every 3 months, 6 months, or once a year depending on the kind of work engaged.

iii) Close Medical Examination

The personnel who are found to have some physical abnormalities in the Regular and Special Regular health Check-ups shall receive close medical examination.

iv) Provisional Medical Examination

The Health Officer shall carry out, when necessary, provisional medical examination for those who suffer acute toxicosis by gas, etc.

g) Measures to be Taken when Physical Abnormality Found

Those who are found to have been affected shall submit medical certificates issued by doctors to the Health Officer, who shall carry out provisional physical examination, when necessary. The findings shall be reported to the supervisor through the General Health Supervisor.

h) Decision of Guidance

For those who are found to have been affected in health check-ups, guidance on living for daily life shall be decided by medical doctor in accordance with the pre-determined class from the view point of restrictions on daily life and medical treatment.

i) After-treatment

The Commandant shall take necessary measures for after-treatment according to the decision of guidance in allowing holidays, medical treatment by temporary leave, change of duty place, etc.

j) Records of Health

The Commandant shall prepare the records of health for individual personnel, when their necessity is found from the view point of maintaining their health, and shall make use of them as appropriate.

k) Submission of Result of Health Check-up

The Commandant shall report the result of health check-up for the personnel to the National Personnel Authority once a year.

4) Summary of Standards for Security

The detailed standards are defined for the security of personnel. Following are the summary:

a) Prevention of Danger

The Commandant shall take necessary measures as defined by the National Personnel Authority for prevention of hazards on the personnel to be possibly caused by the following dangers:

i) Dangers by machines, devices and such other installations
ii) Dangers by explosives, inflammables, ignitable items, and such
iii) Dangers by electricity, heat and other energy sources
iv) Dangers caused by works method in drilling, quarrying, etc.
v) Dangers in high places where possibility exists in crashing.

b) Emergency Situations

The Commandant shall take necessary measures of

suspending works, evacuation of personnel and so on in the face of imminent dangers against the personnel. He shall also prepare necessary facilities for facilitating such measures, and carry out necessary training for the personnel.

c) Personnel Engaged in Works with Danger

The Commandant shall not allow his personnel to engage in such works with danger as operation of boilers, cranes and construction machines of a certain level or over, and of installations and equipment with danger, unless they are qualified by the provisions of certificates defined by the National Personnel Authority.
The Commandant shall not allow his personnel to engage in the operation of equipment and facilities with danger having a certain level or less, unless they have had the special training for prevention of hazards defined by the National Personnel Authority.

d) Restrictions in Use of Facilities and Equipment

The Commandant shall not allow personnel to operate such facilities and equipment as boilers, cranes, diving equipment, etc. unless they meet the condition specified by the National Personnel Authority.

e) Inspection of Facilities and Equipment

The Commandant shall carry out installation, modification, performance and regular inspections for such installations, equipment as boilers, cranes, etc. having a certain level or higher standards, and a regular inspection for facilities of a certain level or less standards.

f) Notification on Facilities

The Commandant shall notify the National Personnel Authority of the installation of such facilities as boilers having a certain level or higher standards when they are installed.

g) Report on Hazards

The Commandant shall report to the National Personnel Authority on the following when they occur in the duty places.

i) Hazards caused personnel death
ii) Hazards caused injuries, suffocation, acute toxicosis of 3 or more personnel due to the same causes.
iii) Serious accidents of fire, explosion of boiler, etc.

5) Summary of Prevention of Radioactive Hazards

For the prevention of radioactive hazards on personnel, necessary provisions are defined for the following:

- Type, intensity and quantity of radioactive
- Limitation in allowance of radioactive influence
- Standards for facilities
- Prevention measures
- Labelling of danger
- Xray equipment room
- Alarming device
- Regular inspection for equipment
- Off limit
- Protection device and work clothes
- Medical examination

6) Summary of Standards for Personnel's Recreation

For the purposes of restoring vitality of personnel of promoting their mutual closeness and of improving work efficiency through their healthy activities in culture, refinement, sport, etc., relevant provisions are defined on the standards for practice, conduct of various activities within duty hours and so on.

7) Summary of Health, Security and Welfare Arrangement for Female and Jevenile Personnel

Special provisions are defined on the health, security and welfare for female personnel of 18 years old or older and jevenile personnel of younger than 18 years old, referring to the following:

- Restriction on employment for dangerous and hazardous works
- Restriction on mid-night work
- Restriction on work during off duty hours
- Restriction on work during catamenia
- Restriction on work during pregnancy and after delivery
- Allowance for nurture
- Particular provisions for ship crew

Note: Some exclusions are made by MSA for the female personnel upon necessity and as appropriate.

8) Summary of Particular Provisions for Ship Crew

a) Medical Doctor On board

The Commandant shall make the ships, exceeding a certain level of tonnage and number of crew and having defined operation areas, have medical doctors on board.

b) Chief Officer in Charge of Prevention of Danger on Crew

The Commandant shall designate a Chief Officer in Charge of Prevention of Danger on Crew, a crew member who has the expertise knowledge and skill, for specific dangerous tasks to be carried out on board, and shall let him perform the task of prevention of danger.

c) Necessary Measures for Experiments

The Commandant shall request leaders of such teams as the experiments, surveys, observations etc. to be carried out on board MSA ships to take necessary measures for arranging their methods, when necessity exists for prevention of hazards to health or of danger.

d) Medical Supplies

The Commandant shall furnish MSA ships with necessary medical supplies.

e) Prevention of Epidemics

The Commandant shall take such necessary measures as preventive injection for the prevention of epidemics.

f) Suspension of Work

The Commandant shall not allow the personnel,

who suffer from epidemics, possess virus of epidemics, or suffer from psychological disease, to work, if it would be considered necessary to prevent other crew from being contagious or from danger.

g) Hazardous Works

The Commandant shall take necessary measures to prevent the personnel from any hazards for their health in such hazardous works as welding etc. to be carried out on board vessels.

h) Personnel Engaging in Dangerous Works

The Commandant shall allow only crew who have specific certificates, qualifications and such to work for such dangerous works as boiler operation, etc.

9) Others

The Maritime Safety Agency has also established the criteria, procedures provisions as given below for detailed execution of health arrangement for the personnel, in addition to the above regulations.

a) Criteria for Appointment of Chief Officer in Charge of Prevention of Danger and Chief Officer in Charge of Prevention of Danger on Crew

Details of service, tasks are defined together with necessary qualifications, certificates, etc.

b) Maintenance and Operation Procedures for Navaids Service Vehicles

Procedures for operation, maintenance and

checking as well as matters of safety are defined for vehicles to be used for maintenance of navaids facilities.

c) Work Procedures for Buoy Tender Operation

Details are defined on procedures for efficient execution of works by buoy tenders and for prevention of hazards to be possibly caused by buoying works.

d) Others

The matters concerned with safety are defined as part of the work procedures for the rescue operations, patrol vessels, special rescue units, diving works, etc.

APPENDICES

CONTENTS OF APPENDICES

APPENDIX-1

LOCAL OFFICES AND FACILITIES VISITED BY THE FIELD AND SITE SURVEY GROUPS

LOCAL OFFICES, FACILITIES, SITES AND OTHER PLACES VISITED BY THE FIELD AND SITE SURVEY GROUPS.

Notes :

KANWIL : Regional Sea Communication
LH : Lighthouse
LB : Light Beacon
MF : Medium-Wave Radiobeacon
(Ref. 1. Short Term Development Plan for Aids to Navigation and Maritime Telecommunications System, August 1983, Directorate General of Sea Communication
2. Medium-wave Radio Beacon Stations, (F-ST-3C, Directorate General of Sea Communication)

Marked * : Additional sites surveyed as alternatives under the own judgement of the survey groups.

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
I	Jakarta Coastal Radio Station Gas Plant "Cilincing"			
	Surabaya KANWIL IV Coastal Radio Station			
	B e n o a District Navigasi Port Administration		Bukit Badung Tg. Sedihing, MF(No.10)	
	Lembar Port Administration Coastal Radio Station	Ampenan LH		
		Petagan LB	Tg. Pandanan Pulau Trewangan	
	Badas Harbour Master	Pulan Medang LB		
	S a p e Harbour Master			
		Kelapa LH		
				Bajo Port

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
I	R e o Harbour Master		Toro Besi (*)	
	Maumere Harbour Master Coastal Radio Station			
	Banjarmasin KANWIL V Port Administration Harbour Master District Navigasi	Tg. Selatan LH	Tg. Selatan, MF(No.9)	
	Balikpapan District Navigasi Port Administration Harbour Master Coastal Radio Station		Muara Manggar Tg. Jumalai, MF(No.11)	
	Samarinda District Navigasi Coastal Radio Station Harbour Master Port Administration			
	Cirebon Harbour Master District Navigasi Port Administration			

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
II	Jakarta District Navigasi Work Shop Buoy Base	Tg. Layar LH Serdang LH (Under Construction) Tikus LH	Ujung Kulon, MF(No.20)	
	Bengkulu harbour Master		Bengkulu MF(No.44)	
	Teluk Bayur Harbour Master District Navigasi Port Administration Coastal Radio Station Work Shop		Tuapejat MF(No.43)	
	Sibolga District Navigasi Port Administration Coastal Radio Station Work Shop	Sei Bramei LH Ujung Karang LH		
	Meulaboh Port Administration	Ujung Kareung LB	Meulaboh MF(No.42)	
	Sabang Harbour Master District Navigasi Port Administration Coastal Radio Station Work Shop	Ie'Meule LH	Ie'Meule MF(No.1)	

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
II	Belawan District Navigasi Port Administration Harbour Master Coastal Radio Station Work Shop Buoy Base	Nipa Larangan LH	Nipa Larangan MF(No.47) Peureuga LH	
	Medan Kanwil I			
	Dumai Kanwil II District Navigasi Port Administration Coastal Radio Station Work Shop Buoy Base	Tg. Medang LH Tg. parit LH (Under Constraction)	Tg. Medang MF(No.48)	
	Tg. Balai Harbour Master	Tg. Rambut LH (Under Construction)	Tg. Rambut MF(No.49)	
	Tg. Pinang District Navigasi Port Administration Harbour Master			

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
III	Surabaya KANWIL IV District Navigasi Coastal Radio Station Work Shop, (Buoy Base) Harbour Master Pilot Station in Jamuang Is	Jamuang LH	Jamuang MF(No.8)	
	Masalembo Harbour Master	Masalembo LH		
	Samarinda		Ambo LH	
	Ujung Pandang KANWIL VI District Navigasi Harbour Master		P. Sahara LH Dewakang Besar (MF.14) Janeponto LH Tg. Lasa MF (No.22) Tg. BUlobulo LH (Alternative site; Janeponto)	
	U. Pandang Work Shop Coastal Radio Station		Kabaena LH Wangi Wangi MF(No.23)	
	Kendari		Wawoni LH	
	Pare-pare Harbour Master Port Authority			Pare-pare Port

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
III	Semarang District Navigasi Work Shop Coastal Radio Station	Mandalika LH Menara Suar LH	Mandalika MF (No.6)	Pulse 8 Station JPC-EXAKTA Semarang port
	Cilacap Distric Navigasi Work Shop Coastal Radio Station (TX STN)	Cimiling LH	Cimiling MF(No.7)	
	Jakarta Tg. Prioku bouy base			Air Communica- tion kantor Meteorologi Hidro-Oseanografi (Navy H.Q.)

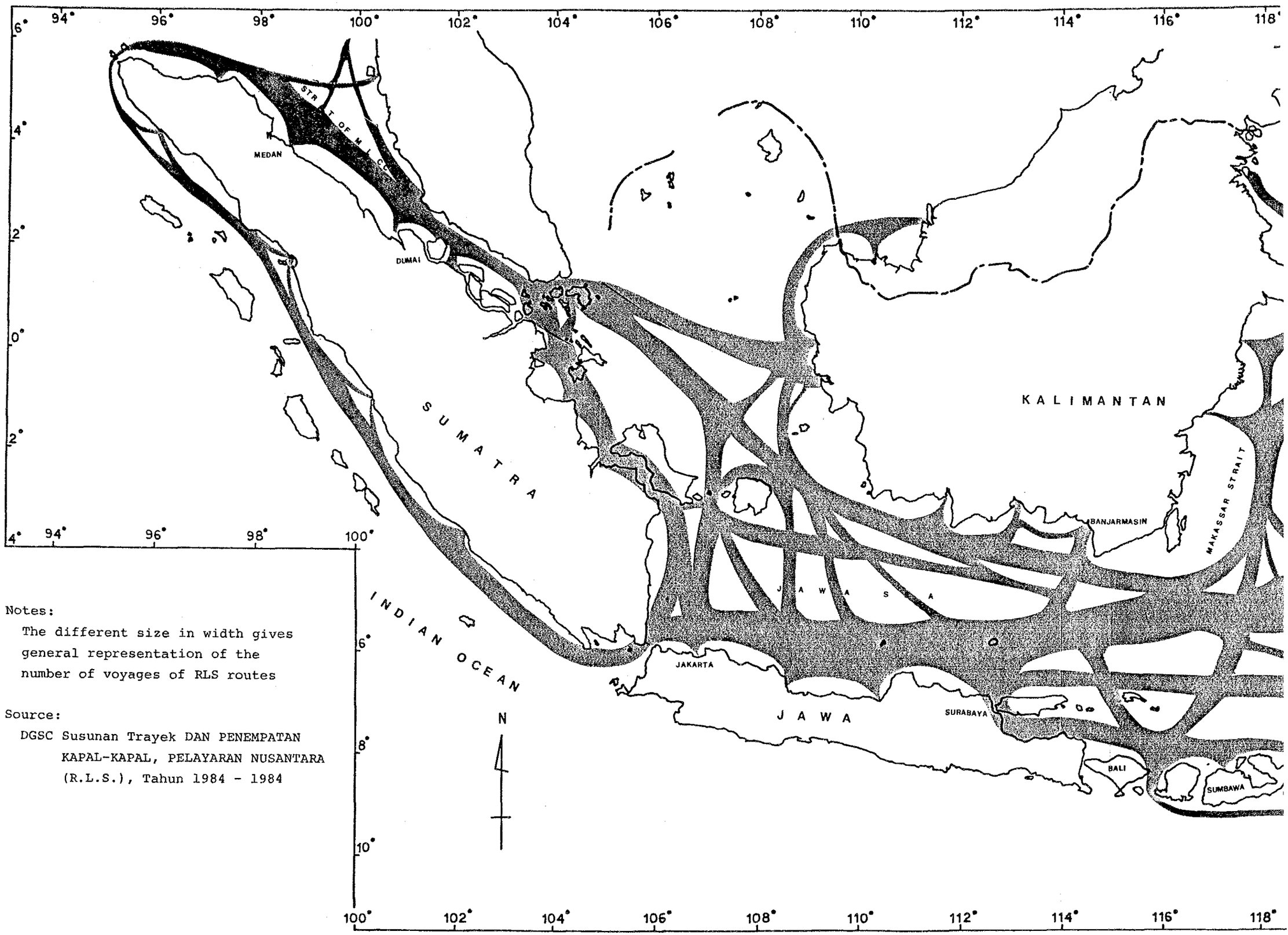
Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
IV	Jakarta District Navigasi Work Shop in Tg. Priok Gas House "Cilincing" Coastal Radio Station (TX)			Sunda Kelapa Port
	Biak Harbour Master	Mokmer L.H.	Mokmer MF (No.59)	
	Monokwari District Navigasi Coastal Radio Station	Tg. Memori L.B.	Memori MF (No.58)	
	Jayapura KANWIL IX District Navigasi	Tg. Svaja L.H.	Svaja MF (No.36)	
	Sorong District Navigasi Coastal Radio Station	Pu. Buaya L.H.	Buaya MF (No.17)	
	Ambon KANWIL VIII District Navigasi Coastal Radio Station	Tg. Nusanive L.H.	Nusanive MF (No.15) Tg. Barututui Tg. Fogi plus alternative site at Pu. Tengah Pu. Nampale Manipa MF (No.27)	M/S Pradawana Waloa Village Ternate Village Waigama Village Puluhili Village

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
IV	Manado/Bitung KANWIL VII District Navigasi Coastal Radio Station at Bitung	Talisei L.H.	Talisei MF (No.34)	Bitung Port
	Parigi Harbour Master	Parigi L.H.		
	Donggala Harbour Master	Tg. Karang L.H.		Donggala Port
	Pantaloan Harbour Master			Pantaloan Port

Group	Local Office	Aids to Navigation		Others
		Existing	Proposed	
V	Dumai District Navigasi Harbour Master Port Administration			Kubu Jaya (Rakyat Shipping & Co.) Bintan Samudra (Sailing Vessel Co.)
	Surabaya Kanwil IV District Navigasi Harbour Master			INSA Surabaya
	Benoa District Navigasi Port Administration Harbour Master			PT PELNI Samudera Besar (Fishing Co.)
	Padangbae Harbour Master			
	Makasar Kanwil VI			Rating School (B.P.L.P.D Barombong)
	Jakarta Port Administration			INSA Head Office

APPENDIX-2

REGULAR LINER SERVICE (RLS) ROUTES AND LIST OF PORTS



Notes:

The different size in width gives general representation of the number of voyages of RLS routes

Source:

DGSC Susunan Trayek DAN PENEMPATAN KAPAL-KAPAL, PELAYARAN NUSANTARA (R.L.S.), Tahun 1984 - 1984

104° 106° 108° 110° 112° 114° 116° 118° 120° 122° 124° 126° 128° 130° 132°

6° 4° 2°

KALIMANTAN

CELEBES SEA

MENADO

MOLUCCA SEA

HALMAHERA

SULAWESI

MAKASSAR STRAIT

CERAM SEA

SERAM

MBON

BANJARMASIN

UJ. PANDANG

BANDA SEA

JAKARTA

J A W A

SURABAYA

BALI

SUMBAWA

FLORES

NUSA TENGGARA

SUMB

TIMOR

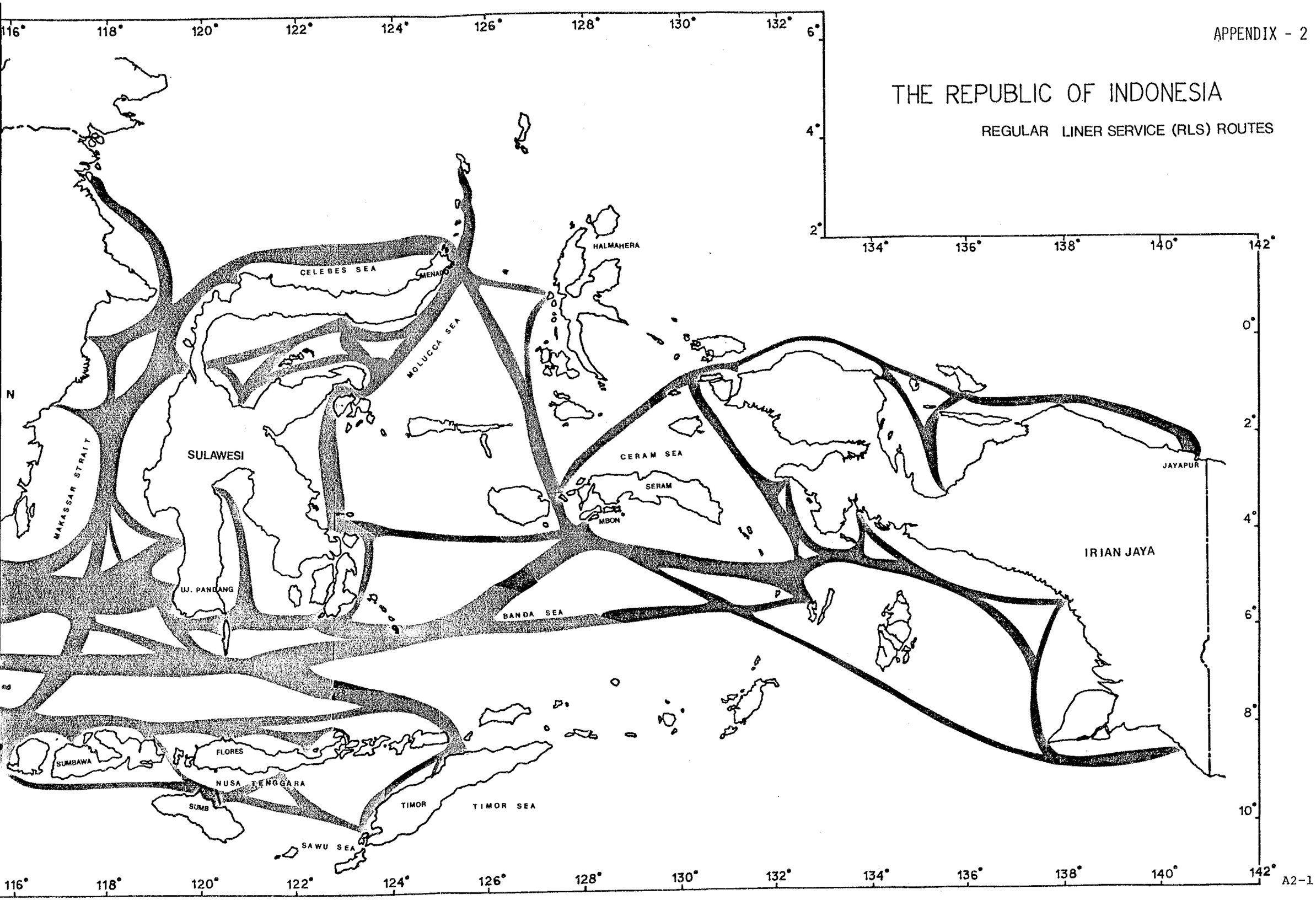
TIMOR SEA

SAWU SEA

104° 106° 108° 110° 112° 114° 116° 118° 120° 122° 124° 126° 128° 130° 132°

THE REPUBLIC OF INDONESIA

REGULAR LINER SERVICE (RLS) ROUTES



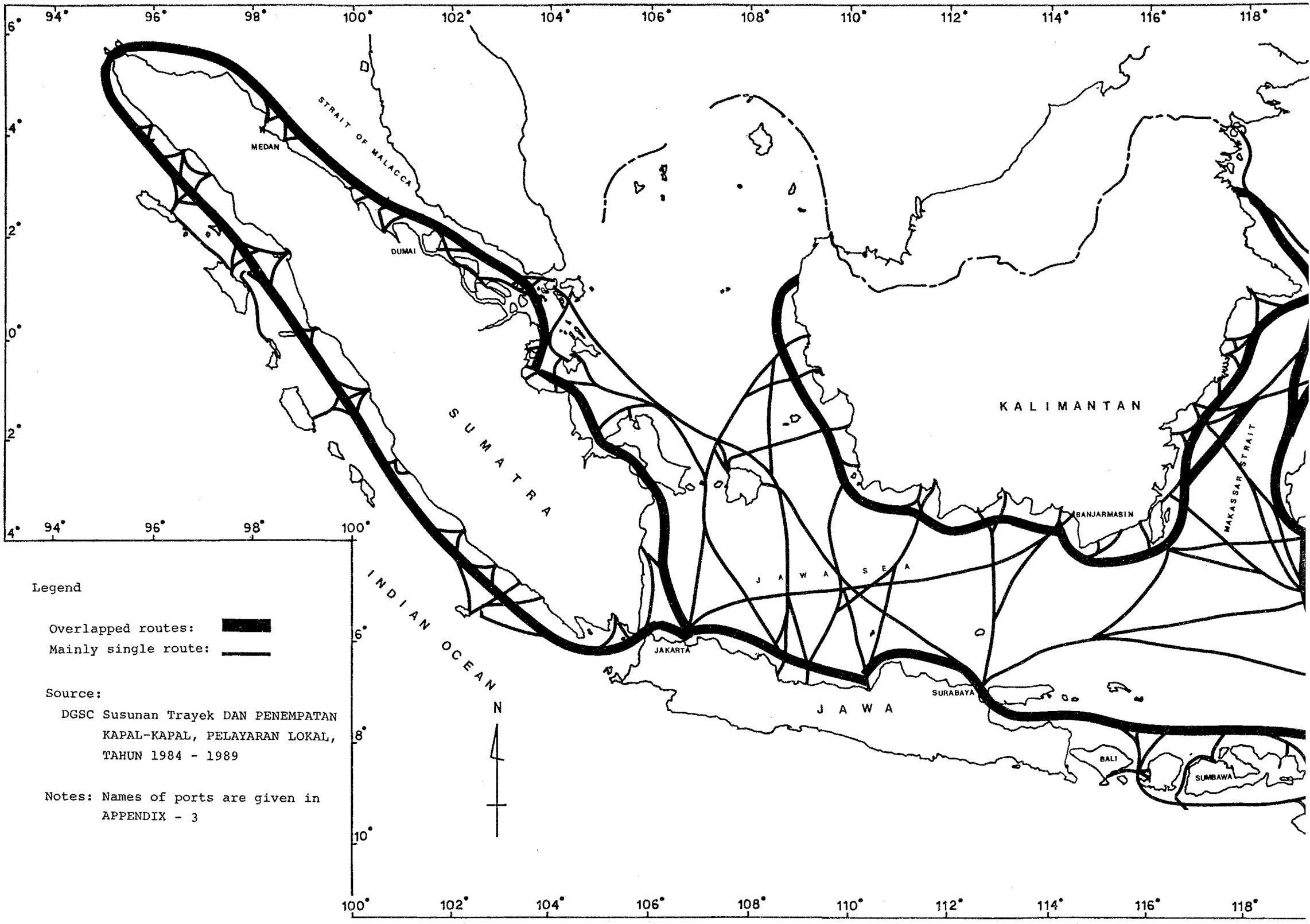
List of Regular Liner Service (RLS) Ports

No.	RLS PORT	No.	RLS PORT
1	BELAWAN	31	SEMARANG
2	LHOKSEUMAWE	32	SURABAYA
3	MALAHAYATI	33	KUCHING
4	PENANG	34	SIBU
5	PORT KELANG	35	BENOA
6	KATANG	36	LEMAR
7	SINGAPORE	37	BELINYU
8	TANJUNG PINANG	38	MANGGAR
9	TEMBILAHAN	39	CELUKAN BAWANG (*)
10	JAMBI	40	CATTLE PORTS (*)
11	PALEMBANG	41	ACEH PORTS
12	TANJUNG PANDAN	42	MAKASSAR
13	PANGKAL BALAM	43	BANABUNGI (*)
14	PAKAN BARU	44	BALIKPAPAN
15	TELUK BAYUR	45	SAMARINDA
16	SIBOLGA	46	BAJARMASIN
17	PULAN BATAM	47	BONTANG
18	MEULABOH	48	BITUNG
19	TG. PRIOK	49	PARE-PARE
20	CIGADING	50	PANTALOAN
21	MERAK	51	TOLI-TOLI
22	BENGKULU	52	SIAU
23	SINGKEL	53	TAHUNA
24	CIREBON	54	KENDARI
25	PANJANG	55	LUWUK
26	DUMAI	56	POSSO
27	BENGKALIS	57	GORONTALO
28	BAGAN SIAPIAPI	58	TERNATE
29	PONTIANAK	59	PARIGI
30	SINTETE	60	AMBON

No.	RLS PORT	No.	RLS PORT
61	SORONG	76	MAUMERE
62	MANOKWARI	77	WAINGAPU
63	NABIRE	78	ENDE
64	BIAK	79	ATAPUPU
65	KAYAPURA	80	LARANTUKA
66	MERAUKE	81	REO
67	KUPANG	82	TUAL
68	DILLY	83	SELAYAR
69	SAMPIT	84	FAK FAK
70	TARAKAN	85	AGATS
71	PALOPO	86	KAIMANA
72	BAU-BAU	87	KUMAI
73	RAHA		
74	SUMBAWA		
75	BIMA		

APPENDIX-3

LOCAL SHIPPING ROUTES AND LIST OF PORTS



Legend

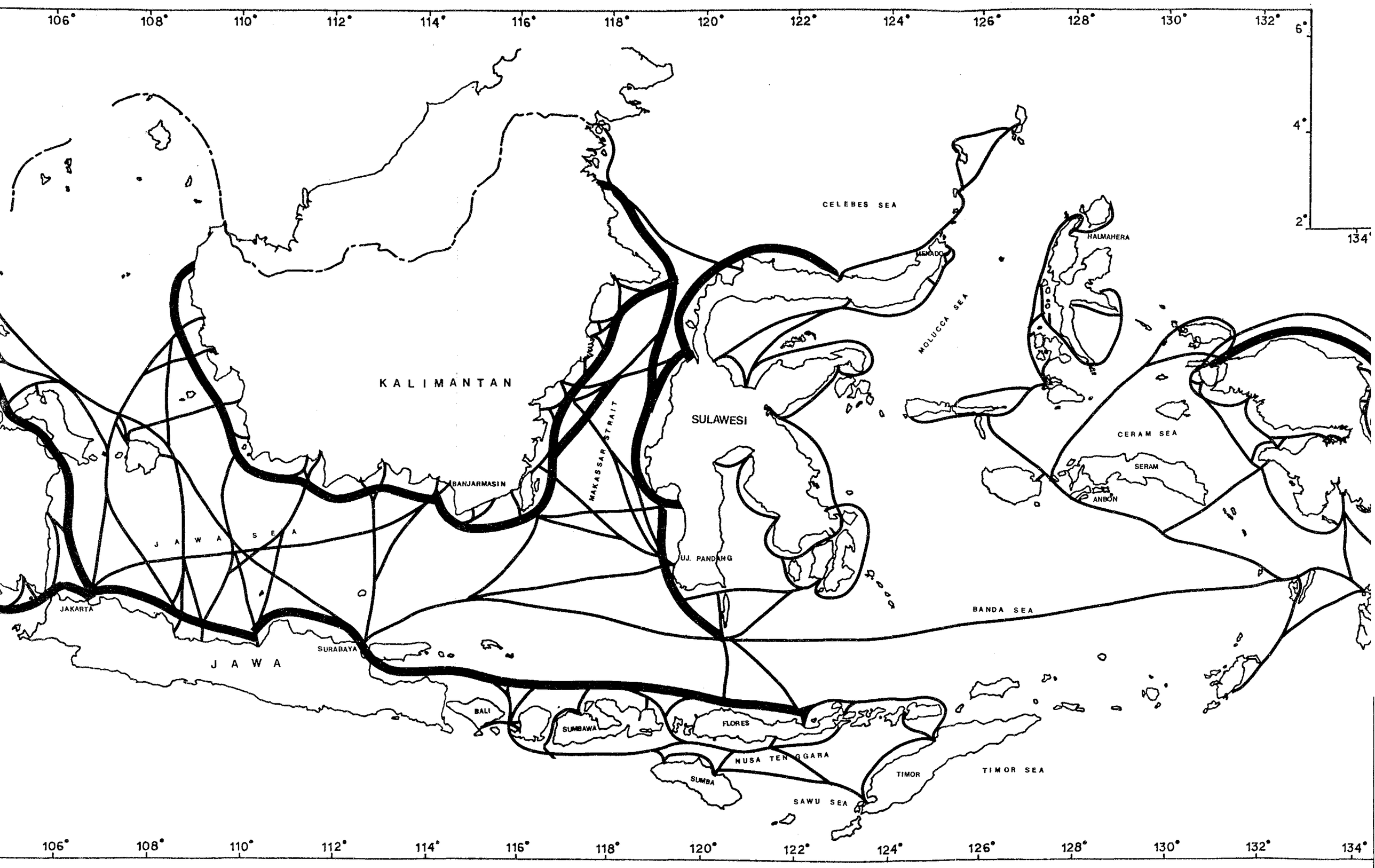
Overlapped routes:

Mainly single route:

Source:

DGSC Susunan Trayek DAN PENEMPATAN KAPAL-KAPAL, PELAYARAN LOKAL, TAHUN 1984 - 1989

Notes: Names of ports are given in APPENDIX - 3


106°
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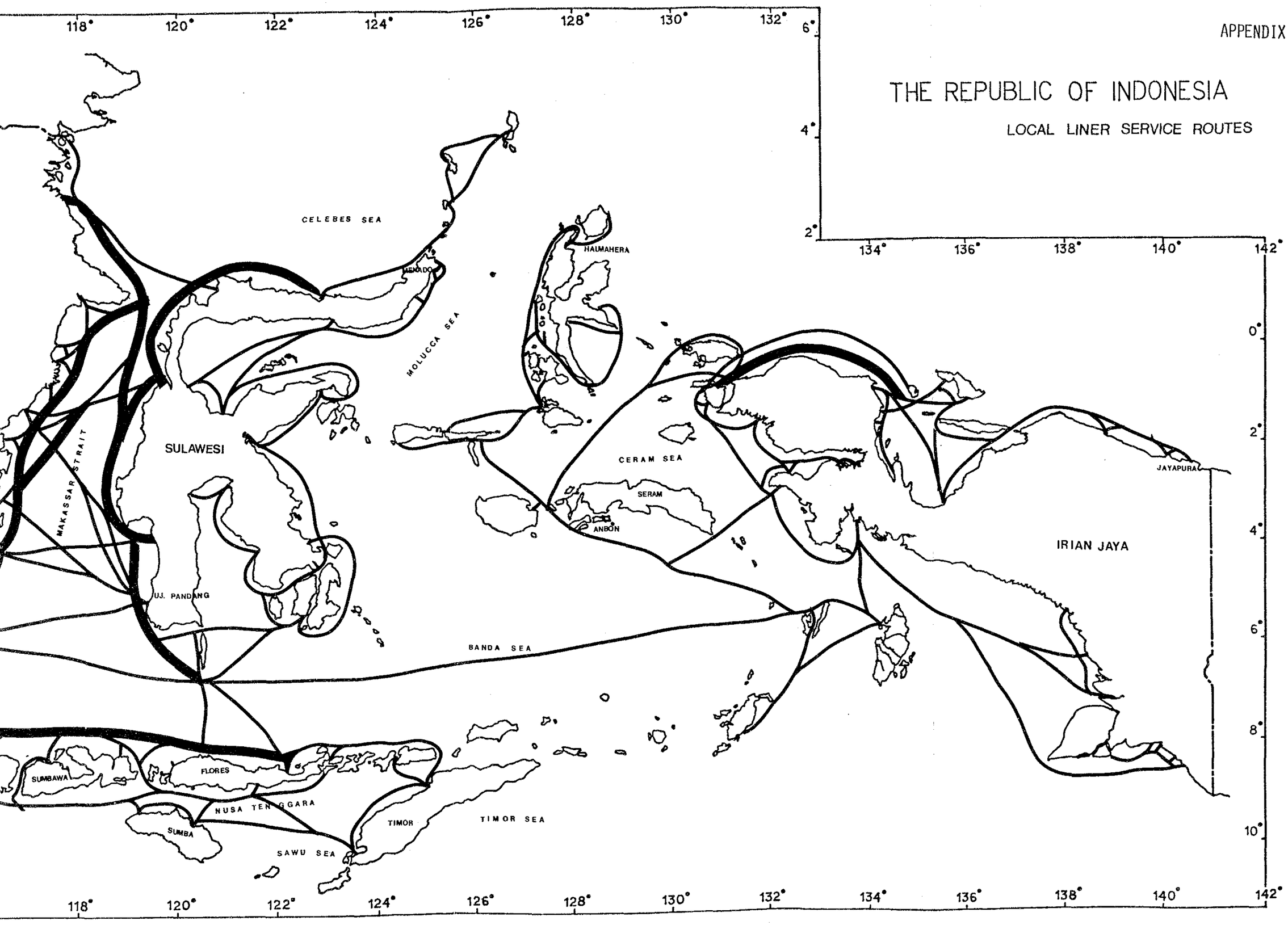
122°
124°
126°
128°
130°
132°
134°
6°
4°
2°
KALIMANTAN
CELEBES SEA
MANADO
HALMAHERA
MOLUCCA SEA
SULAWESI
CERAM SEA
SERAM
AMBON
MAKASSAR STRAIT
BANJARMASIN
JAWA SEA
UJ. PANDANG
BANDA SEA
JAKARTA
SURABAYA
JAWA
BALI
SUMBAWA
FLORES
NUSA TENGGARA
SUMBA
TIMOR
TIMOR SEA
SAWU SEA

THE REPUBLIC OF INDONESIA

LOCAL LINER SERVICE ROUTES



List of Local Shipping Ports

No.	LOCAL PORT	No.	LOCAL PORT
1	BELAWAN	31	SEMARANG
2	TG. BALAI ASAHAN	32	RENGAT
3	LABUHANBILIK	33	TG. BATU
4	ACHE	34	SEI PAKNING
5	UTARA MALAYSIA PANTAI BARAT	35	SIAK
		36	MORO
6	SINGAPORE	37	P. SAMBU
7	PK. SUSU	38	JAMBI
8	PK. BRANDAN	39	PALEMBANG
9	DUMAI	40	TG. UBAN
10	TG. PINANG	41	DABO SINGKEP
11	TG. BALAI KARIMUN	42	MENTOK
12	TEMBILAHAN	43	TG. PANDAN
13	SELAT PANJANG	44	MORO
14	BENGKALIS	45	KEP. MENTAWAI (SIBERUT)
15	PANIPAHAN	46	AIR BANGIS
16	BEGAN SIAP-API	47	SINGKEL
17	TG. LEDONG	48	TAPAK TUAN
18	SUNDA KELAPA	49	SUSOH
19	SIBOLGA	50	BENGKULU
20	G. SITOLI	51	BANTAL
21	PULAU TELLO	52	TAREMPA (*)
22	SINABANG	53	MA. SAKAI (*)
23	MUARA PADANG	54	LETUNG (*)
24	MEULABOH	55	PAREMPA (*)
25	SABANG	56	MUKOMUKO
26	ULEE LHEVE	57	MANNA
27	PAKAN BARU	58	BINTUHAN
28	PANJANG	59	ENGGANO
29	CIREBON	60	MANGGAR
30	BATU AMPAR	61	PANJANG (SINGKEP)

No.	LOCAL PORT	No.	LOCAL PORT
62	SEI SELAN (*)	95	MENDAWAI
63	BLINYO	96	KOTA BARU
64	PKL. BALAM (*)	97	PEGATAN
65	KA. TUNGKAL (*)	98	BATU LICIN
66	PONTIANAK	99	PANGKALAN BUN
67	PEMANGKAT	100	KUMAI
68	SINGKAWANG	101	BALKPAPAN
69	SINTETE	102	TANAH GROGOT
70	BANJARMASIN	103	SAMARINDA
71	KATIANGAN (*)	104	BENOA
72	P. PISAU (*)	105	LEMBAR
73	KUALA KAPUAS	106	TARAKAN
74	SATIN (*)	107	BAU-BAU
75	ASAM-ASAM	108	KENDARI
76	KETAPANG	109	REO
77	KENDAWANGAN	110	MAUMERE
78	TEGAL	111	LARANTUKA
79	PULAU KIJANG	112	ATAPUPU
80	KA. TUNGKAL (MUARA)	113	WAIKELO
81	KA ENOK	114	WAINGAPU
82	PANUBA	115	ENDE
83	SINABOY (*)	116	KUPANG
84	KRUI	117	CELUKAN BAWANG
85	SURABAYA	118	TALIWANG
86	TELUK BETUNG	119	BADAS (SUMBAWA)
87	MESUJI	120	BIMA
88	WAY SEPUTIH (*)	121	KALABAHI
89	SEI SUGIHAN (*)	122	TUAL
90	KALIMAS (*)	123	DOBO
91	SATUI	124	ELAT (BANDA ELAT)
92	MUARA BAHAN	125	SAUMLAKI
93	KUALA PEMBUANG	126	MUARA BADAK (SAMARINDA)
94	SAMPIT		

No.	LOCAL PORT	No.	LOCAL PORT
127	SANGKULIRANG	160	GORONTALO
128	TG. REDEP (*)	161	PARIGI
129	NUNUKAN	162	UNAUNA
130	TG. SANTAN	163	TERNATE
131	UJUNG PANDANG	164	JAILOLO
132	PARE PARE	165	IBU
133	KARIMUN JAWA	166	KUDI (*)
134	DONGGALA	167	GALELA
135	KWANDANG	168	DARURA (PARURA) (*)
136	TAWAO	169	BEREBERE
137	TG. SELOR	170	TOBELO
138	SELAYAR	171	PARURA (DARURA) (*)
139	RAHA	172	SOASLU
140	KOLONEDALE	173	TIDORE
141	LUWUK	174	SAKETA
142	AMPANA	175	GANEDALAM (*)
143	POSSO	176	MAFA (*)
144	JAPEA	177	WITA (*)
145	AMPENAN	178	PATATI (*)
146	KOLAKA	179	BICOLUBULI (BICOLI)
147	BAYOA (*)	180	SABAFI (SAYAFI)
148	PALOPO	181	WEDA
149	MALILI	182	KAYOA
150	BITUNG	183	LABUHA
151	MANADO	184	LAIWUL
152	TAGULANDANG	185	SANANA
153	SIAW	186	BOBONG
154	TAHUNA	187	DOFA
155	LIRUNG	188	AMBON
156	BEE	189	BANDA
157	TOLITOLI	190	GESER
158	PANTOLOAN	191	KATOLOKA (*)
159	KOTABUNAN	192	NAMLEA

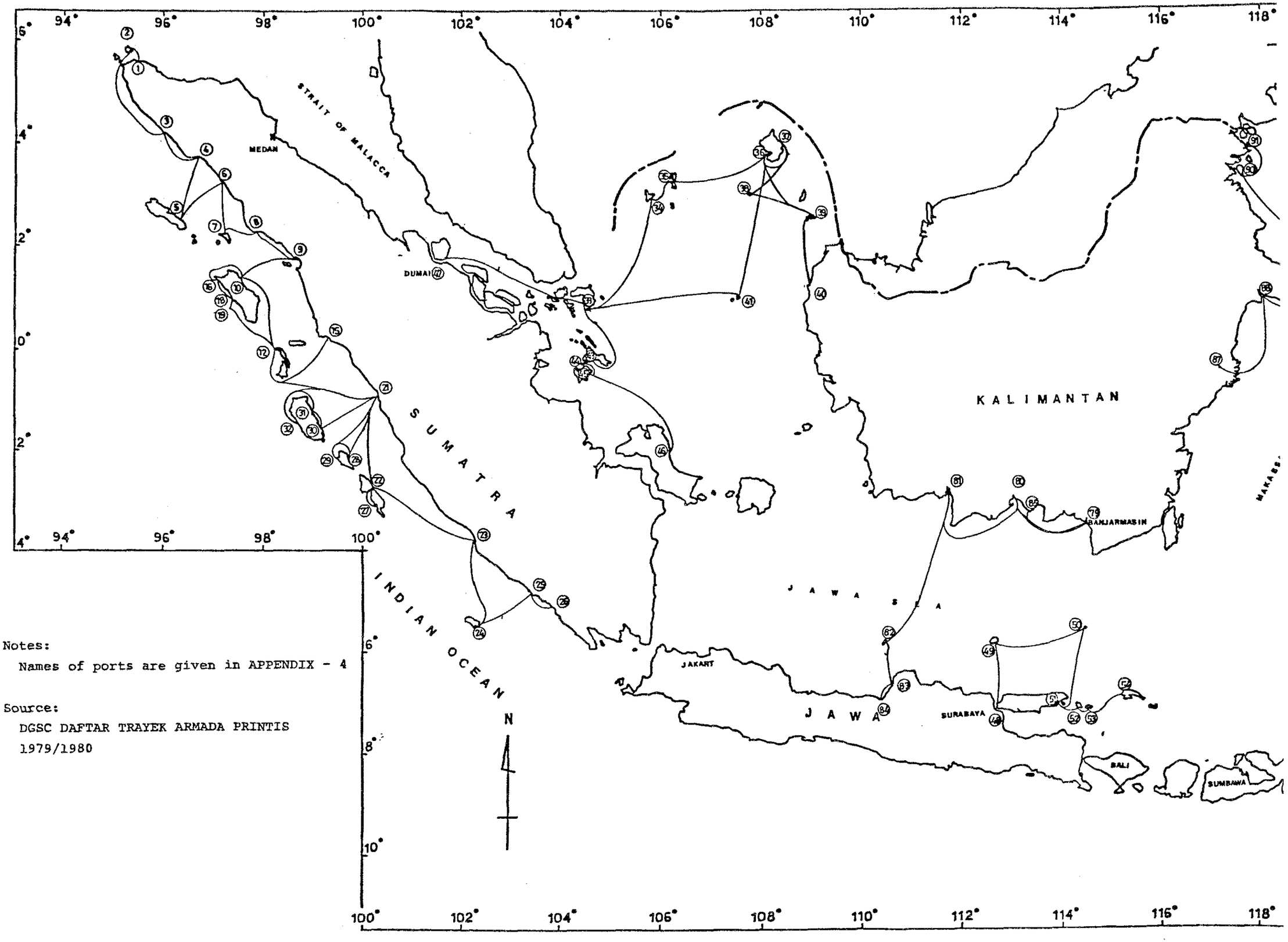
No.	LOCAL PORT
193	LARAT
194	JAYAPURA
195	DEMTA
196	SERUI
197	MEMBERAMO (TEBA)
198	KASOMAWEJA (*)
199	BIAK
200	NABIRE
201	MANOKWARI
202	SORONG
203	FAKFAK
204	ORANSBARI
205	RASSIKIL (*)
206	WINDESI
207	WASIER
208	RANSIKI
209	KARIGO (KARIDO?)
210	WARGE (*)
211	SAILOLOF
212	SEGE
213	TEMINABUAN
214	INAWATAN
215	BINTUNI
216	KAIMANA
217	SEMIMI (*)
218	KEKWA (*)
219	SUSUNA (*)
220	KOKAS
221	DABO
222	GEREM (*)
223	TULEHU (*)
224	BABOKOKAR (*)
225	MERAUKE
226	BADE (BADIE?)
227	KEPI
228	TANAH MERAH
229	PRIMAPON (PIRIMAPUAN) (*)
230	AGATS
231	YAUSAKER (*)
232	YAMAS (*)
233	OKABA
234	KIMAAN
235	GOTENTIRI (*)
236	KUMBE
237	YUKIM (*)
238	MUTING
239	SARMI
240	BEGUSA (*)
241	WAIGEO UTARA

Note:

* Approximate locations

APPENDIX-4

PIONEER SERVICE ROUTES AND LIST OF PORTS



Notes:

Names of ports are given in APPENDIX - 4

Source:

DGSC DAFTAR TRAYEK ARMADA PRINTIS
1979/1980

104° 106° 108° 110° 112° 114° 116° 118° 120° 122° 124° 126° 128° 130° 132°

6° 4° 2°

KALIMANTAN

J A W A S E A

JAKART

J A W A

SURABAYA

BANJARMASIN

BALI

SUMBAWA

FLORES

SUMBA

NUSA TENGGARA

SULAWESI

UJ. PANDANG

MAKASSAR STRAIT

CELEBES SEA

MENADO

MOLUCCA SEA

HALMAHERA

CERAM SEA

SERAM

AMBON

BANDA SEA

TIMOR

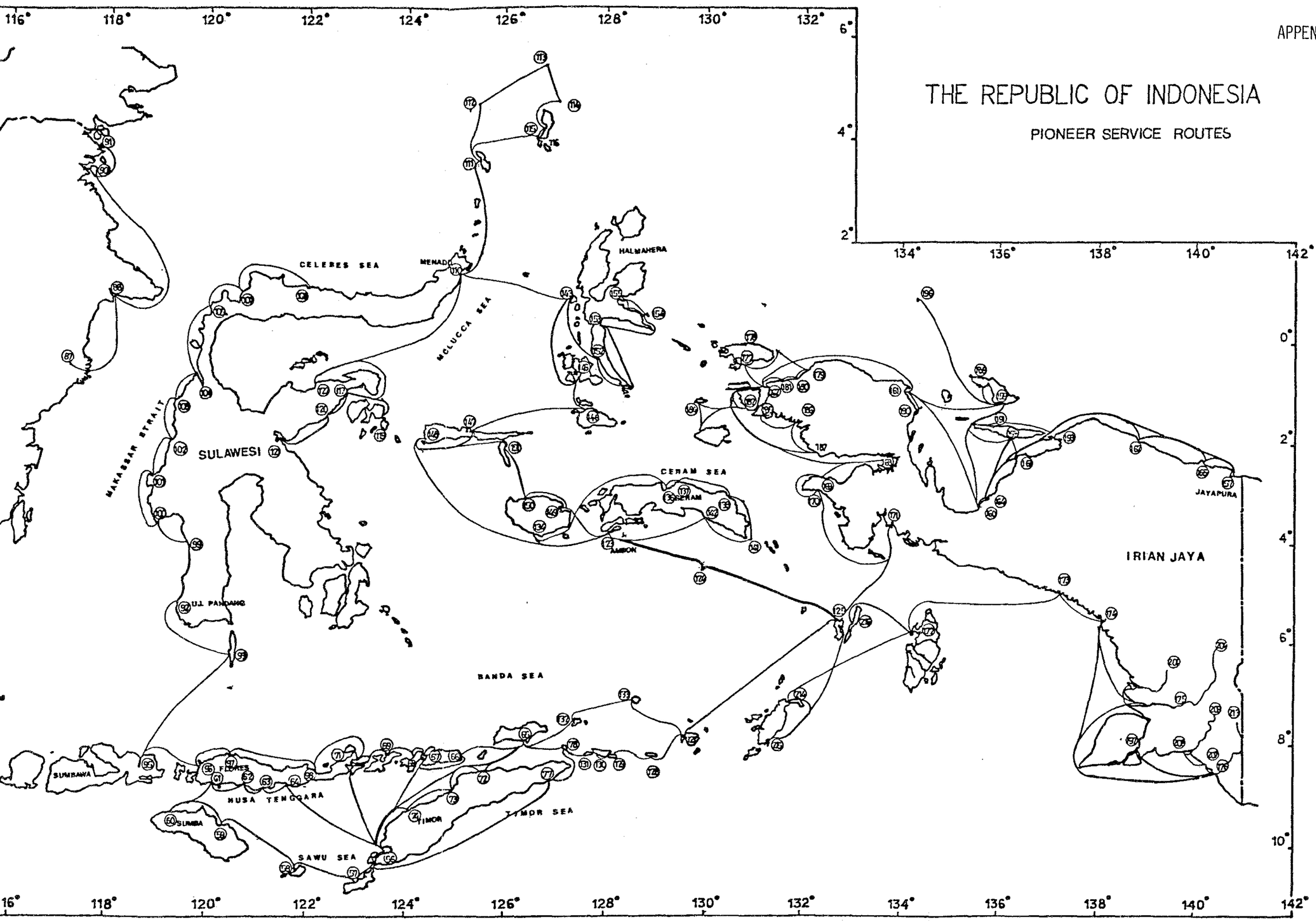
TIMOR SEA

SAWU SEA

104° 106° 108° 110° 112° 114° 116° 118° 120° 122° 124° 126° 128° 130° 132°

THE REPUBLIC OF INDONESIA

PIONEER SERVICE ROUTES



List of Pioneer Service Ports

No.	Pioneer Ports
	SUMATERA
1	KRUENG RAYA
2	SABANG
3	MEULABOH
4	SUSOH
5	SINABANG
6	TAPAK TUAN
7	P. BANYAK
8	SINGKEL
9	SIBOLGA
10	G. SITOLI
11	T. DALAM (*)
12	P. TELLO
13	SAERU (*)
14	SIGOLOGOLO (*)
15	AIR BANGIS
16	LAHEWA
17	SOLONAKO (*)
18	SIROMBU
19	HINAKO
20	SEHE
21	TELUKBAYUR
22	BENGKULU
24	ENGGANO
25	BINTUHAN
26	KRUI
27	BAKE
28	SIUBAN
29	TUA PEJAT
30	SIBERUT
31	SIKABALUAN
32	SIMATALU
	TG. PINANG
33	TG. PINANG
34	LETUNG
35	TAREMPA
36	SEDANAU
37	RANAI
38	MIDAI
39	SERASAN
40	PEMANGKAT
41	TAMBELAN
42	SENAYANG (*)
43	DAIK
44	PENUBA
45	DABO
46	PK. PINANG
47	DUMAI
	JAWA TIMOR
48	SURABAYA
49	BAWEAN
50	MASALEMBO
51	KALIGNGET
52	GAYAM
53	RAAS
54	KANGEAN
56	KUPANG
57	BAA

No.	Pioneer Ports
58	SEBA
59	WAINGAPU
60	WAIKELO
61	NANGALILI
62	AIMERE
63	MAUMBAWA
64	ENDE
65	ILWAKI
66	KOLAMA
67	KALABAHI
68	KABIR
69	BALAURING
70	WAIWERANG (*)
71	LARANTUKA
72	DILLY
73	ATAPUPU
74	OEKUSI
75	LALETE (*)
76	BAEKE (*)
77	LORE
78	KISAR
	BANJARMASIN
79	BANJARMASIN
80	SAMPIT
81	KUMAI
82	KARIMUNJAWA
83	JEPARA
84	SEMARANG
85	PEGATAN
86	KOTABARU (*)

No.	Pioneer Ports
	KALIMANTAN
87	SAMARINDA
88	PENGALAN
89	SANGKULIRANG (*)
90	TARAKAN
91	NUNUKAN
	SULAWESI
92	UJUNG PANDANG
93	SALAYAR
94	JAMPEA (*)
95	BIMA
96	LB BAJO
97	REO
98	MAUMERE
99	PARE PARE
100	MAJENE
101	MAMUJU
102	BUDING BUDING
103	PASANGKAYU
104	PANTOLOAN
105	OGOAMUS
106	OGOTUA (*)
107	TOLI TOLI
108	LEOK (*)
109	PALELEH
110	BITUNG
111	TAHUNA
112	MARORE
113	MIANGAS
114	KARATUNG

No.	Pioneer Ports
115	BEO
116	LIRUNG
117	LUWUK
118	SALAKAN (*)
119	BANGGAI
120	TOILI
121	KOLONEDALE
122	BUNTA
	AMBON
123	AMBON
124	BANDA
125	TUAL
126	KROING (*)
127	TEPA
128	LELANG
129	LAKOR
130	MOA
131	LETI
132	ROMANG
133	DAMAR
134	LEKSULA
135	TANIWEL (*)
136	SAWAI
137	WAHAI
138	BULA
139	KATALOKA (*)
140	AIMAR (*)
141	GESER
142	WERINAMA

No.	Pioneer Ports
	TERNATE
143	TERNATE
144	GOTO (*)
145	LABUHA
146	LAIWUI
147	DOFA
148	BOBONG
149	NAMLEA
150	AER BUAYA
151	SANANA
152	SAKETA
153	WEDA
154	SAYAFI
155	BULI
156	BICOLI
	JAYAPURA
157	JAYAPURA
158	SERUI
159	BIAK
160	NABIRE
161	MANOKWARI
162	SORONG
163	WAREN
164	NAFAN
165	DEMTA
166	WAKDE
167	SARMI

No.	Pioneer Ports
	SORONG
168	BINTUNI
169	KOKAS
170	FAK FAK
171	KAIMANA
172	DOBO
173	AMAMAPARE
174	AGATS
175	BADE
176	MERAUKE
177	SAONEK
178	KABAREI
179	SAUSAPOR
180	MEGA
181	MAKBON
182	SAILALAF
183	WAIGAMA
184	KAFIAN
185	SEGET
186	TEMINABUAN
187	INAWATAN
188	KORIDO
189	KAMERI (*)
190	ORANSBARI
191	POM
192	KARINAN (*)
193	KARUDU
194	ASWAN
195	WAINAFA
196	MAPIA

No.	Pioneer Ports
	MERAUKE
197	BATUMERAH/KIMAN
198	ATSY (*)
199	SENGGO (*)
200	BAYUN (*)
201	YAUSAKOR (*)
202	SAWAERMA (*)
203	GOTENTRI (*)
204	TANAH MERAH
205	MUR (*)
206	KEPIR
207	KEMBE
208	BIAN/OKABA
209	MUTING
210	BIAN/OKABA
211	KUBE (*)
212	SEMANGGA/TANAHMIRING
213	BUPUL
214	KELIOBAR
215	LAURANG
216	BANDA ELAT