4-2-3 Relevant Projects

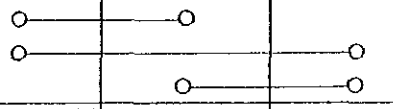
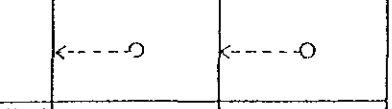
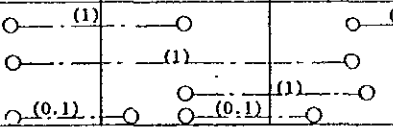
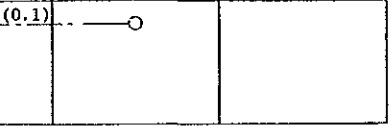
In order to secure the safety of navigation at sea, the following plans are to be implemented.

(1) Coast station

A long term development plan has been established for the general coast stations, and first part of the project has already been in progress and expected for its completion within about three years time. The second phase of long term plan will also be implemented in the near future. Upon completion of the total project, remarkable improvement in the services is expected including expansion in the coverages and frequencies.

The long term plan includes classification and new categorization of the coast stations as given in **Tables 4-2-3/1** and **4-2-3/2**.

Table 4-2-3/1 Classification of Coastal Radio Stations

Item \ Class		A		B	C	D
		Jakarta	Others			
Water area for which the station is in charge		whole Indonesian water and over	nearby coast area	nearby coast area	within the port area	within the port area
Service hour	Maritime communication	24	24	16 - 24	8	8
	Watch for distress signals	24	24	24	8 - 24	8
Frequency band for maritime communication		MF,HF & VHF	MF,HF & VHF	MF,HF & VHF	VHF	VHF
Distress frequencies to watch		500, 2182, 4125, 6215.5 & 8364 KHz 156.8 MHz SOS Buoy freq.			2182 & 6215.5 KHz & 156.8MHz	156.8MHz
Communication distance Type of transmission / Freq. band / TX output (KW) / Communication distance (KM) Note: G: Telegraph, P: Telephone, M: MF, H: HF, V: VHF		G /H /5 /1000 or over P/ H/M /5/1000 or over G/H /5/ 1500or over P/V/0.05/50	G / M / 1 / 500 or over P / H/M / 1 / 500 or over G / H / 1 / 750 or over P / V / 0.05 / 50		P / V / 0.05 / 50	
Maritime mobile services						
SAR Communication		Yes	Yes	Yes	Yes(VHF)	Yes(VHF)
Watch for distress signal		Yes	Yes	Yes	Yes	Yes
Radio navigation		Yes	Yes	Yes		
Special service		Yes				
Public correspondence		Yes	Yes	Yes	Yes	Yes
Port operation		Yes	Yes	Yes	Yes	Yes
Ship movement		Yes	Yes	Yes	Yes	Yes
NBDP & DSC		Yes	Yes			
Fixed services						
P-P Communication		Yes	Yes	Yes		
Broadcast		Yes	Yes			
Station site and building						
Transmitting station		Separated	Separated	Separated	At the same location	At the same location
Receiving station						
Operation center		In the RX station	In the RX station	In the RX station		
Means of P-P communication (Note 1)	Main					
	Back-up					

Note 1: ○——○ Dedicated line(PERUMTEL)

○- - - - - - - -○ Public telephone line

○- - -(1)- - -○ Back-up circuit by Sea Comm's own HF circuit

(1) ← Transmitting power(KW)

Table 4-2-3/2 List of newly categorized coast stations

KANWIL	NEW Class	Existing Class	Name of Coast Stations
I	A	I	Belawan
	B	II	Sabang
	B	IVa	Sibolga
II	A	I	Dumai
	B	III	Teluk Bayur
	B	IVa	Tg. Uban
	C	IVa	Tg. Pinang
	C	IVa	Tg. Balai Kariman
III	A	I	Jakarta
	B	I	Palembang
	B	III	Panjang
	B	III	Cirebon
	B	III	Pontianak
	C	IVa	Jambi
IV	A	I	Surabaya
	B	III	Semarang
	B	III	Cilacap
	B	III	Kupang
	B	IVa	Lembar (Ampenan)
	C	IVa	Benoa
	C	IVa	Panarukan
	C	IVa	Dili
V	A	III	Banjarmasin
	B	II	Balikpapan
	B	III	Tarakan
	B	IVa	Samarinda
	C	IVa	Sampit

KANWIL	NEW Class	Existing Class	Name of Coast Stations
VI	A	I	Ujung Pandang
	B	IVb	Kendari
VII	A	I	Bitung
	B	III	Donggala
VIII	A	I	Ambon
	B	IVa	Ternate
IX	A	I	Jayapura
	B	III	Sorong
	B	III	Merauke
	B	IVa	Biak
	B	IVb	Fak-Fak
	C	IVa	Manokwari
I-IX	D	IVb	All Class IVb stations except Fak-Fak and Kendari

(2) SAR Telecommunication Project

In order to cope with the implication of SAR Convention, the project will be for the establishment of telecommunications facilities for exclusive use of SAR, separating its services from the general coastal services.

A long term development plan has been established for carrying out useful and effective SAR operations by KPLP as maritime SAR task force: the SAR operation system is established within the organizations of Central and District Headquarters of Sea Communications having the Central Center in Jakarta and Regional Center each at the District Headquarters. KPLP Detachments under the command of the respective Regional Headquarters are connected with the SAR operating coast stations for their necessary communications for SAR. **Fig. 4-2-3/1** shows the overall system, and the KPLP P-P communications network is given in **Fig. 4-2-3/2.**

Fig. 4-2-3/1 OVERALL SAR OPERATION SYSTEM

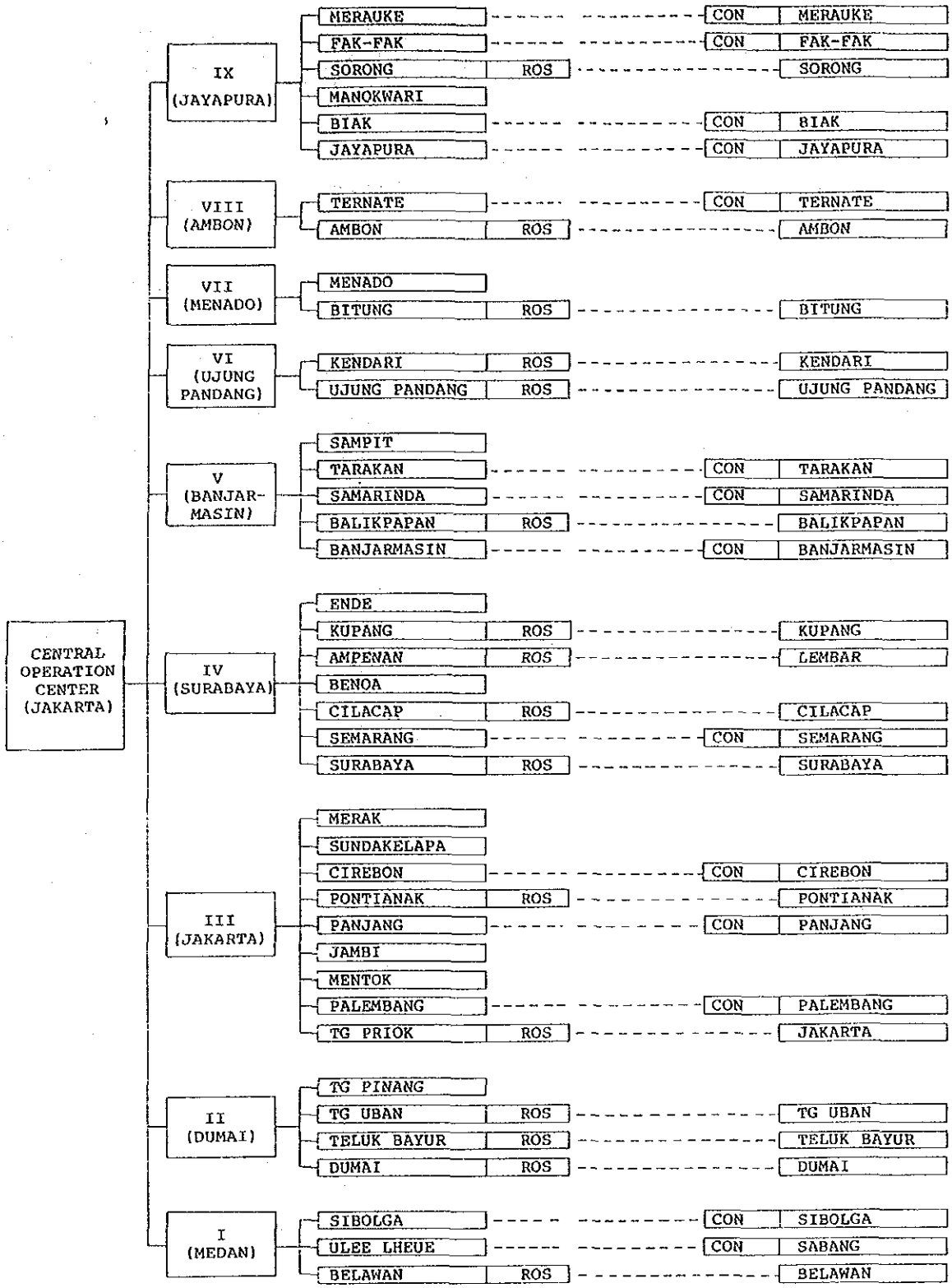
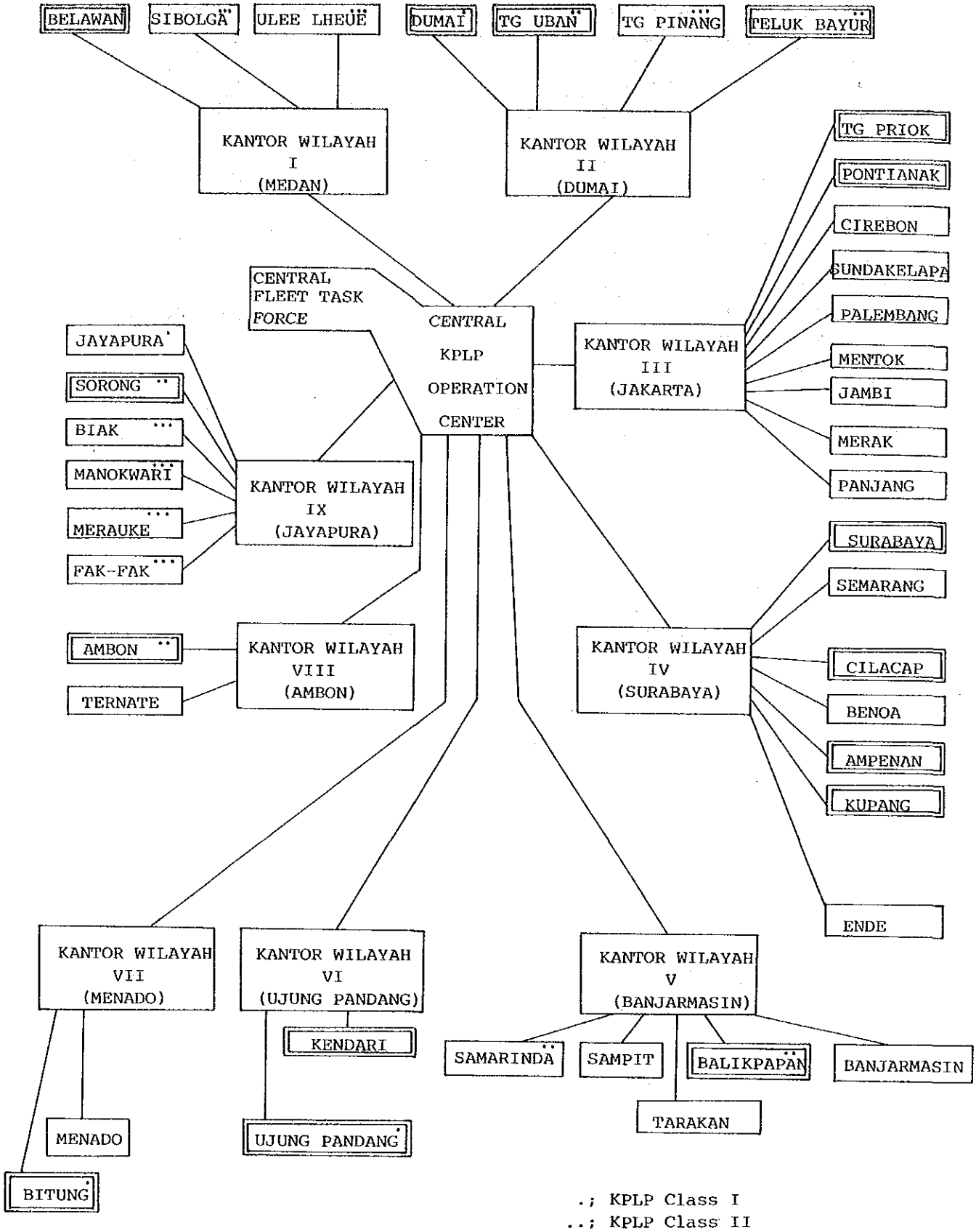


Fig. 4-2-3/2

KPLP P-P NETWORK



.; KPLP Class I
..; KPLP Class II
...; KPLP Class III
▭ ; SAR ROS

4-3 Development and Improvement Plan

The development and improvement plan consists of the long term and short term plans, each of which is categorized into the development and improvement.

4-3-1 Long Term Plan

The long term plan is aimed at the target year of 2,000.

(1) Development Plan

1) Visual Aids to Navigation

The number of existing visual aids to navigation in Indonesia as of March, 1984 is as follows:

Types of Navaids	No. of Units
Lighthouse (on land)	149 units
Lighthouse (off shore)	-
Light beacon (incl. 163 harbour lights)	599 "
R.L.B	2 "
Lighted buoy	342 "
Total	1,092 "

The above figure gives 3.3 units/100 NM.

The government of the Republic of Indonesia has been proceeding with the development plans for inter-insular maritime transportation network for

ports and traffic routes, and industrial development as a part of its long term development plan, and an urgent need, therefore, exists for the development of aids to navigation to meet the requirements of new traffic routes, size-enlargement of vessels and increase in fleet.

(A) Development Criteria for Visual Aids to Navigation

The development of visual aids to navigation is planned, according to the criteria set forth as given below, taking into account "Short Term Development Plan for Aids to Navigation and Maritime Telecommunication System, August 1983", sea traffic, various traffic routes, fishery, marine accidents and other relevant factors.

(a) Lighthouse (on-land):

- Location requiring the covering range of 20 NM or over
- Landfall from ocean wards
- Isolated island in open sea
- Important turning point
- Landfall for port
- Entrance to strait
- Other navaids sparse area

(b) Lighthouse (off shore)

- Critical navigation danger for vessels traffic in important traffic areas requiring long limunous range

(c) Light beacon (on land)

- Similar to lighthouses except the locations where easy maintenance and control may be carried out from nearby Districts of Navigation.
- Breakwaters, jetties, islands, dangers, etc. within ports and harbours

(d) Light beacon (dangers on land)

- Tiny islands, rocks in traffic routes or their vicinity

(e) Light beacon (dangers off shore)

- Sunken dangers in traffic routes or their vicinity

(f) Resilient beacon

- Long approach channels to ports, where entrance thereto needs to be shown.
- Entrance to narrow channel where suitable navaids may not properly be installed.

(g) Light buoy

- Entrance to approach channels and cardinal marks
- Dangers within port areas and other areas
- Other areas supplementary to other main aids.

(B) Selection Criteria

a) Lighthouse

The site selection for lighthouses is made on charts based on the afore-mentioned development criteria, and the selection evaluation is made according to the standards shown in **Table 4-3-1-(1)/1**, and as a result 190 lighthouses (on land) and 11 lighthouses (off shore) are planned.

b) Light beacon

Light beacons for off shore and dangers have been selected in the same way as for the selection of lighthouses, and as a result 150 light beacons are planned.

The light beacons for harbour lights are planned as shown below according to the proposed number of lights given in the site allocation models, **Fig. 4-3-1/1** to **Fig. 4-3-1/3**.

Long Term Development Plan for
Light Beacons for Harbour Lights

Category of Port	No. of Ports	No. of Units/ Port	Total
Gateway	4	5	20
Collector	14	3	42
Trunk	25	1	25
Other	226	(Approx 30% of No. of Ports)	71
Total	269		158

The light beacons for ports and harbours are those to be installed in ports and harbours, those to be used for ship's entering and leaving ports and harbours and also include the additional number of 27, about 10% of the total number of ports, which will be required in connection with the long term port development plan for the year 2,000.

Accordingly, the following number of light beacons are planned for the development:

Light Beacons		No. of Units
Coastal aids and navigation dangers	.....	150 units
Ports and harbours	.....	158 "
Others	.....	27 "
Total		335 units

c) Resilient light beacon

Eighteen locations have been selected for RLB installations, where approach channels exist in the ports in the Gateway system, and the entrances to estuaries need to be identified.
However, Malacca and Singapore Straits are excluded in this plan.

d) Lighted buoy

Plans for 247 light buoys are made to basically meet the requirement of port development in the Gateway system applying the model installations given in **Fig. 4-3-1/1** to **Fig. 4-3-1/3.**

Also, an estimation is made for the annual average increase of about 2% in relation to the existing installations of light buoys. It gives the number of 103 lighted buoys. As a result, the total number of 350 units is planned as given below:

Long Term Development Plan for Lighted Buoys

Category of Port	No. of Ports	No. of Units/ Port	Total
Gateway	4	15	60
Collector	14	8	112
Trunk	25	3	75
Estimated Annual Average Increase			103
Total			350 units

The selection of sites for coastal aids and navigational dangers is made based on the evaluation carried out according to the criteria given in **Table 4-3-1-(1)/1.**

Table 4-3-1-(1)/1 Evaluation of Traffic Routes and Light Aids

Ranavids \ Traffice Routes		Gate Way - Gate Way	Gate Way - Collector	Collector - Truck	*1 Others
COASTAL AIDS	Landfalls from Seawards	a	b	c	c
	Landfalls for Ports and Harbours	a	b	b	b
	Landfalls	b	b	c	c
	Coasts where no lights established for 30 NM or over	b	b	c	c
	Turning points	b	b	c	c
	Coast where fishing grounds exist	b	b	c	c
	Entrance to Narrow Channels	b	b	c	c
	Sides of entrance to narrow channels	c	c	c	c
	Islands in traffic routes	c	c	c	c
DANGERS	Navigational dangers	c	c	c	c
	rocks and tiny islands	c	c	c	c
	High density accidents areas	b	b	b	b

Evaluation Method: The following points are applied for the selection of priority sites
a ... 5 points, b ... 3 points, c ... 1 point

Notes: *1: RLS, Local and Pioneer service routes.

Fig. 4-3-1/1 Model of Aids to Navigation Arrangement for Gateway Port

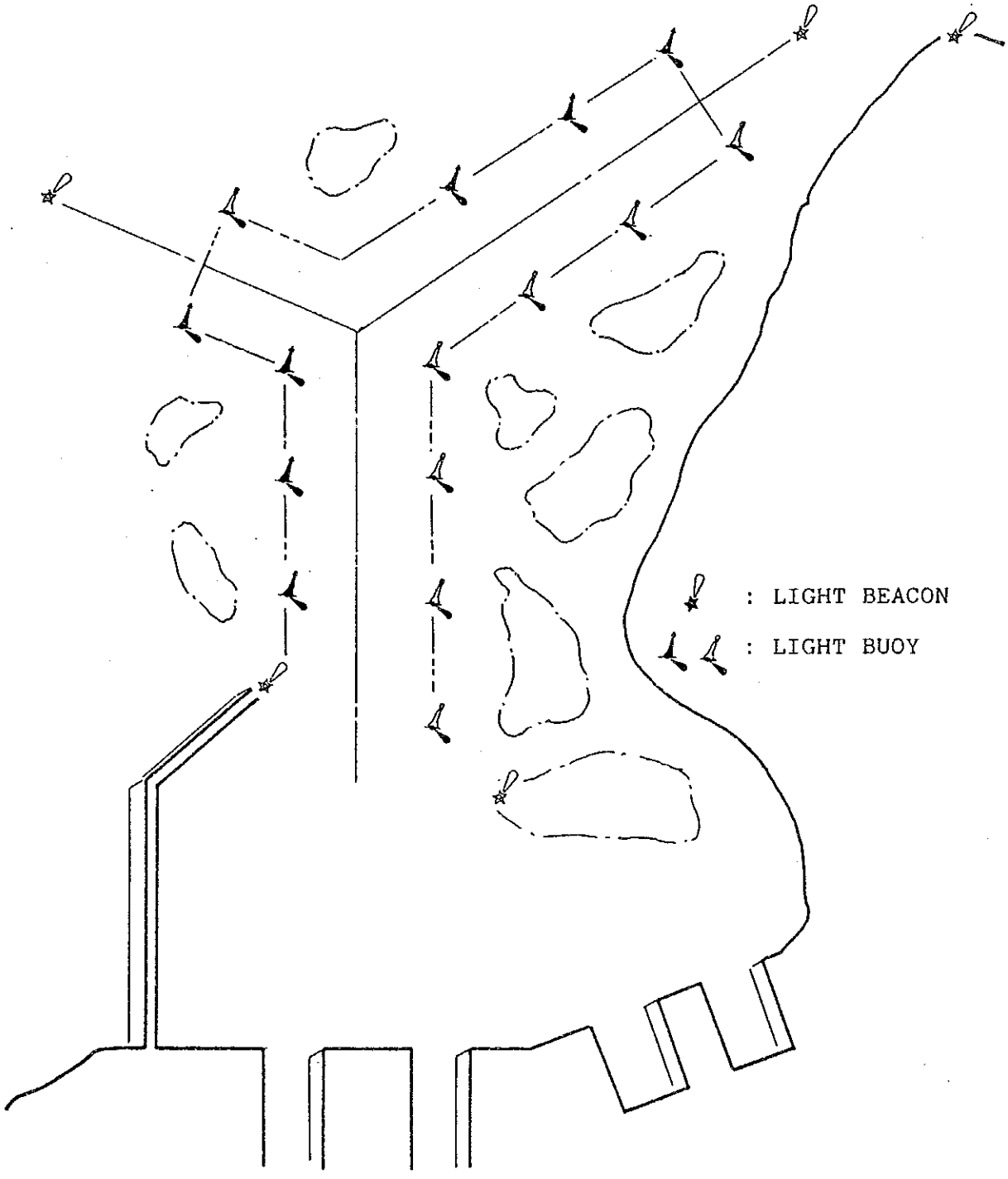


Fig. 4-3-1/2 Model of Aids to Navigation Arrangement for Collector Port

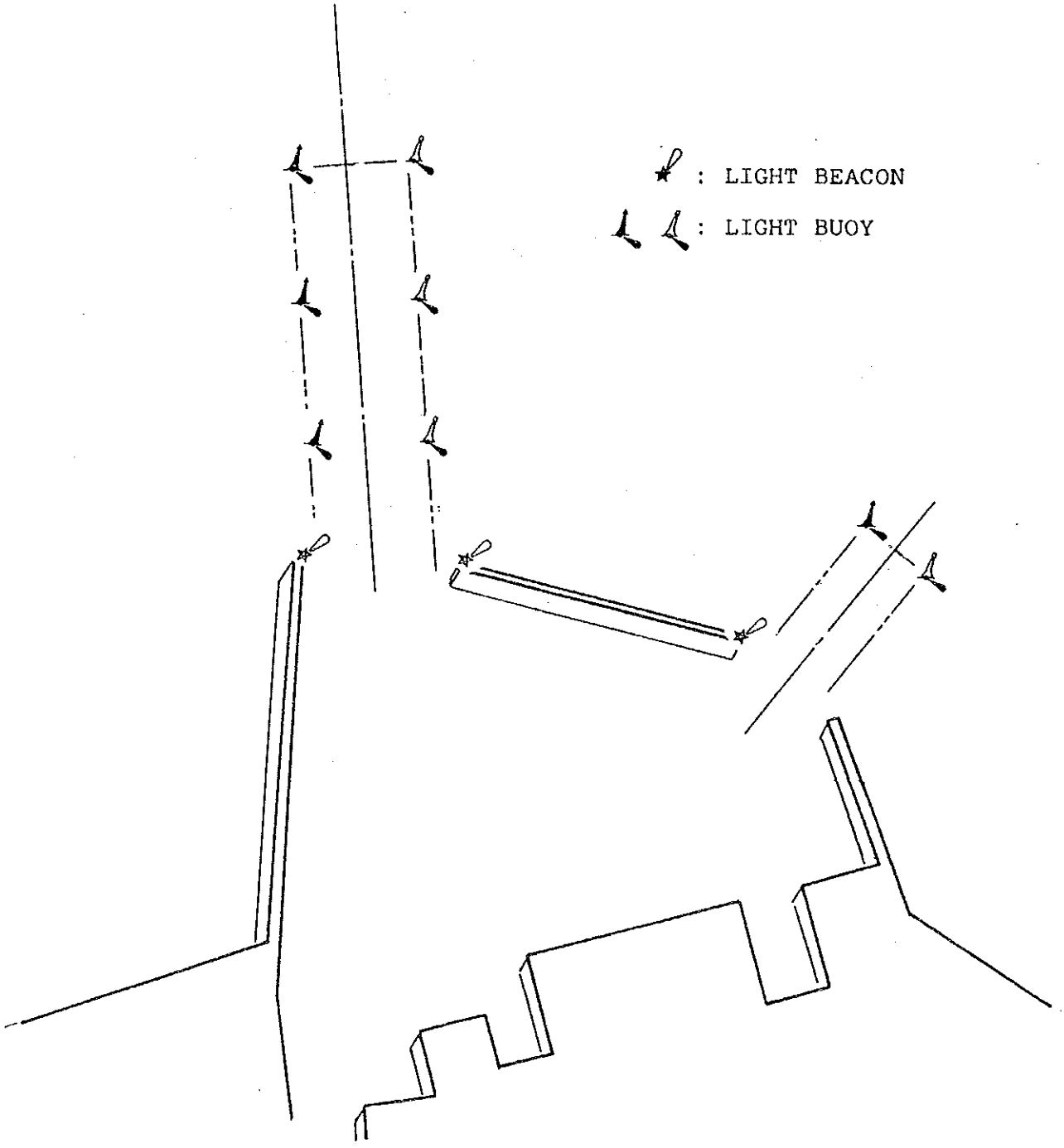
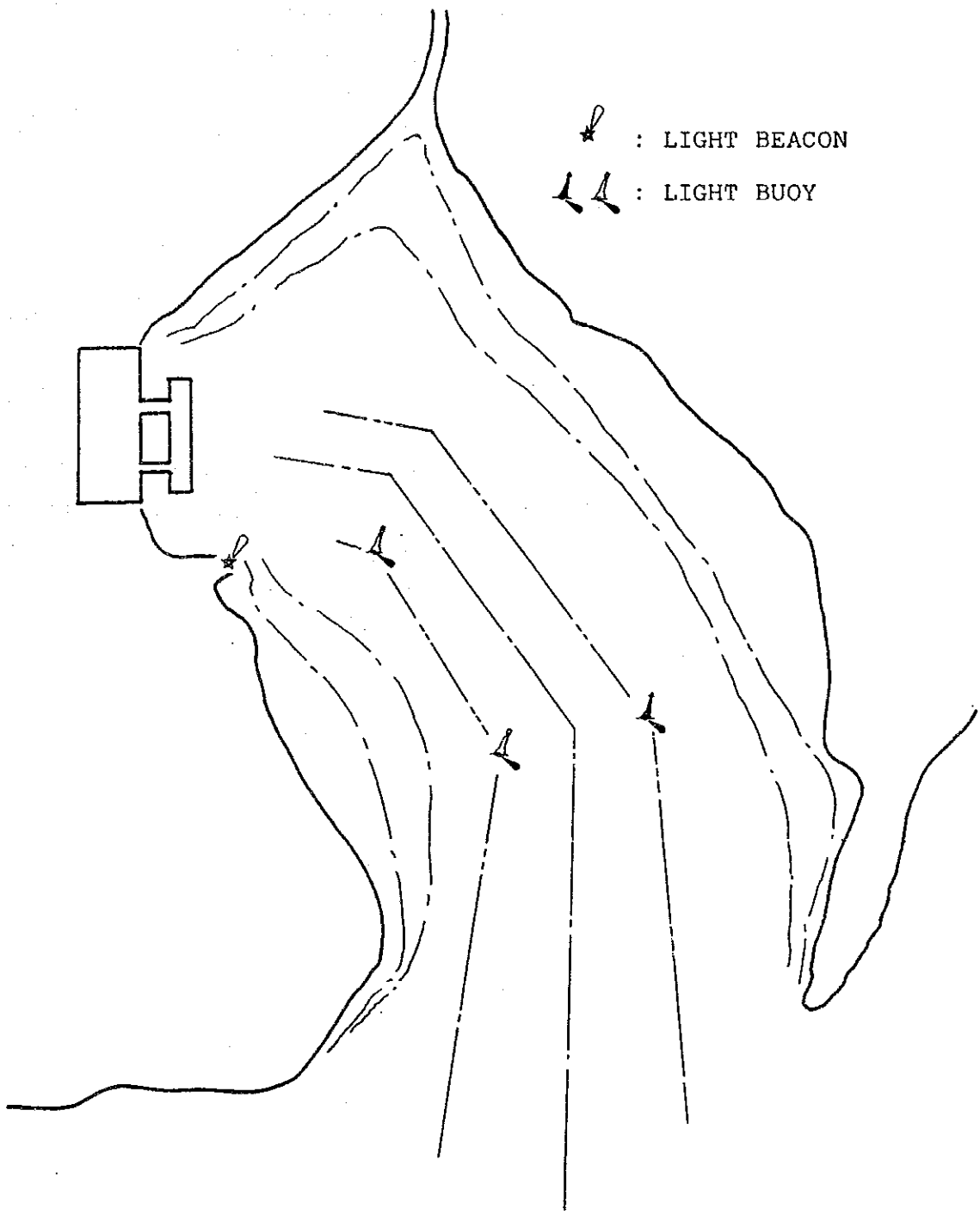


Fig. 4-3-1/3 Model of Aids to Navigation Arrangement for Trunk Port



(C) Number of Visual Aids to be Developed

As described in Section 4-2-2, (2), 'Forecast for Needs of Visual Aids to Navigation up to the Year 2000', the reasonable number of visual navaids to be developed will be as follows:

Annual average growth rate ... 3.5 - 4.0%

Number of visual aids to be established ..... 800 - 953 units

On the other hand, forecast for the budgetary resources is made to estimate that the total amount respectively of US$338 million for foreign fund and of Rp 156,000 million for domestic fund will be required up to the year 2,000 for the development of aids to navigation.

However, this amount of resources needs to be allocated to the development of such other projects as for electronic navaids and also for supporting facilities as well as to the rehabilitation of existing aids to navigation. In view of the above, an estimate is made that about a half of the total budgetary resources will be allocated to the development of visual aids to navigation.

Table 4-3-1-(1)/2 gives the number of visual aids to be developed, which is estimated according to the selection criteria and the estimated resources.

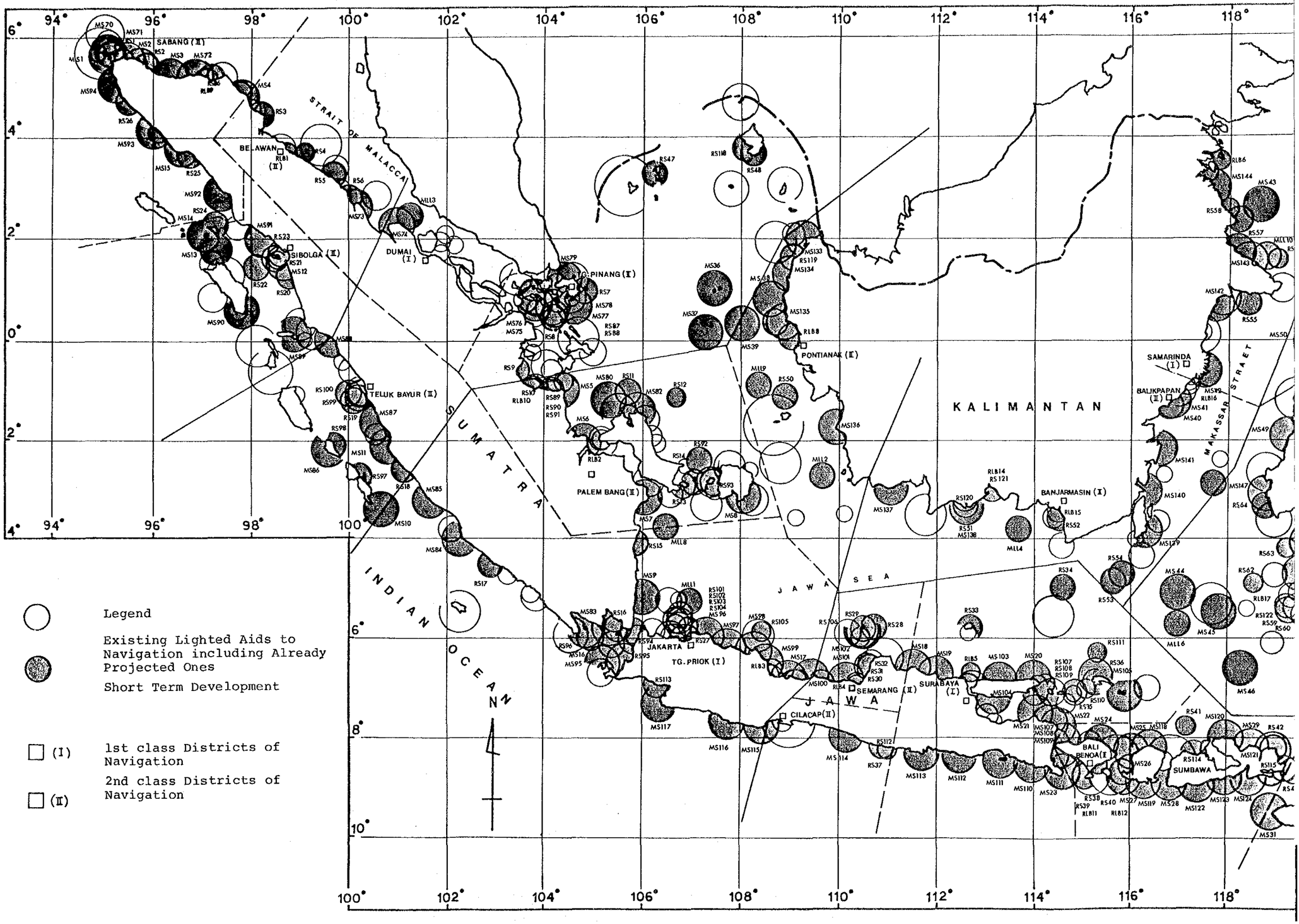
Table 4-3-1-(1)/2 Long Term Development Plan for Lighted Aids to Navigation

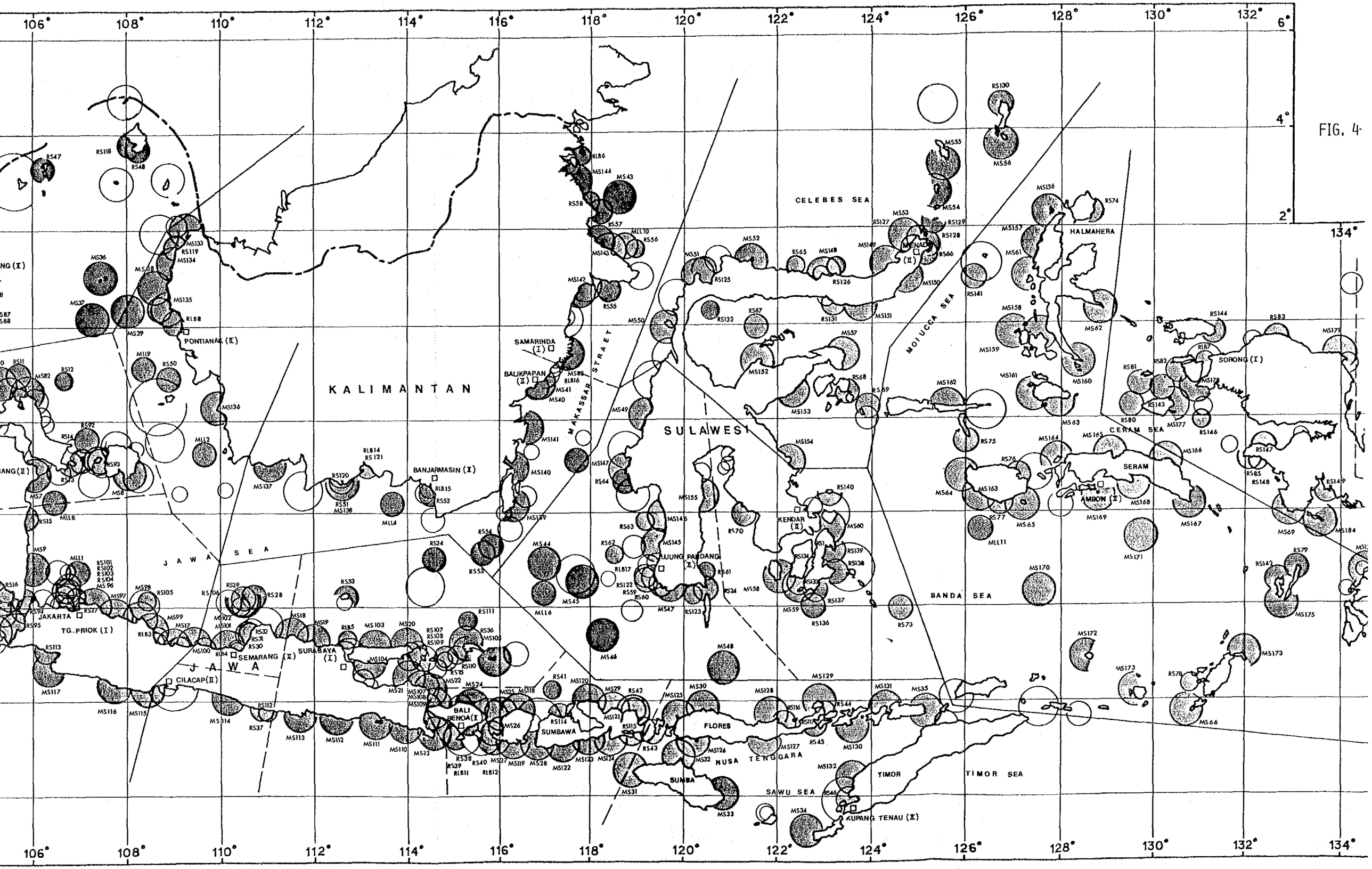
Item / Types of Aids	No. of Lights	Remarks	
		Existing	Total
Lighthouse (on land)	190	149	339
Lighthouse (off shore)	11	0	11
Light Beacon (incl. Harbour Lights)	335	599	934
RLB	18 (+4*)	2	24
Light Buoy	350	342	692
Total	904 (+4*)	1,092	2,000
No. of Units/100 NM		3.30	6.05

Notes: * shows the number in on-going projects for Malacca/Singapore Straits.

(D) Site Arrangement Plan for Visual Aids to Navigation

The site arrangement plan for the new lights having the range of 10 miles or upwards is shown in **Fig. 4-3-1-(1)/1** with the halo together with the existing ones. The details of lighthouses on land, lighthouses offshore, light beacons and resilient light beacons planned for long term development are given in **Table 4-3-1-(1)/3, /4, /5,** and **/6** respectively.


SABANG (II)
BELAWAN (II)
SIBOLGA (II)
DUMAI (I)
G. PINANG (II)
TELUK BAYUR (II)
PALEM BANG (II)
JAKARTA
TG. PRIOK (I)
CILACAP (II)
SEMARANG (II)
SURABAYA (I)
PONTIANAK (II)
SAMARINDA (I)
BALIKPAPAN (II)
BANJARMASIN (I)
BALI BENOA (I)
SUMBAWA
KALIMANTAN
STRAIT OF MALACCA
SUMATRA
INDIAN OCEAN
JAWA SEA
MAKASSAR STRAET
JAWA
Legend
Existing Lighted Aids to Navigation including Already Projected Ones
Short Term Development
(I) 1st class Districts of Navigation
(II) 2nd class Districts of Navigation


106°
108°
110°
112°
114°
116°
118°
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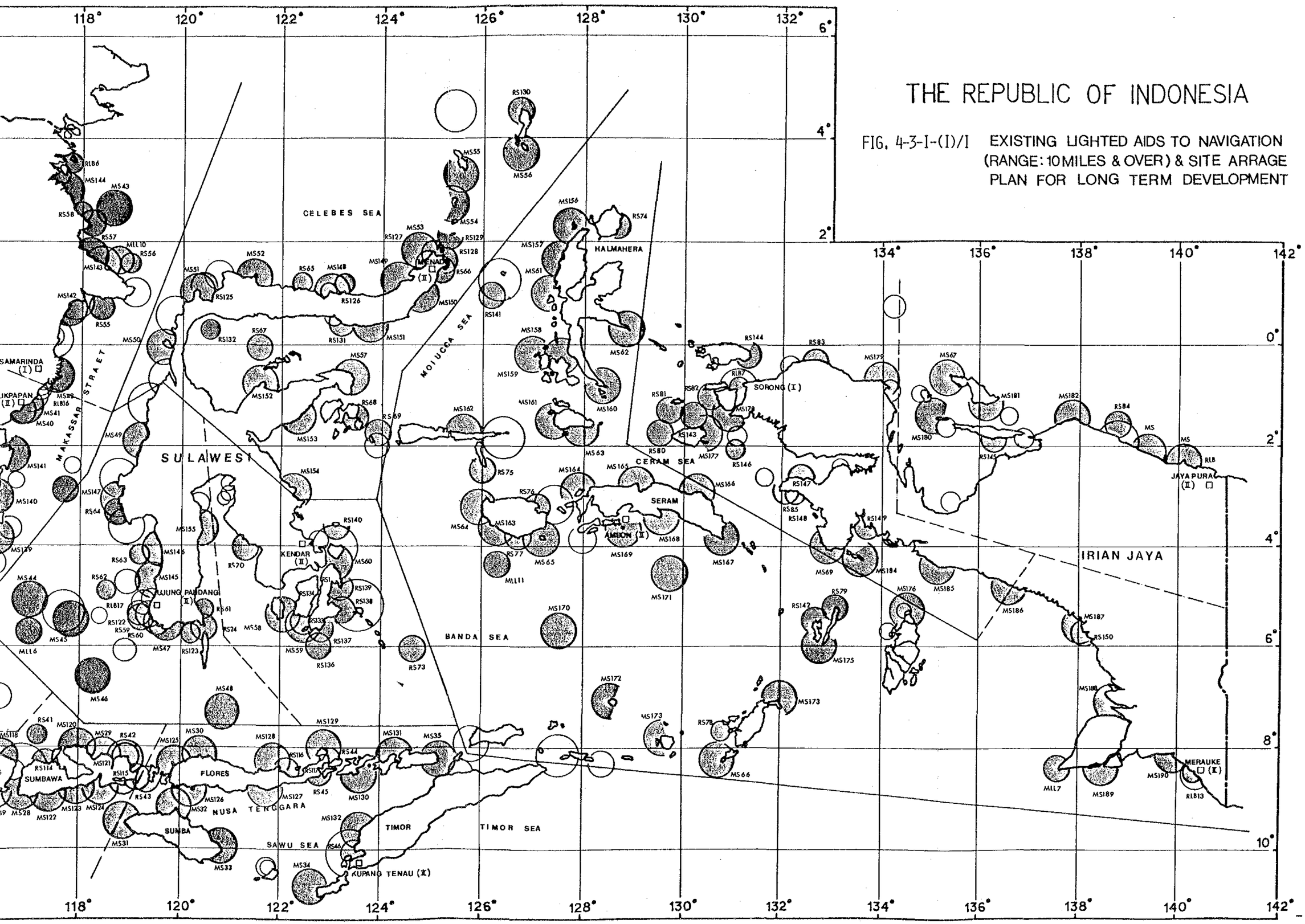
122°
124°
126°
128°
130°
132°
134°
6°
4°
2°
KALIMANTAN
SULAWESI
JAWA
JAWA SEA
CELEBES SEA
MOLUCCA SEA
CERAM SEA
BANDA SEA
TIMOR SEA
SAWU SEA
MAKASSAR STRAET
HALMAHERA
SERAM
FLORES
SUMBAWA
SUMBA
TIMOR
NUSA TENGGARA
PONTIANAK (II)
SAMARINDA (I)
BALIKPAPAN (II)
BANJARMASIN (I)
MENADO (II)
KENDARI (II)
LUJUNG PANDANG (II)
AMBON (II)
SORONG (I)
JAKARTA
TG. PRIOK (I)
CILACAP (II)
SEMARANG (II)
SURABAYA (I)
BALI BENOA (I)
KUPANG TENAU (II)

FIG. 4

THE REPUBLIC OF INDONESIA

FIG. 4-3-1-(I)/1 EXISTING LIGHTED AIDS TO NAVIGATION (RANGE: 10 MILES & OVER) & SITE ARRAGE PLAN FOR LONG TERM DEVELOPMENT



Long Term Development Plan for Visual Aids

Table 4-3-1-(1)/3 Development of Lighthouses (on land)

Table 4-3-1-(1)/4 Development of Lighthouses (off shore)

Table 4-3-1-(1)/5 Development of Light Beacons

Table 4-3-1-(1)/6 Development of Resilient Light Beacons

Remarks:

MS	Lighthouse (on land)
MLL	Lighthouse (off shore)
RS	Light Beacon
RLB	Resilient light beacon
(P)	: for Port
(S)	: from Seawards
(T)	: for Traffic Route

Table 4-3-1-(1)/3 Development of Lighthouses (on Land)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS1	Pu. BUNTA	20	N- 5-33 95-09	Landfall (T)
MS2	Uj. PIDIE	20	N- 5-30 95-53	Landfall (S)
MS3	Tg. RAJA	20	N- 5-13 96-28	Landfall (S)
MS4	Tg. PEUREULA	20	N- 4-53 97-53	Landfall (S)
MS5	Tg. DYABUNG	20	S- 1-01 104-21	Landfall (T)
MS6	BATAKARANG	20	S- 2-01 104-51	Landfall (T)
MS7	LUCIPARAT	20	S- 3-13 106-04	Landfall (T)
MS8	AYAR MASIN	20	S- 3-14 108-23	Landfall (S)
MS9	Pu. SEGAMA	20	S- 5-10 106-06	Landfall (S)
MS10	SANDING	20	S- 3-28 100-39	Landfall (S)
MS11	Uj. TANJUNG	20	S- 2-09 100-50	Landfall (S)
MS12	TUNGKUS NASI	20	N- 1-35 98-41	Landfall (P)
MS13	SERANGBAUNG	20	S- 1-44 97-26	Landfall (T)
MS14	Pu. BENGKARU	20	N- 2-02 97-07	Landfall (P)
MS15	Uj. RAJA	20	N- 3-44 96-32	Landfall (S)
MS16	Tg. LESUNG	20	S- 6-28 105-40	Landfall (P)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS17	Tg. LOSARI	20	S- 6-45 108-49	Landfall (S)
MS18	Tg. BENDOH	20	S- 6-37 111-29	Landfall (S)
MS19	Tg. AWER AWER	20	S- 6-46 111-57	Landfall (S)
MS20	MADARA	20	S- 6-52 113-56	Landfall (S)
MS21	Tg. PATJINAN (PACINAAN)	20	S- 7-37 114-02	Landfall (P)
MS22	Pu. MENDIANGA	20	S- 8-05 114-31	Landfall (T)
MS23	Tg. BANTENAN	20	S- 8-46 114-31	Landfall (S)
MS24	Tg. TEKURENAN	20	S- 8-11 115-29	Landfall (S)
MS25	Pu. TREWANGAN	20	S- 8-21 116-02	Landfall (T)
MS26	Pu. PO	20	S- 8-42 115-58	Landfall (P)
MS27	Tg. BATU GENDANG	20	S- 8-49 115-50	Landfall (T)
MS28	Tg. AMAT	20	S- 8-58 116-43	Landfall (T)
MS29	Tg. NAROE	20	S- 8-19 119-00	Landfall (T)
MS30	Tg. TORO BESI	20	S- 8-14 120-26	Landfall (S)
MS31	Tg, KAROSSO	20	S- 9-30 118-58	Landfall (S)
MS32	Tg. SASAR	20	S- 9-16 119-56	Landfall (S)
MS33	Tg. UNDU	20	S- 10-05 120-50	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS34	Pu. DAO B.	20	S- 10-48 122-38	Landfall (S)
MS35	Tg. LAISUMBU	20	S- 8-19 125-07	Landfall (S)
MS36	Pu. TAHBELAN	20	N- 1-00 107-36	Landfall (T)
MS37	PEDYANTANG	20	N- 0-07 107-13	Landfall (T)
MS38	Pu. LEMUKUTAN	20	N- 0-48 108-42	Landfall (S)
MS39	Pu. PENGIKI	20	N- 0-15 108-02	Landfall (T)
MS40	Tg. JUMALAI	20	S- 1-22 116-44	Landfall (P)
MS41	Tg. MANGGAR	20	S- 1-11 116-59	Landfall (P)
MS42	Tg. MABAYOR	20	S- 0-45 117-35	Landfall (P)
MS43	Tg. BALI TUWATAN	20	N- 2-33 118-33	Landfall (T)
MS44	Pu. SAHARU	20	S- 5-05 117-03	Landfall (T)
MS45	DOANG DOANGAN	20	S- 5-25 117-56	Landfall (T)
MS46	LONG KOITONG	20	S- 6-41 118-16	Landfall (T)
MS47	Tg. BULO BULO	20	S- 5-42 119-43	Landfall (S)
MS48	BONE RATE	20	S- 7-23 121-05	Landfall (T)
MS49	Tg. LALERAH	20	S- 1-59 119-12	Landfall (S)
MS50	MANIMBAYA	20	N- 0-06 119-37	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS51	SEMATAN	20	N- 1-05 120-24	Landfall (P)
MS52	Tg. KANDI	20	N- 1-18 121-27	Landfall (S)
MS53	MANTAR AWE	20	N- 1-45 124-44	Landfall (S)
MS54	ULU SIAU	20	N- 2-44 125-24	Landfall (P)
MS55	Pu. BENGLAUT	20	N- 3-29 125-43	Landfall (S)
MS56	KABURUANG	20	N- 3-58 126-49	Landfall (S)
MS57	Tg. TALABU	20	S- 0-46 123-27	Landfall (S)
MS58	TELAGA BESAR	20	S- 5-30 122-03	Landfall (T)
MS59	Tg. HASSIGA	20	S- 5-41 122-28	Landfall (T)
MS60	Tg. BUTON	20	S- 4-23 123-04	Landfall (T)
MS61	HIRI (HALMAHERA)	20	N- 0-55 127-19	Landfall (P)
MS62	Tg. NGOTOPORO	20	N- 0-13 128-53	Landfall (S)
MS63	Tg. WOOI	20	S- 1-43 128-01	Landfall (S)
MS64	Pu. TENGAH	20	S- 3-14 125-59	Landfall (S)
MS65	AMBELAU	20	S- 3-53 127-13	Landfall (T)
MS66	Tg. ARO USU	20	S- 8-20 130-45	Landfall (S)
MS67	Tg. MANDUNDI	20	S- 0-39 135-17	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS68	MATTERER	20	S- 2-19 140-09	Landfall (S)
MS69	Tg. PAPISOI	20	S- 4-05 133-00	Landfall (S)
MS70	Uj. BAU	20	N- 5-54 95-13	Landfall (S)
MS71	Uj. BATEEPUTEH	20	N- 5-37 95-37	Landfall (P)
MS72	Uj. PEUSANGAN	20	N- 5-16 96-50	Landfall (S)
MS73	Tg. PERTANDANGAN	20	N- 2-43 100-13	Landfall (P)
MS74	Tg. SENEBUI	20	N- 2-19 101-02	Landfall (S)
MS75	DURIAN	20	N- 0-42 103-43	Landfall (T)
MS76	Tg. JANGKA	20	N- 0-52 103-43	Landfall (T)
MS77	GALANG BARU	20	N- 0-37 104-17	Landfall (T)
MS78	NUMBING	20	N- 0-44 104-45	Landfall (T)
MS79	Tg. SADING	20	N- 1-12 104-23	Landfall (P)
MS80	Pu. PEKATYANG	20	S- 1-10 105-18	Landfall (T)
MS81	Tg. GENTING	20	S- 1-42 105-21	Landfall (P)
MS82	Tg. GRASAK	20	S- 1-30 105-55	Landfall (S)
MS83	Tg. BATU KEBUTJUNG	20	S- 5-51 104-52	Landfall (P)
MS84	Uj. Tk. PUNGGUR	20	S- 3-56 102-18	Landfall (P)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS85	SEBLAT	20	S- 3-14 101-37	Landfall (S)
MS86	Tg.SUNAILIPIT	20	S- 2-15 99-33	Landfall (S)
MS87	Uj.BATU PANDANG	20	S- 1-31 100-37	Landfall (S)
MS88	Uj.MASANG	20	S- 0-18 99-48	Landfall (S)
MS89	Tg.FEIBU	20	N- 0-07 98-50	Landfall (T)
MS90	TELUK DALAM	20	N- 0-33 97-49	Landfall (S)
MS91	Uj.SIRABI	20	N- 2-02 98-15	Landfall (S)
MS92	Uj.MANGKI	20	N- 2-55 97-26	Landfall (S)
MS93	MEULABOH	20	N- 4-07 96-08	Landfall (P)
MS94	Uj.TANGKURA	20	N- 5-07 95-17	Landfall (S)
MS95	Tg.PARAT	20	S- 6-32 105-15	Landfall (T)
MS96	Tg.SEDARI	20	S- 5-58 107-21	Landfall (S)
MS97	Tg.BOBOS	20	S- 6-12 107-49	Landfall (S)
MS98	Tg.INDRAMAYU	20	S- 6-15 108-16	Landfall (S)
MS99	Tg.TANAH	20	S- 6-29 108-32	Landfall (P)
MS100	Tg.PEMALANG	20	S- 6-48 109-30	Landfall (S)
MS101	Tg.KOROWELANG	20	S- 6-52 110-10	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS102	KARIUH JAWA	20	S- 5-52 110-26	Danger
MS103	KETAPANG	20	S- 6-54 113-17	Landfall (S)
MS104	Pu. KAMBING	20	S- 7-19 113-13	Landfall (S)
MS105	KALISANGKA	20	S- 6-50 115-14	Landfall (S)
MS106	Tg. KIAU	20	S- 7-07 115-55	Landfall (S)
MS107	Tg. SEDANO	20	S- 7-50 114-28	Landfall (T)
MS108	Tg. JANGKAR	20	S- 7-45 114-14	Landfall (S)
MS109	Tg. SEMBULUNGAN	20	S- 8-27 114-23	Landfall (T)
MS110	KALONG	20	S- 8-35 113-55	Landfall (S)
MS111	Uj. TJARAT	20	S- 8-28 113-16	Landfall (S)
MS112	SEMPU	20	S- 8-27 112-42	Landfall (S)
MS113	SOLIHA	20	S- 8-23 111-46	Landfall (S)
MS114	WATES	20	S- 7-59 110-12	Landfall (S)
MS115	Tg. MADASARI	20	S- 7-48 108-30	Landfall (S)
MS116	Tg. GEDEH	20	S- 7-46 107-51	Landfall (S)
MS117	Tg. GETEING	20	S- 7-22 106-24	Landfall (S)
MS118	MARBU	20	S- 8-12 116-20	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS119	Tg. BUNGKULAN	20	S- 8-58 116-22	Landfall (S)
MS120	Tg. PAKIDJONGAN	20	S- 8-05 117-55	Landfall (S)
MS121	Tg. BATU BESAR	20	S- 8-15 118-30	Landfall (S)
MS122	Tg. LESSEK	20	S- 9-03 117-26	Landfall (S)
MS123	Tg. MATA	20	S- 8-57 117-54	Landfall (S)
MS124	TORO DORO	20	S- 8-53 118-30	Landfall (S)
MS125	SERAJA BESAR	20	S- 8-23 119-51	Landfall (T)
MS126	TOREN EIL	20	S- 8-54 120-17	Landfall (S)
MS127	Tg. IYA	20	S- 8-54 121-39	Landfall (S)
MS128	PALU	20	S- 8-22 121-43	Landfall (T)
MS129	Tg. KOPONDAI	20	S- 8-02 122-50	Landfall (S)
MS130	Tg. ATADEI	20	S- 8-35 123-33	Landfall (S)
MS131	Tg. MUNA	20	S- 8-11 124-20	Landfall (T)
MS132	Tg. MAS	20	S- 9-39 123-41	Landfall (S)
MS133	Tg. API	20	N- 1-57 109-20	Landfall (S)
MS134	RAYA	20	N- 1-15 109-00	Landfall (S)
MS135	Tg. BANGKA	20	N- 0-20 108-55	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS136	Tg. BERAS BASAH	20	S- 1-50 109-55	Landfall (S)
MS137	Tg. SELAKA	20	S- 3-04 111-00	Landfall (S)
MS138	KUMAI	20	S- 3-28 112-33	Landfall (P)
MS139	Tg. SELOKA	20	S- 3-54 116-18	Landfall (S)
MS140	Tg. DOWN	20	S- 3-08 116-16	Landfall (P)
MS141	Tg. ARU	20	S- 2-10 116-35	Landfall (P)
MS142	Tg. BUNGALUN	20	N- 1-22 117-42	Landfall (S)
MS143	Tg. PERUPU	20	N- 1-46 118-04	Landfall (P)
MS144	Tg. BELANAK	20	N- 2-53 117-43	Landfall (P)
MS145	Tg. TUA	20	S- 4-45 119-29	Landfall (T)
MS146	Tg. BODJO	20	S- 4-05 119-36	Landfall (P)
MS147	Tg. ONGKONA	20	S- 3-05 118-47	Landfall (P)
MS148	Tg. BESAR	20	N- 0-57 122-57	Landfall (P)
MS149	Tg. LAINPONGI(SIDATE)	20	N- 1-10 124-20	Landfall (S)
MS150	BENTENAN	20	N- 0-59 124-53	Landfall (S)
MS151	Tg. DOMINANGO	20	N- 0-18 123-46	Landfall (S)
MS152	Tg. API	20	S- 0-48 121-39	Landfall (T)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS153	TOILI	20	S- 1-27 122-24	Landfall (T)
MS154	PADABALE(LALOMPA)	20	S- 2-52 122-20	Landfall (S)
MS155	Tg. LOKO-LOKO	20	S- 3-45 120-27	Landfall (S)
MS156	NORTH LOLODA Is.	20	N- 2-11 127-45	Landfall (S)
MS157	SIDANGA	20	N- 1-39 127-29	Landfall (S)
MS158	Tg. BATU SOMBO	20	S- 0-18 127-33	Landfall (T)
MS159	LATA-LATA	20	S- 0-16 127-01	Landfall (S)
MS160	Tg. LIBOBO	20	S- 0-55 128-27	Landfall (S)
MS161	Tg. AKE LAHO	20	S- 1-40 127-24	Landfall (S)
MS162	Tg. LAMPAU	20	S- 1-48 125-47	Landfall (S)
MS163	BOBO	20	S- 3-39 126-18	Landfall (S)
MS164	BOANO	20	S- 2-56 127-55	Landfall (T)
MS165	Tg. NAHAA	20	S- 2-48 129-02	Landfall (P)
MS166	Tg. LAMA	20	S- 2-59 130-21	Landfall (S)
MS167	CERAM REI	20	S- 3-53 130-52	Landfall (T)
MS168	HAYA	20	S- 3-28 129-33	Landfall (P)
MS169	NUSA LAUT	20	S- 3-41 128-48	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS170	LUCIPARA Is.	20	S- 5-30 127-35	Landfall (T)
MS171	BANDA Is.	20	S- 4-33 129-56	Landfall (T)
MS172	DAMAR	20	S- 7-08 128-32	Landfall (S)
MS173	YALTUBUNG	20	S- 7-48 129-38	Landfall (S)
MS174	Tg. WAARLANGIER	20	S- 7-00 132-00	Landfall (S)
MS175	NOIKO	20	S- 5-57 132-42	Landfall (T)
MS176	WALILAU	20	S- 5-15 134-32	Landfall (S)
MS177	Tg. OPENTA	20	S- 1-50 130-25	Landfall (S)
MS178	SEGET	20	S- 1-27 131-05	Landfall (S)
MS179	Tg. SAWEBA	20	S- 0-44 133-59	Landfall (S)
MS180	MIOS NUM	20	S- 1-30 135-10	Landfall (S)
MS181	MOKMER(BIAK)	20	S- 1-11 136-08	Landfall (P)
MS182	CD. U. RVILLE	20	S- 1-28 137-55	Landfall (P)
MS183	BIRI	20	S- 2-08 139-23	Landfall (S)
MS184	TUMBU TUMBU	20	S- 4-16 133-29	Landfall (S)
MS185	Tg. NAMARIPI	20	S- 4-27 135-11	Landfall (S)
MS186	WAJETERI	20	S- 4-57 136-47	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MS187	Ha. AGAT	20	S- 5-43 138-05	Landfall (P)
MS188	DE JONG'S	20	S- 6-53 138-32	Landfall (P)
MS189	CAPEKUL	20	S- 8-19 138-47	Landfall (T)
MS190	SAM DUHANDE	20	S- 8-13 139-59	Landfall (P)

Following gives the on-going projects:

MS2, MS4, MS13, MS14, MS15, MS17, MS21, MS26, MS32, MS33, MS35
MS38, MS41, MS42, MS43, MS44, MS45, MS46, MS47, MS48, MS49
MS50, MS52, MS54, MS55, MS56, MS58, MS59, MS60, MS64, MS65

Table 4-3-1-(1)/4 Development of Lighthouses (offshore)

No.	N A M E	RANGE	LOCATION	R E M A R K S
MLL1	GOSONG ETNA	15	S- 5-18 106-54	Landfall
MLL2	CORY FORT REEF	15	S- 2-42 109-40	Landfall
MLL3	GOSONG PYRAMID	15	N- 2-25 101-21	Landfall
MLL4	GOSONG MALATAYUR	15	S- 3-48 113-38	Landfall
MLL5	SELATAN Pu.ABO(TAKATALLU)	15	S- 3-04 117-43	Landfall
MLL6	SIBALD BANK	15	S- 5-47 117-07	Landfall
MLL7	Tg.SOLAH	15	S- 8-27 137-40	Landfall
MLL8	CITY OF CARLISLE Bk.	15	S- 3-49 106-26	Landfall
MLL9	GRIEG REEF	15	S- 1-06 108-34	Landfall
MLL10	Kr.BESAR	15	N- 1-38 118-32	Landfall
MLL11	S-30NM OF BURU Is.	15	S- 4-18 126-16	Landfall

Table 4-3-1-(1)/5 Development of Light Beacons

No.	N A M E	RANGE	LOCATION	R E M A K S
RS1	Uj. EUNPEE	15	N- 5-36 95-11	Channel
RS2	SIGLI	15	N- 5-23 95-57	Entrance (P)
RS3	Uj. TAMIANG	15	N- 4-26 98-17	Landfall (P)
RS4	GOSONG BUNGA	10	N- 3-45 99-05	Danger
RS5	Pu. SALAHANAMA	15	N- 3-21 99-43	Danger
RS6	Tg. SIAPIAPI	15	N- 2-55 99-59	Landfall (P)
RS7	Pu. MARAPAS	15	N- 0-56 104-55	Channel
RS8	BATU BELAYAR	10	N- 0-24 104-15	Danger
RS9	Tg. LABU	15	S- 0-46 103-28	Entrance (P)
RS10	Tg. SOLOK	15	S- 1-00 103-48	Entrance (P)
RS11	DOKAN	15	S- 1-00 105-39	Danger
RS12	HAWKINS	10	S- 1-09 106-39	Danger
RS13	Tg. MURUNG	15	S- 3-02 106-53	Channel
RS14	Pu. CELAKA	15	S- 2-52 107-00	Channel
RS15	Tg. PASIR	15	S- 4-08 105-49	Entrance (P)
RS16	CUKU BLANTUNG	15	S- 5-41 105-31	Entrance (P)

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS17	MANA	15	S- 4-29 102-53	Landfall (S)
RS18	MUKO MUKO	15	S- 2-34 101-06	Landfall (S)
RS19	SIKOWAI	15	S- 1-09 100-19	Entrance (P)
RS20	Pu. ILIR	15	N- 1-16 98-43	Landfall (S)
RS21	LABU LABU	15	N- 1-35 98-35	Entrance (P)
RS22	Pu. BINTANAH	15	N- 1-28 98-10	Danger
RS23	MANSALAR	15	N- 1-40 98-33	Landfall(S)
RS24	Pu. BAGU	15	N- 2-17 97-24	Channel
RS25	SUSOH	15	N- 3-43 96-47	Entrance (P)
RS26	Uj. BARO	15	N- 4-39 95-32	Entrance (P)
RS27	NASSAU REEF	10	S- 5-49 106-50	Danger
RS28	GENTING	15	S- 5-51 110-36	Danger
RS29	KARIUM JAWA	15	S- 5-50 110-28	Danger
RS30	Pu. PANJANG	15	S- 6-35 110-37	Landfall (P)
RS31	JEPARA	15	S- 6-35 110-39	Entrance (P)
RS32	Tg. KUNIRAN	15	S- 6-34 110-39	Entrance (P)
RS33	Tg. MANTIGI	15	S- 5-43 112-41	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS34	Pu. KERAHIAN	15	S- 5-06 114-36	Landfall (S)
RS35	Pu. KAHUDI	15	S- 7-06 114-47	Channel
RS36	KANGEAN	15	S- 7-00 115-17	Entrance (P)
RS37	Tg. NGAMBER	15	S- 8-14 111-05	Entrance (P)
RS38	Tg. MEBULU	15	S- 8-40 115-05	Landfall (S)
RS39	Tg. SERANGAN	10	S- 8-43 115-15	Entrance (P)
RS40	Tg. PANDANAN	15	S- 8-44 115-51	Channel
RS41	Gs. SEKUMOI	10	S- 7-51 117-12	Danger
RS42	SANGEANG	15	S- 8-14 119-01	Channel
RS43	LANG KOI	15	S- 8-44 119-22	Channel
RS44	Kr. SERBETE	10	S- 8-09 122-50	Channel
RS45	Pu. LANOTOBI	15	S- 8-36 122-50	Channel
RS46	KERA	15	S- 10-05 123-33	Entrance (P)
RS47	Tg. PEDAS	15	N- 3-14 106-12	Entrance (P)
RS48	Tg. PIAN PADANG	15	N- 3-39 108-18	Landfall (S)
RS49	Pu. SITINJAN	15	N- 0-21 108-44	Landfall (S)
RS50	Pu. LEMAN	15	S- 1-17 108-53	Channel

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS51	Tg. SIAHOK	15	S- 3-23 112-33	Entrance (P)
RS52	Tg. BURUNG	15	S- 3-33 114-31	Entrance (P)
RS53	KALAMBAU	15	S- 4-55 115-39	Landfall (S)
RS54	MATASIRI	15	S- 4-49 115-48	Landfall (S)
RS55	Pu. BIRAH BIRAHAN	15	N- 0-41 118-27	Danger
RS56	Kr. BILANG BILANGAN	10	N- 1-34 118-57	Danger
RS57	PANDYANG	15	N- 2-23 118-12	Danger
RS58	Kr. BALIK TABA	10	N- 2-30 118-00	Danger
RS59	Tg. JEMBATAN	15	S- 5-34 119-15	Channel
RS60	Tg. LAIKANG	15	S- 5-36 119-27	Landfall (S)
RS61	KARANG MALABIRI	10	S- 5-15 120-26	Danger
RS62	TAKA BAKANG	10	S- 4-58 118-33	Danger
RS63	Kr. PANKAMANDRA	10	S- 4-16 119-17	Danger
RS64	Tg. CINRANA	15	S- 3-19 118-50	Entrance (P)
RS65	Kr. BULIOGUT	10	N- 1-08 122-25	Danger
RS66	BATU KAPAL	15	N- 1-32 125-17	Channel
RS67	UNA UNA	15	S- 0-10 121-36	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS68	Pu. BAKAKANG	15	S- 1-35 123-27	Channel
RS69	TEMPAU	15	S- 1-51 124-01	Channel
RS70	Pu. LAHBASINA	15	S- 4-04 121-19	Entrance (P)
RS71	Pu. KADATUA	15	S- 5-31 122-30	Channel
RS72	Pu. BATU SURI	15	S- 5-21 122-39	Channel
RS73	Pu. MORO-MORO	15	S- 6-07 124-37	Landfall (S)
RS74	Pu. TABAILENGI	15	N- 2-22 128-40	Entrance (P)
RS75	Tg. WAKA	15	S- 2-28 126-02	Landfall (S)
RS76	Tg. KARBAU	15	S- 3-16 127-07	Entrance (P)
RS77	Tg. WATINA	15	S- 3-47 126-43	Landfall (S)
RS78	BARA SADI	10	S- 7-48 130-48	Landfall (S)
RS79	Tg. BORONG	15	S- 5-17 133-08	Landfall (S)
RS80	NAMPALE	15	S- 1-47 129-37	Channel
RS81	Tg. TABEK	15	S- 1-17 129-43	Channel
RS82	SAGEWIN	15	S- 0-57 130-39	Channel
RS83	Tg. WIEIOS(VALSCHE CAPE)	15	S- 0-22 132-43	Landfall (S)
RS84	KUMAMBA	15	S- 1-36 138-44	Landfall (S)

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS85	P. EKKA	15	S- 2-58 132-07	Landfall (S)
RS86	LHOK SEUMAWE	15	N- 5-10 97-09	Entrance (P)
RS87	Pu. SELANGA	15	N- 0-30 104-21	Channel
RS88	ALOR	15	N- 0-28 104-18	Danger
RS89	KUALA BERBAK	10	S- 1-04 104-11	Entrance (P)
RS90	SIMPANG TUA	10	S- 1-16 104-10	Entrance (P)
RS91	SUNGAI DURIAN	10	S- 1-34 103-31	Entrance (P)
RS92	GASPAR	15	S- 2-25 107-04	Danger
RS93	Pu. SIKIDANG	15	S- 2-56 107-29	Channel
RS94	SANGIAN	15	S- 5-58 105-51	Channel
RS95	RAKATA	15	S- 6-09 105-26	Channel
RS96	Pu. HUNDU	15	S- 5-51 104-50	Channel
RS97	TOSUNGU/SIKAKAP	15	S- 2-46 100-13	Channel
RS98	SIUBAN	15	S- 2-11 99-44	Entrance (P)
RS99	LAUT	15	S- 1-08 100-10	Danger
RS100	KARANG STORT	10	S- 0-56 99-59	Danger
RS101	Pu. PANCA RIRANG B.	15	S- 5-27 106-34	Danger

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS102	Pu. UNTUNG JAWA	15	S- 5-58 106-42	Danger
RS103	KARANG JALAN	10	S- 6-02 106-46	Danger
RS104	Pel. PASAR IKAN	15	S- 6-06 106-48	Enrance (P)
RS105	NORTH REEF	10	S- 5-49 108-27	Danger
RS106	SVERRE REEF	10	S- 6-02 110-21	Danger
RS107	GILI RAJA	15	S- 7-14 113-47	Channel
RS108	GILI LAWAK	10	S- 7-12 114-03	Danger
RS109	GILI JANG	15	S- 6-59 114-14	Channel
RS110	KARANG TAKAT	10	S- 7-02 114-57	Danger
RS111	PRINS MAURITS REEF	10	S- 6-25 115-14	Danger
RS112	Tg. KARANG SEMANDA	10	S- 8-15 111-05	Entrance (P)
RS113	PELABUHAN RATU	15	S- 6-59 106-31	Entrance (P)
RS114	BADAS	10	S- 8-28 117-23	Entrance (P)
RS115	Tg. TORRO JAMPANG	15	S- 8-45 118-59	Entrance (P)
RS116	MAUMERE	15	S- 8-36 122-13	Entrance (P)
RS117	LARANTUKA	15	S- 8-17 123-01	Entrance (P)
RS118	SEDANAU	15	N- 3-48 108-42	Entrance (P)

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS119	SINTETE	15	N- 1-18 109-11	Entrance (P)
RS120	Pel. KUMAI	15	S- 3-25 112-33	Entrance (P)
RS121	SAMPIT	15	S- 3-11 112-59	Entrance (P)
RS122	TANA KEKE	15	S- 5-30 119-19	Channel
RS123	TAKA BOLOH	10	S- 5-48 120-13	Danger
RS124	SARONTANG	15	S- 5-41 120-19	Channel
RS125	KAPTAN	15	N- 1-04 120-27	Entrance (P)
RS126	Kr. JASINA	10	N- 1-03 123-09	Danger
RS127	Tg. LIKU(NOORD CAPE)	15	N- 1-45 124-59	Channel
RS128	Tg. PUISAN	15	N- 1-41 125-10	Channel
RS129	BIARO	15	N- 2-04 125-41	Landfall (S)
RS130	Tg. AMBORA	15	N- 4-32 126-45	Landfall (S)
RS131	Tg. TOMBALIATU	15	N- 0-18 123-16	Landfall (S)
RS132	Tlk. TOMINI	10	N- 0-22 120-30	Entrance (P)
RS133	Tg. KOLANDRIN	15	S- 5-21 122-38	Channel
RS134	Pu. TEBUTAN	15	S- 4-56 122-48	Channel
RS135	Tg. LOBA	15	S- 4-32 122-52	Channel

No.	N A M E	RANGE	LOCATION	R E M A R K S
RS136	BATU ATU	15	S- 6-12 122-45	Landfall (S)
RS137	Tg.BATU TURO	15	S- 5-41 122-47	Landfall (S)
RS138	Tg.KASSOLANATUHBI	15	S- 5-17 123-12	Channel
RS139	Tg. GORAH	15	S- 4-51 123-12	Landfall (S)
RS140	MANUI	15	S- 3-38 123-06	Landfall (S)
RS141	GUREDA	15	N- 0-59 126-09	Landfall (S)
RS142	Pu.KRUS	15	S- 5-35 132-39	Entrance (P)
RS143	FUILU	15	S- 1-22 130-13	Channel
RS144	Tg.HOMFAFA	15	S- 0-17 131-19	Landfall (S)
RS145	SERUI	15	S- 1-55 136-16	Entrance (P)
RS146	DARAH	10	S- 2-09 130-54	Danger
RS147	Tg.SEKAR	15	S- 2-41 132-25	Entrance (P)
RS148	Kr.METI METI	10	S- 2-57 132-17	Entrance (P)
RS149	Tg.BITSARA	15	S- 3-44 133-48	Entrance (P)
RS150	MASUK AGATS	10	S- 5-36 138-02	Entrance (P)

Following:

RS1, RS2, RS3, RS4, RS6, RS7, RS8, RS9, RS10, RS15
RS18, RS20, RS25, RS29, RS30, RS31, RS34, RS35, RS41
RS42, RS48, RS51, RS57, RS58, RS59, RS60, RS61, RS62
RS63, RS64, RS70, RS71, RS73, RS80, RS81

Table 4-3-1-(1)/6 Development of Resilient Light Beacons

No.	N A M E	RANGE	LOCATION	R E M A R K S
RLB1	BELAWAN	10	N- 4-01 98-50	Entrance of Belawan
RLB2	PALEMBANG	10	S- 2-09 104-58	Entrance of Palembang
RLB3	CIREBON	10	S- 6-32 108-51	Entrance of Cirebon
RLB4	SEMARANG	10	S- 6-54 110-24	Entrance of Semarang
RLB5	Tg. PEARK	10	S- 6-37 112-44	Entrance of Surabaya
RLB6	TARAKAN	10	S- 3-14 117-53	Entrance of Tarakan
RLB7	SORONG	10	S- 0-52 131-12	Entrance of Sorong
RLB8	PONTIANAK	10	N- 0-17 110-50	Entrance of Pontianak
RLB9	LOHK SEUMAWEH	10		Entrance of Lohk Seumaweh
RLB10	JAMBI	10		Entrance of Jambi
RLB11	BENOA	10		Entrance of Benoa
RLB12	LEMBER	10		Entrance of Lember
RLB13	MERAUKE	10		Entrance of Merauke
RLB14	SAMPIT	10		Entrance of Sampit
RLB15	BANJARMASIN	10		Entrance of Banjarmasin
RLB16	SAMARINDA	10		Entrance of Samarinda

No.	N A M E	RANGE	LOCATION	R E M A R K S
RLB17	Uj. PANDANG	10		Entrance of Uj. Pandang
RLB18	JAYAPURA	10		Entrance of Jayapura

(E) Development Schedule

The development schedule for lighted aids to navigation is made in a form of three phases up to the target year of 2,000 taking into account the following points: In the first phase development, priority is given to the Gateway system to urgently establish necessary navaids; consideration is made to try to provide the averaged budget distribution throughout the scheduled period (see **Fig. 4-3-1-(1)/3**); the budget for the first phase is slightly decreased because of inclusion of the on-going projects, which are as given below:

Number of Lighted Aids
included in
On-going Projects

Types of Navaids	No. of Units
Lighthouse (on land)	35 units
Lighthouse (off shore)	-
Light beacon (incl. harbour lights)	81 "
Light buoy	222 "
Total	338 units

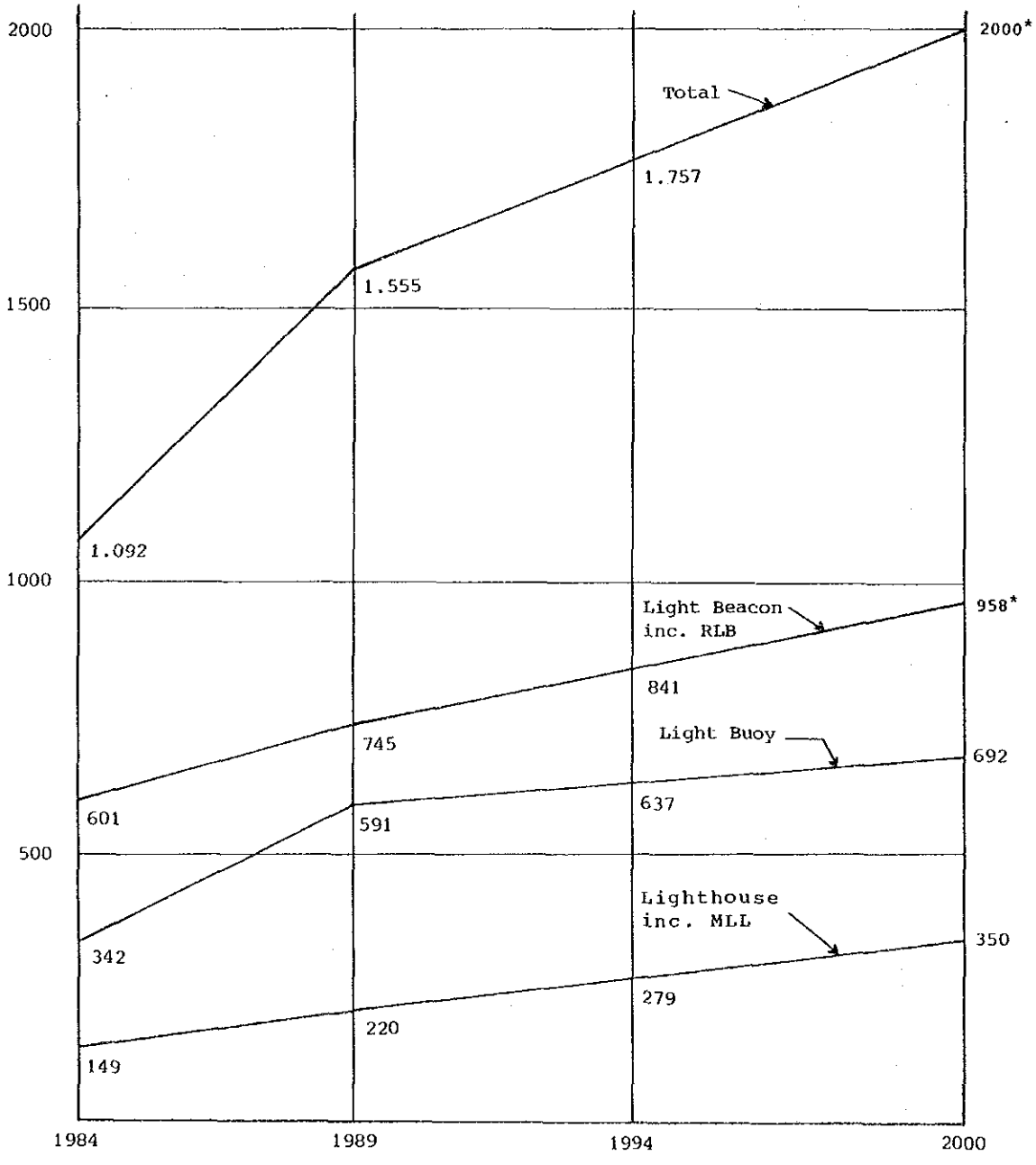
The overall development schedule of lighted aids to navigation is established as given in **Table 4-3-1-(1)/7** and **Fig. 4-3-1-(1)/2.**

Table 4-3-1-(1)/7 Overall Development Schedule for Lighted Aids to Navigation

Year / Type	1984	84/85-88/89		89/90-93/94		94/95-99/2000		Total
	Existing	Planned	Total	Planned	Total	Planned	Total	(Planned)
Lighthouse (on land)	149	69 (35)*	218	55	273	66	339	190(35)*
Lighthouse (off shore)	0	2	2	4	6	5	11	11
Light Beacon inc. Harbour Light	599	131 (81)*	730	92	822	112	934	335(81)*
Light Buoy	342	249 (222)*	591	46	637	55	692	350(222)*
RLB	2	8 (+4)**	14	5	19	5	24	18(+4)**
Total	1,092	459 (+4)** (342)*	1,555	202	1,757	243	2,000	904 (338)* (+4)**
Units/100 NM	3.30		4.7		5.32		6.05	

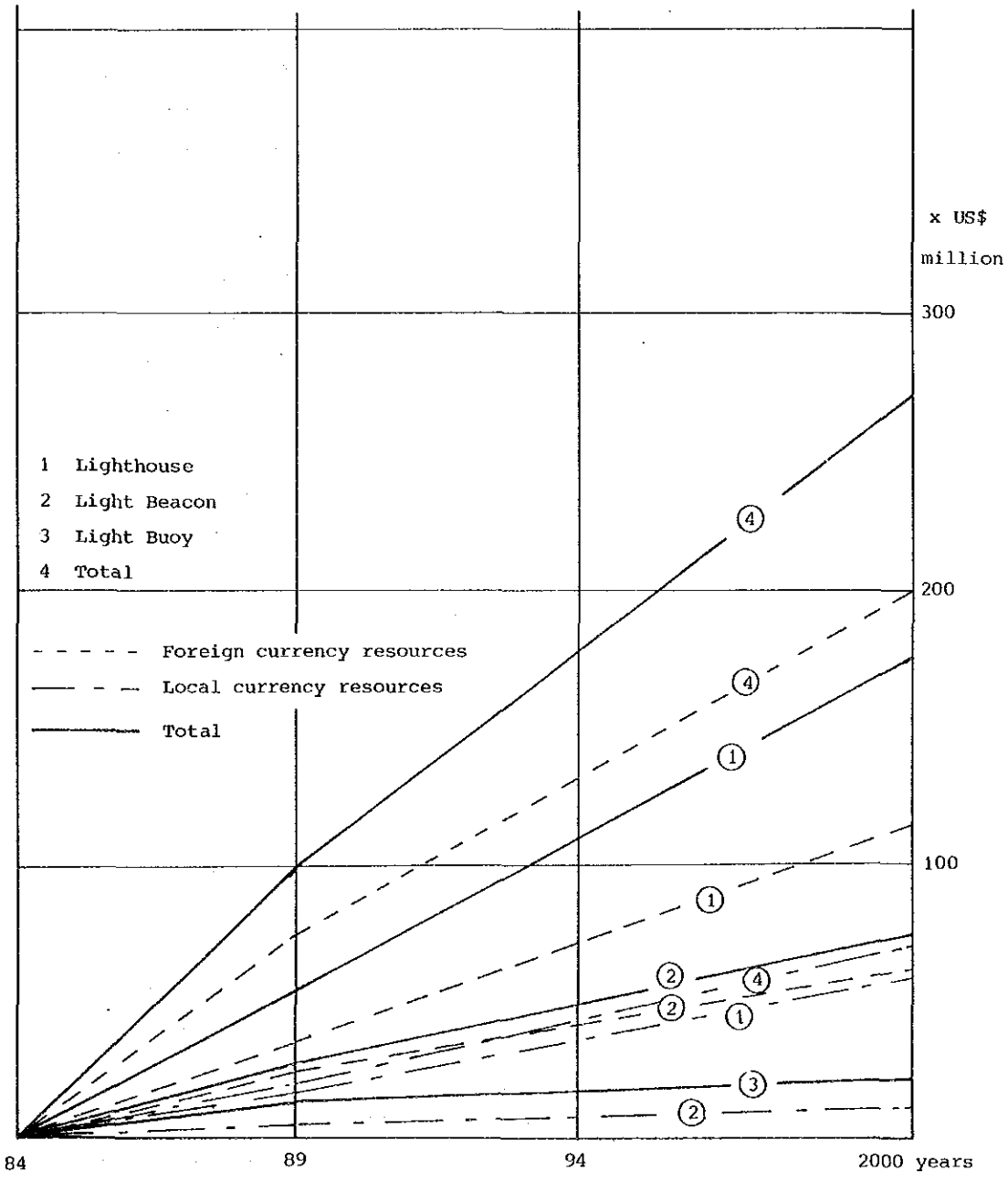
Notes: * ( ) shows the number of navaids included in the on-going projects.
** ( ) shows the number of RLB for Malacca/Singapore Straits.

Fig. 4-3-1-(1)/2 Development Schedule for Lighted Aids to Navigation with the Target Year of 2,000



Note: * includes the number of RLB's for Malacca/Singapore Straits

Fig. 4-3-1-(1)/3 Distribution of the Budget Required for Development of Visual Aids to Navigation



(F) Facility and Equipment Plan

The facility and equipment plan for visual aids to navigation is given below:

a) Lighthouse (on land)

Luminous range:	20 - 25 NM or over T=0.74
Geographical range:	20 NM or over h=5m
Tower:	
Structure:	Iron-framed or ferro-concrete (solid ground)
Foundation:	Survey to be needed, Concrete pile or concrete
Height:	Survey to be needed
Power source:	Engine generator, 7.5 KVA x 3
Associated facilities:	
Office:	35 m^2
Quarters:	35 m^2 x 5 families
Engine room + storage:	80 m^2
Fresh water tank:	15 m^3 x 5 ea.
Fence:	1 set
Jetty:	For isolated islands, etc.
Access road:	Survey needed
Site Area:	3,500 m^2

b) Lighthouse (off shore)

Luminous range:	20NM or over T = 0.74
Geographical range:	15NM or over

Tower:

Structure:	Cylindrical FRP or iron
Foundation:	Survey to be needed
Height:	12 m or over
Power source:	Engine generator, 7.5 KVA x 3

Associate facilities:

Watch room:	16m^2
Rest room:	16m^2
Engine room + storage:	108m^2
Fresh water tank	
Water tank	
Helideck:	484m^2

c) Light Beacon (on land)

Luminous range:	12 NM or over T=0.74
Geographical range:	16 NM or over

Tower:

Structure:	Iron-framed or ferro-concrete (solid ground)
Foundation:	Survey to be needed, Pile or ferroconcrete
Height:	Subject to survey with conditions that it should be higher than 30 m to overlook the trees nearby.
Power source:	Solar cells, commercial power + stand-by supply

Associated facilities:

Equipment room

+ storage:	4 m^2

Access road:	Survey needed
Site Area:	100 - 150 m^2

d) Light Beacon (off shore)

Luminous range:	10 NM or over
Geographical range:	10 NM or over
Tower:	
Structure:	Cylindrical FRP or iron
Foundation:	Concrete pile or steel pile, Survey to be needed
Height:	7 m
Power Source:	Solar cells
Associated facilities:	
Equipment room + storage:	2.6 m^2

e) Resilient Light Beacon (RLB)

Luminous range:	10 NM or over T=0.74
Geographical range:	10 NM or over
Tower:	
Structure:	Iron cylindrical, Aluminum on upper portion
Foundation:	Concrete sinker Survey to be needed
Height (above mean sea level):	7 m or over
Power source:	Solar cells

f) Light Buoy (Deep Water)

Luminous range:	6 NM or over T=0.74

Geographical range:	6 NM or over
Buoy:	
Material:	Iron
Diameter:	2,600 m/m or over
Weight:	Approx. 5.5 tons
Total height:	Approx. 8.5 m
Mooring:	
Chain:	32 mmø
Length:	Subject to oceanographic conditions
Sinker:	Concrete, Subject to oceanographic conditions
Power source:	Batteries, gas, solar cells or wave-activated generator

g) Light Buoy (Shallow Water)

Luminous range:	4 NM or over
Geographical range:	6 NM or over
Buoy:	
Material:	Iron
Diameter:	2400 m/m or over
Weight:	Approx. 3 tons
Total height:	Approx. 5 m
Mooring:	
Chain:	30 mmø
Length:	Subject to oceanographic conditions
Sinker:	Subject to oceanographic conditions
Power source:	Batteries, gas, wave-activated generator, solar cells

2) Electronic Aids to Navigation

(A) Development Criteria for Electronic Aids to Navigation

The development criteria for electronic aids to navigation is established in reference to the water areas defined in Section 4-2-2, (3), 3) as given below:

(a) Medium-wave radiobeacon stations

a) Very Important Waters (VIW):

Cross bearings by two or more stations may generally be obtainable throughout the water areas.

b) Important Waters (IW) and Main Waters (MW): Single bearing may be obtainable in almost 100% probability along main traffic routes.

As regards system-wise criteria, the medium-wave radiobeacon stations planned in this study function both as directional beacon and as omni-directional beacon: The directional radiobeacon is simple and easy to use, not requiring any technical skills, and only a simple type of receiver is required. It is an economical system for users. The omni-directional radiobeacon requires a special equipment of radio direction finder on board for its use, and is, therefore, economically more expensive.

The actual status of domestic shipping in Indonesia is that a great number of motorized sailing

and sailing ships occupy considerable part of it together with small to medium sized steel ships in service in such main shipping routes as RLS, etc.

The directional radiobeacon is useful both for small type of ships including fishing vessels which have no power supply onboard and for large vessels as well, while the omni-directional radiobeacon is used by limited number of users, i.e. direction finder fitted vessels, but is important especially in view of SOLAS convention for oceangoing vessels.

(b) Radar Beacon Station

a) VIW; Radar beacons are to be installed to indicate main landfalls, navigation dangers, and turning points widely covering the whole areas.

b) IW; Same as VIW

c) MW; Radar beacons are to be installed to indicate the main landfalls and navigation dangers in the areas.

The concept of establishing radar beacon stations is in conformity with that of the medium-wave radiobeacon stations.

(B) System Criteria

(a) Medium-wave radiobeacon station

a) The output power shall be so designed that a directional radiobeacon station may provide the service coverage of 100 nautical miles range during daytime (ref. **APPENDIX-13**).

b) The output power shall be so designed that an omni-directional radiobeacon station may provide the service coverage of 200 nautical miles range during daytime (ref. **APPENDIX-13**).

c) A radiobeacon station shall be able to provide the both services of directional and omni-directional radiobeacons.

d) The operation of a radiobeacon station shall be fully automated.

(b) Radar beacon (Racon) station

a) The frequency band to be applied shall be X-band, which is currently in its main use.

b) The covering range of a radar beacon station shall be 10 - 20 NM for that of coastal installation such as co-location at coastal lighthouse, etc., and about 5 NM for that of small-type installed as navigational danger.

(C) Site Arrangement Plan for Electronic Aids to Navigation

(a) Medium-wave Radiobeacon Stations

a) VIW;

The geographical coverage gaps existing in VIW are to be filled supplementing the service coverages of the eighteen (18) stations, 1st Phase Implementation of medium-wave radiobeacon stations.

The Jawa Sea areas are the Very Important Waters, where three of the four Gateway ports are situated creating congested traffic throughout together with RLS routes running through and a great number of small types of motorized sailing and sailing ships crossing by, in addition to a number of fishing grounds where many fishing boats engage in operation day and night. Occurrence of marine casualties as a whole stands highest in the areas. The complete coverage of medium-wave radiobeacons in Jawa Sea is urgently needed.

b) IW and MW;

The service coverages are to be provided to cover main traffic routes running through in IW and MW.

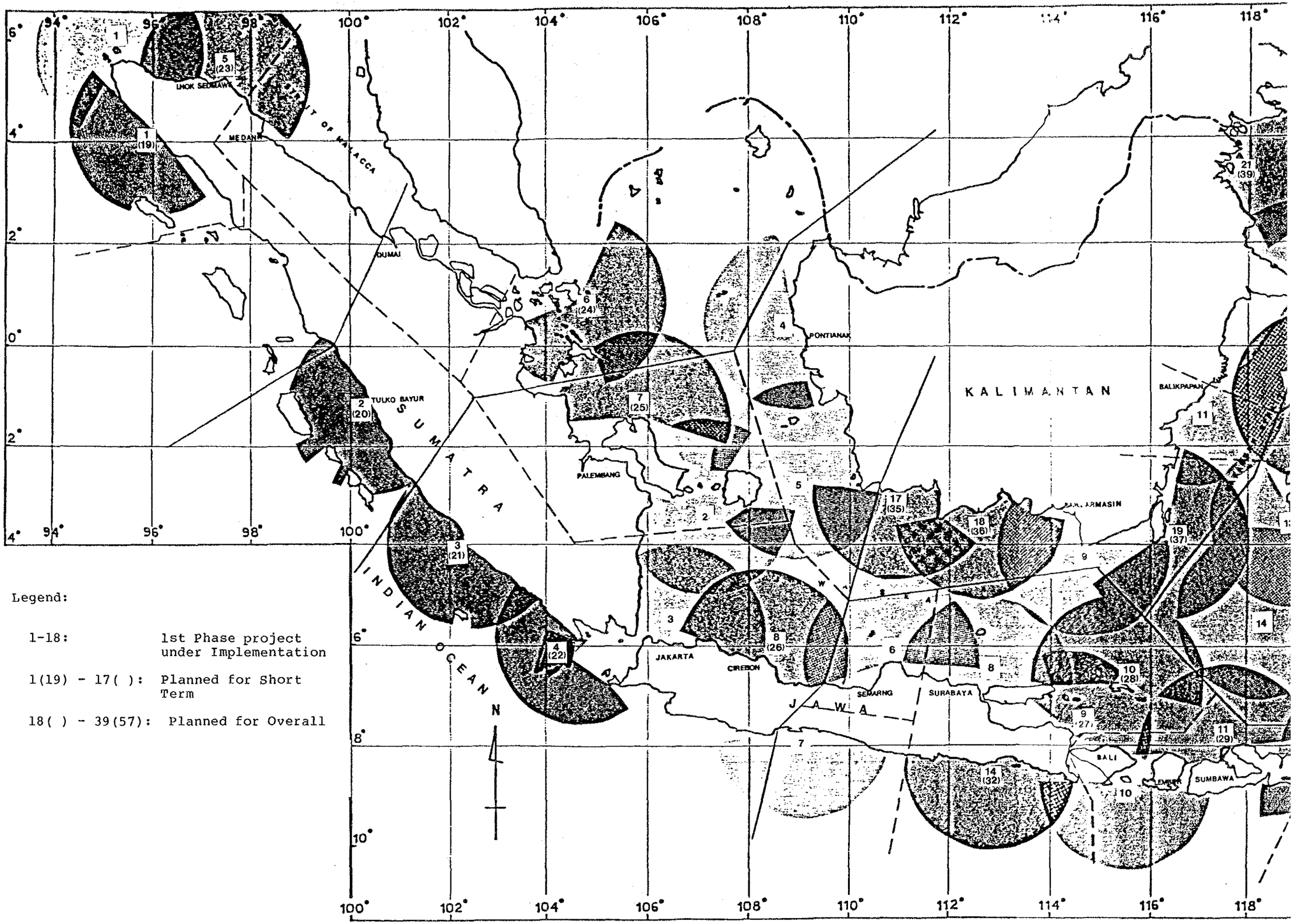
The Important Waters - Makassar Strait, Flores Sea, Ceram Sea, the sea areas of

south-west of Sumatera and north-west Banda Sea - have the main traffic routes running through for Gateway to Collector ports, RLS and Local services. The occurrence rate of marine accidents is also high in these areas due to the high density of traffic including a number of small ships engaged in fishing operations.

The Important Waters need to be covered by the radiobeacons immediately following VIW.

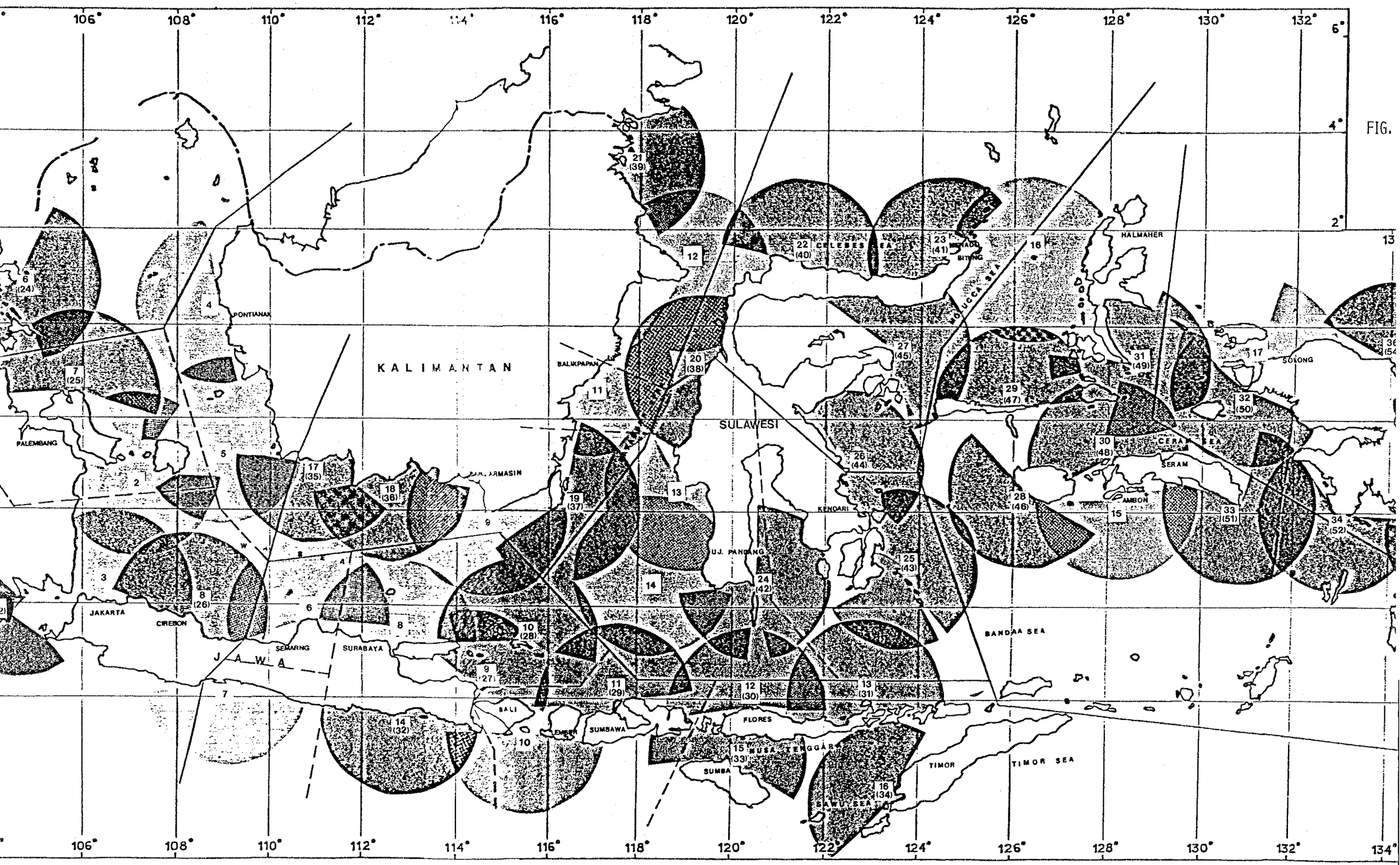
The Main Waters are the areas of north-west Irian, Molucca Sea and Banda Sea, where the traffic routes between Collector to Collector ports, Collector to Trunk ports run through and the Local shipping and Pioneer services operate, in addition to a number of small ships including fishing vessels.

The site allocation of medium-wave radiobeacon stations for the long term development is shown in **Fig. 4-3-1-(1)/4**, and a list of the stations is given in **Table 4-3-1-(1)/7.**



Legend:

1-18:	1st Phase project under Implementation
1(19) - 17( ):	Planned for Short Term
18( ) - 39(57):	Planned for Overall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PONTIANAK
BANJARMASIN
BALIKPAPAN
PALEMBANG
JAKARTA
CIREBON
SEMARANG
SURABAYA
JAWA
BALI
SUMBAWA
FLORES
SUMBA
TIMOR
TIMOR SEA
BANDAA SEA
CELEBES SEA
MOLUCCA SEA
SERAM SEA
MANADO
BITUNG
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FIG.

THE REPUBLIC OF INDONESIA

FIG. 4-3-I-(I)/4 MF RADIOBEACON STATIONS UNDER IMPLEMENTATION & SITE ARRANGEMENT PLAN (DIRECTIONAL) FOR LONG TERM DEVELOPMENT

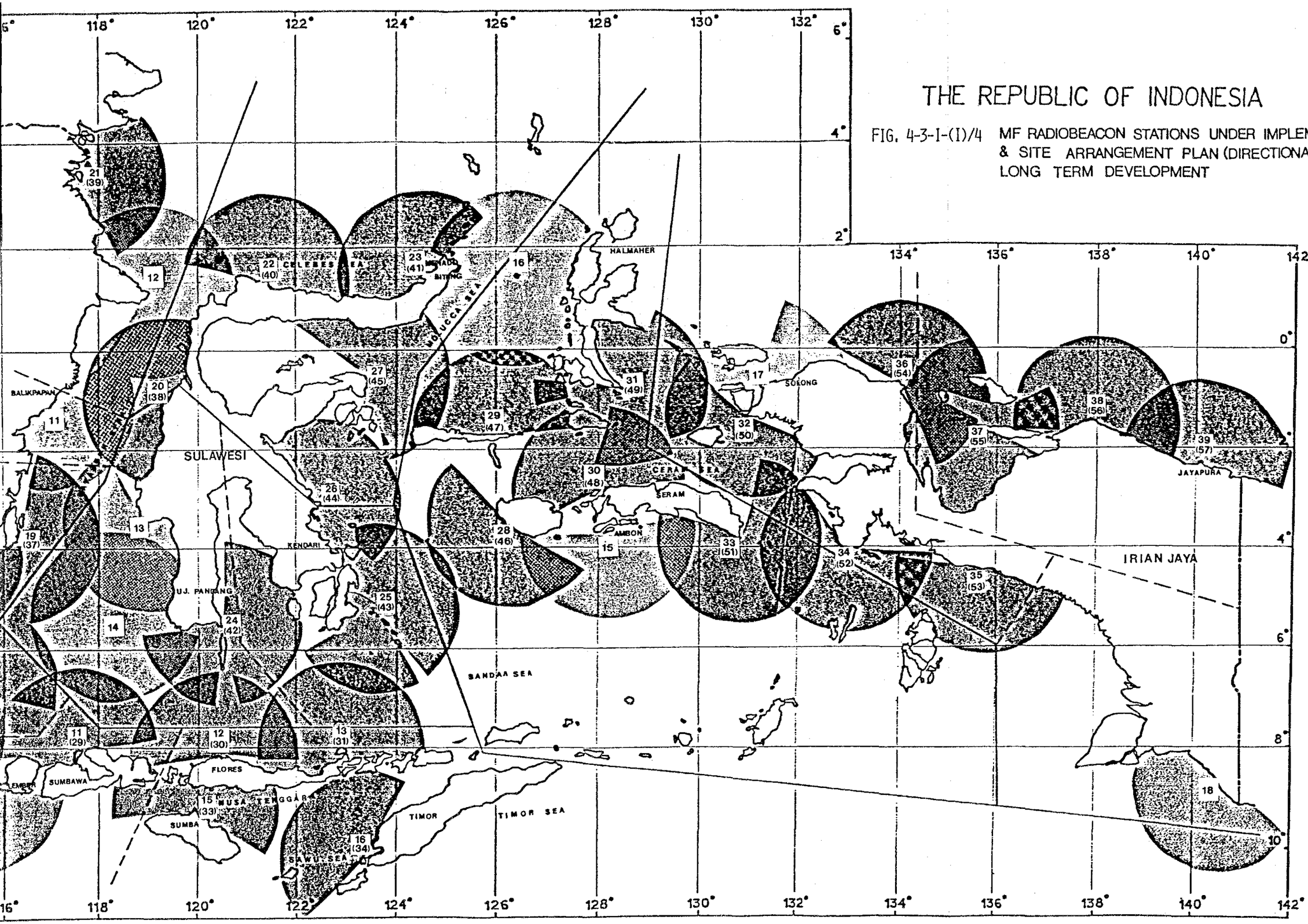


Table 4-3-1-(1)/8 List of Medium-wave Radiobeacon Stations - Overall Development Plan -

No.	STP# No.	Name of Station	LAT/LON	Covering area	KANWIL	Weather Broad-casting	District NAVIGASI	Monitor Station	Remarks
1 (19)	-	MEULABOH	N 04° 07' E 96° 08'	North coast of SUMATERA	I		SABANG	SABANG	T to C route (LHOK SEUMAWEH-SIBOLGA)
2 (20)	1	TELUK BAYAR	S 01° 05' E100° 20'	South-west coast of SUMATERA	II		TELUK BAYAR	TELUK BAYAR	C to G route (TG PRIOK-PADANG)
3 (21)	2	Tg. KERBAN	S 03° 53' E102° 18'	South-west Coast of SUMATERA	II	o	TELUK BAYAR	TELUK BAYAR	C to G route (TG PRIOK-PADANG)
4 (22)	3	BELIMBING	S 05° 56' E104° 34'	SUNDA STRAIT	III	o	TG. PRIOK	TG. PRIOK	C to G route (TG PRIOK-PADANG)
5 (23)	-	TG. JAMBO AYE	N 05° 15' E 97° 29'	North SUMATERA	I	o	SABANG	SABANG	C to G route (BELAWAN-LHOK SEUMAWEH)
6 (24)	4	TG. PINANG	N 00° 55' E104° 35'	East Coast of SUMATERA	II	o	TG. PINANG	DUMAI	G to G route (BELAWAN-TG. PEPAK)
7 (25)	5	BANGKA (TG. SAMAK)	S 01° 28' E105° 55'	East of SUMATERA	III	o	PALEMBANG	PALEMBANG	G to G route (BELAWAN-TG. PERAK)
8 (26)	6	INDRAMAYU	S 06° 15' E108° 16'	JAVA SEA	III		TG. PRIOK	CIREBON RADIO	G to G route (TG PRIOK-UJUNG PANDANG)
9 (27)	-	TG. JANGKAR	S 07° 45' E114° 28'	BALI SEA	IV		SURABAYA	SURABAYA	C to G route (TG PERAK-LEMBER)

No.	STP# No.	Name of Station	LAT/LON	Covering area	KANWIL	Weather Broad-casting	District NAVIGASI	Monitor Station	Remarks
10 (28)	7	ARIASA	S 06° 47' E115° 20'	JAVA SEA	IV		BENOA	SURABAYA	G to G route (TG PRIOK-UJUNG PANDANG)
11 (29)	-	P. MEDANG	S 08° 08' E117° 20'	FLORES SEA	IV		BENOA	UJUNG PANDANG	C to G route (TG PERAK-KUPANG)
12 (30)	-	REO	S 08° 10' E120° 25'	FLORES SEA	IV		KUPANG	KUPANG	Main fishing areas in FLORES SEA
13 (31)	-	TG. KOPONDEI	S 08° 02' E122° 50'	FLORES SEA	IV	o	KUPANG	KUPANG	Main fishing area in FLORES SEA
14 (32)	-	PU. SEMPU	S 08° 27' E112° 42'	South coast of JAWA	III		SURABAYA	SURABAYA	T to C route (TG PERAK-CILACAP)
15 (33)	-	TG. SASAR	S 09° 15' E119° 57'	NUSA TENGGARA	IV		KUPANG	KUPANG	C to G route (TG PERAK-KUPANG)
16 (34)	-	TG. KURONG	S 10° 08' E123° 27'	SAVU SEA	IV	o	KUPANG	KUPANG	C to G route (TG PERAK-KUPANG)
17 (35)	8	TG. SELAKA	S 3° 04' E110° 00'	JAVA SEA	V		BANJARMASIN	BANJARMASIN	G to G route (BELAWAN - TG. PERAB)
18 (36)	9	KUALAPEMBUANG	S 03° 28' E112° 33'	JAVA SEA	V	o	BANJARMASIN	BANJARMASIN	G to G route (BELAWAN-UJUNG PANDANG)
19 (37)	10	LAUT (TG. SELOKA)	S 3° 54' E116° 18'	MAKASSAR STRAIT	V		BANJARMASIN	BANJARMASIN	G to G route (BELAWAN-UJUNG PANDANG) & C to G route (TG. PERAK-BAUKPAPAN)

No.	STP# No.	Name of Station	LAT/LON	Covering area	KANWIL	Weather Broad-casting	District NAVIGASI	Monitor Station	Remarks
20 (38)	-	PASANGKAYU	S 01° 05' E119° 15'	MAKASSAR STRAIT	VI		UJUNG PANDANG	DONGGALA	C to G route (UJUNG PANDANG-BITUNG)
21 (39)	-	TARAKAN	N 03° 27' E117° 40'	CELEBES SEA	V		SAMARINDA	TARAKAN	T to C route (BALIKPAPN-TARAKAN) LNG loading port; traffic congested
22 (40)	11	TG. KANDI	N 01° 20' E121° 28'	CELEBES SEA	VII	o	MENADO/BITUNG	BITUNG	C to G route (UJUNG PANDANG-BITUNG)
23 (41)	12	SIDATE	N 01° 15' E124° 20'	CELEBES SEA	VII	o	MENADO/BITUNG	BITUNG	C to G route (UJUNG PANDANG-BITUNG)
24 (42)	13	PASITANETE	S 05° 45' E120° 30'	South of TELUK BONE	VI	o	UJUNG PANDANG	UJUNG PANDANG	C to G route (UJUNG PANDANG-KENDARI)
25 (43)	14	WANGI-WANGI	S 05° 16' E123° 32'	BANDA SEA	VI	o	KENDARI	KENDARI	C to G route (UJUNG PANDANG-KENDARI)
26 (44)	-	PADABALE	S 02° 52' E122° 20'	BANDA SEA	VII		MENADO/BITUNG	BITUNG	G to C route (UJUNG PANDANG-KENDARI)
27 (45)	-	MALIK (TG. PANGKALSIONG)	S 00° 36' E123° 25'	MOLUCCA SEA	VII		MENADO/BITUNG	BITUNG	T to C route (BITUNG-GORON TALO)
28 (46)	15	BOBO	S 03° 40' E126° 15'	BANDA SEA	VIII		AMBON	AMBON	C to G route (UJUNG PANDANG-SORONG)
29 (47)	-	MANGOLE (TG. LAMPAU)	S 01° 46' E125° 42'	MOLUCCA SEA	VIII		AMBON	AMBON	Main fishing area in MOLUCCA SEA

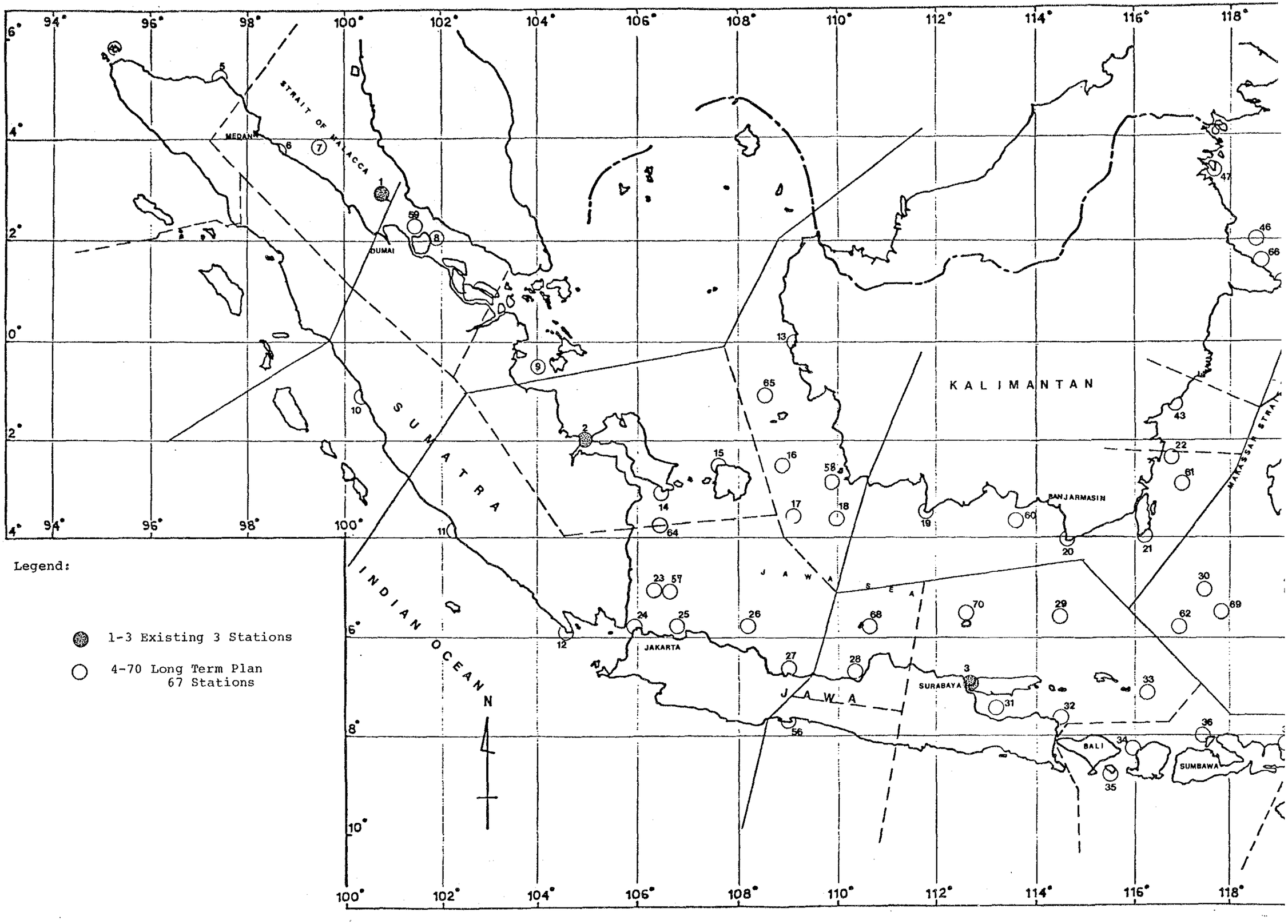
No.	STP# No.	Name of Station	LAT/LON	Covering area	KANWIL	Weather Broad-casting	District NAVIGASI	Monitor Station	Remarks
30 (48)	16	BOAND	S 02° 50' E127° 50'	CERAM SEA	VIII		AMBON	AMBON	C to G route (UJUNG PANDANG-SORONG)
31 (49)	17	TG. LIBOBO	S 00° 50' E128° 29'	HALMAHERA SEA	VIII		AMBON	AMBON	C to G route (UJUNG PANDANG-SORONG)
32 (50)	-	SEGET	S 01° 20' E130° 55'	CERAM SEA	IX		SORONG	SORONG	C to G route (UJUNG PANDANG-SORONG) & T to C route (SORONG-MERAUKE)
33 (51)	-	KWAOS	S 03° 50' E130° 50'	CERAM SEA	VIII	o	AMBON	AMBON	T to C route (SORON-MERAUKE)
34 (52)	-	TG. PAPISO	S 04° 05' E133° 00'	West coast of IRIAN JAYA	IX		SORONG	SORONG	T to C route (SORON-MERAUKE)
35 (53)	-	WANAPIRI	S 04° 26' E136° 00'	West coast of IRIAN JAYA	IX	o	SORONG	SORONG	T to C route (SORON-MERAUKE)
36 (54)	-	MANOKUWARI (TG. MEMORI)	S 00° 52' E134° 8'	North Coast of IRIAN JAYA	IX		SORONG	SORONG	T to C route (SORON-JAYA PURA)
37 (55)	-	TG. WOKA	S 01° 36' E135° 25'	TELUK CENDRAWASIH	IX	o	SORONG	SORONG	T to C route (SORON-BIAK)
38 (56)	-	TEBA (CD URVILLE)	S 01° 28' E137° 55'	North Coast of IRIAN JAYA	IX	o	JAYAPURA	JAYAPURA	T to C route (SORON-JAYA PURA)
39 (57)	-	DEMTA (MATTERER B)	S 02° 20' E140° 10'	North Coast of IRIAN JAYA	IX	o	JAYAPURA	JAYAPURA	T to C route (SORON-JAYA PURA)

Notes: - Nos. in ( ) give the serial number of stations shown in Fig. 4-3-1-(1)/4 inclusive of the 1st Phase 18 stations.

- # ... STP = Short Term Plan

(b) Radar Beacon Stations

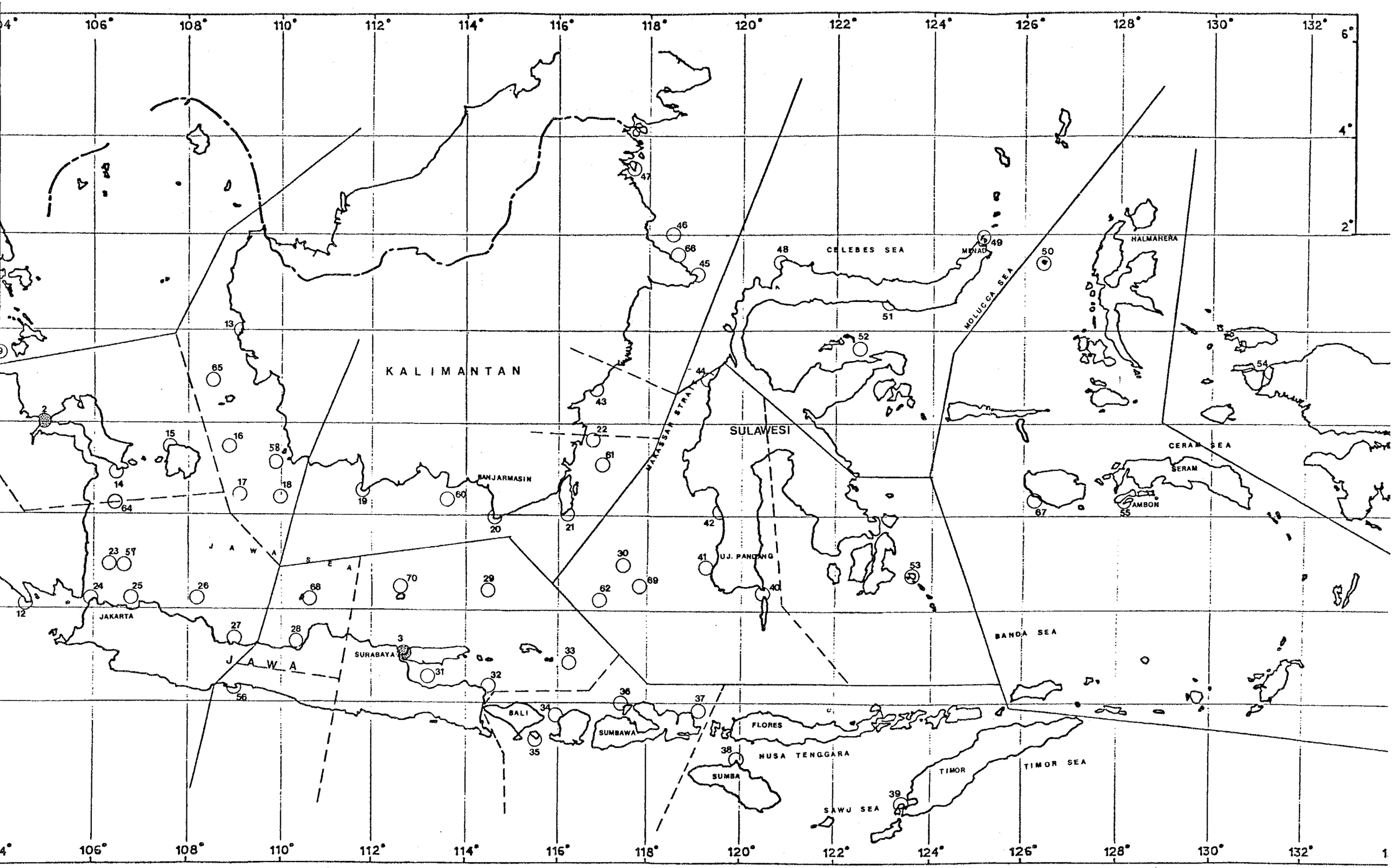
The site allocation is made as given in **Fig. 4-3-1-(1)/5**, and a list of the racon stations is given in **Table 4-3-1-(1)/9.**



Legend:

1-3 Existing 3 Stations

4-70 Long Term Plan
67 Stations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CELEBES SEA
MOLUCCA SEA
HALMAHERA
CERAM SEA
SERAM
AMBON
BANJARMASIN
MAKASSAR STRAIT
UJ. PANDANG
MENADO
JAKARTA
SURABAYA
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BALI
SUMBAWA
FLORES
NUSA TENGGARA
SUMBA
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FIG. 4-3-1-(1)/5 EXISTING RADAR BEACON RACON STATIONS AND SITE ARRANGEMENT PLAN FOR LONG TERM DEVELOPMENT

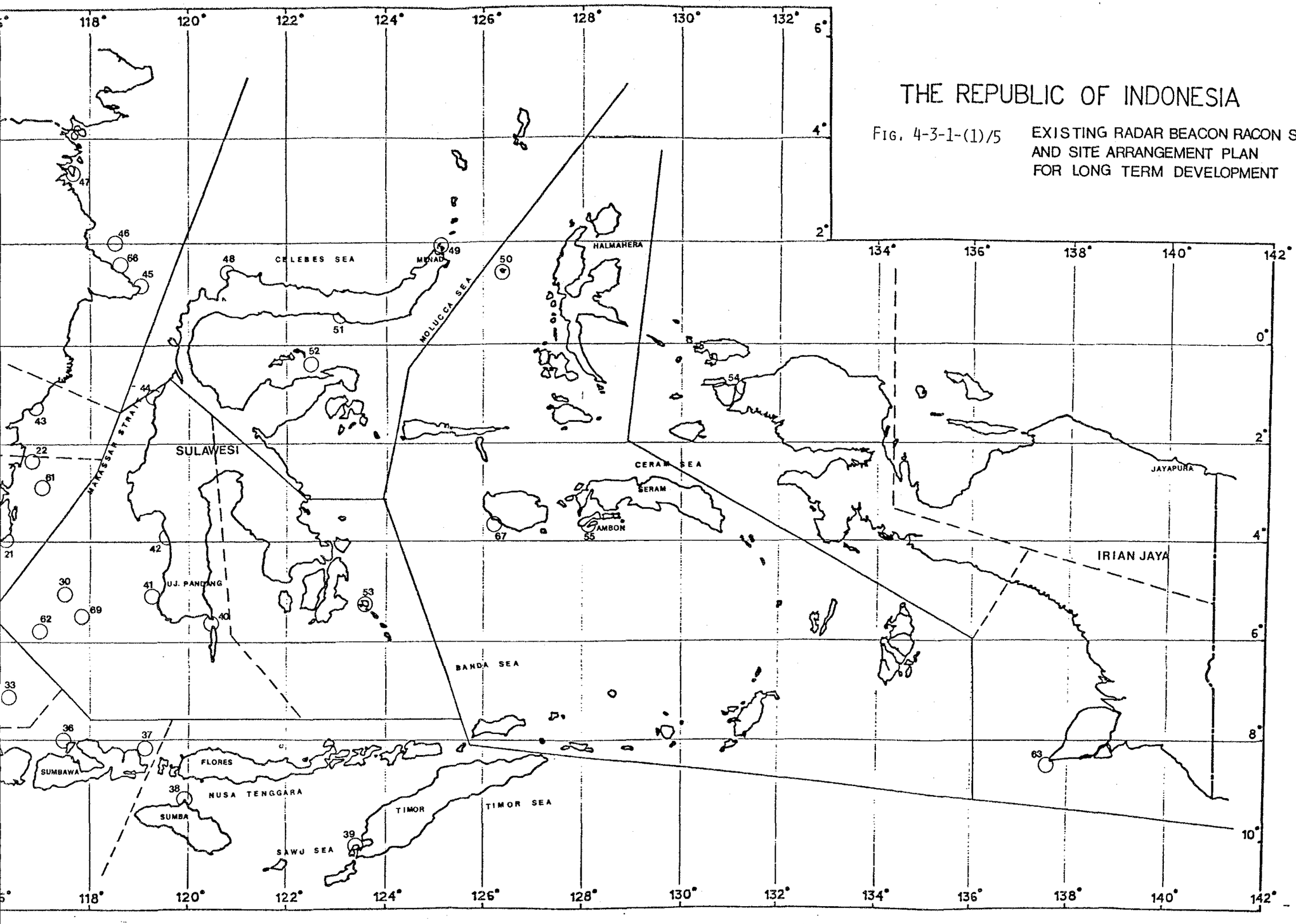


Table 4-3-1-(1)/9 List of Radar Beacon Stations - Overall Development Plan -

No.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
1 (4)	-	IE MEULE	10	N 05° 54' E 95° 20'	North point of SUMATERA	I	SABANG	SABANG	
2 (5)	-	TG. JAMBO AYE	120	N 05° 15' E 97° 29'	Approx. 110 NM NW of BELAWAN (North SUMATERA)	I	SABANG	SABANG	
3 (6)	-	NIPAH LARANGAN	315	S 03° 54' E 98° 41'	Entrance to BELAWAN Port (MALACCA STRAIT)	I	BELAWAN	BELAWAN	
4 (7)	-	BERHALA	Under Construc-tion at FOREIGN FINANCE	N 03° 56' E 99° 26'	Approx. 50 NM East of BELAWAN (MALACCA STRAIT)	I	BELAWAN	BELAWAN	
5 (8)	-	GOSONG PYRAMID	610	N 02° 06' E 101° 53'	Approx. 35 NM NE of DUMAI (MALACCA STRAIT)	II	DUMAI	DUMAI	ON RELEIGH BANK
6 (9)	26	MUCI	930	S 00° 33' E 104° 02'	Approx. 150 NM NNW of PALEMBANG (SELAT BERNALA)	II	TG. PINANG	TG. PINANG	
7 (10)	-	UG. SUNGAI BRAMEI	2570	S 01° 03' E 100° 23'	PADANG Port	II	TELUK BAYAR	TELUK BAYAR	
8 (11)	-	TIKUS	2490	S 03° 51' E 102° 11'	Approx. 210 NM SE PANDANG	II	TELUK BAYAR	TELUK BAYAR	
9 (12)	-	BELIMBING	2290	S 05° 56' E 104° 34'	Approx. 50 NM SW of PANJANG (SELAT SUNDA)	III	TG. PRIOK	PANJANG	

No.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
10 (13)	-	MA. KAPUAS KECIL	2040	S 00° 04' E 109° 10'	PONTIANAK Port	III	PONTIANAK	PONTIANAK	
11 (14)	1	DAPUR	1660	S 03° 08' E 106° 31'	South point of BANGKA Is.	III	PLEMBANG	PALEMBANG	
12 (15)	2	LANGKUAS	1880	S 02° 32' E 107° 38'	NW point of BELITUNG Is. (SELAT KARIMATA)	III	PALEMBANG	PALEMBANG	
13 (16)	3	PESEMUT	Under Construction at FOREIGN FINANCE	S 02° 30' E 108° 50'	Approx. 150 NM South of PONTIANAK (SELAT KARIMATA)	III	PONTIANAK	PONTIANAK	
14 (17)	4	DISCOVERY EASTBANK	1960	S 03° 35' E 109° 10'	Approx. 210 NM South of PONTIANAK (JAVA SEA)	III	PONTIANAK	PONTIANAK	ON BANK
15 (18)	5	FOX BANK	1970	S 03° 31' E 110° 11'	Approx. 220 NM SSE of PONTIANAK (JAVA SEA)	III	PONTIANAK	PONTIANAK	ON BANK
16 (19)	6	TG. PUTING	Under Construction at FOREIGN FINANCE	S 03° 32' E 111° 48'	SW point of KALIMANTAN (JAVA SEA)	V	BANJARMASIN	SAMPIT	
17 (20)	7	SELATAN	4350	S 04° 11' E 114° 39'	South point of KALIMANTAN (JAVA SEA)	V	BANJARMASIN	BANJARMASIN	
18 (21)	8	PU^{2} SAMBRGULANG	4440	S 04°. 24' E 116° 10'	MAKASSAR STRAIT	V	BANJARMASIN	BANJARMASIN	
19 (22)	9	KARANG SULING	4630	S 02° 23' E 116° 44'	Approx. 70 NM South of BALIKPAPAN	V	BALIKPAPAN	BALIKPAPAN	ON REEF

No.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
20 (23)	10	JAGA UTARA	1690	S 05° 12' E 106° 28'	Approx. 50 NM NW of TG. PRIOK (JAVA SEA)	III	TG. PRIOK	TG. PRIOK	
21 (24)	11	TEMPURUNG	2280	S 05° 54' E 105° 56'	Approx. 50 NM West of TG. PRIOK (SELAT SUNDA)	III	TG. PRIOK	PANJANG	
22 (25)	12	DAMAR-BESAR	1720	S 05° 58' E 106° 51'	Approx. 12 NM North of TG. PRIOK (JAVA SEA)	III	TG. PRIOK	JAKARTA	
23 (26)	13	PU. PAKIT	2990	S 05° 57' E 108° 28'	Approx. 50 NM NNW of CIREBON (JAVA SEA)	III	TG. PRIOK	JAKARTA	
24 (27)	-	KARANGJERUK	3120	S 06° 49' E 109° 12'	Approx. 80 NM West of SEMARANG (JAVA SEA)	IV	SEMARANG	CIREBON	ON REEF
25 (28)	14	KOROWELANG	3190	S 06° 49' E 110° 11'	Entrance to SEMARANG Port	IV	SEMARANG	SEMARANG	ON REEF
26 (29)	15	MASALEMBO	Under Construction at FOREIGN FINANCE	S 05° 35' E 114° 27'	Approx. 150 NM NE of TG. PERAK (JAVA SEA)	IV	SURABAYA	SURABAYA	
27 (30)	16	KALUKALUKANG	Under Construction at FOREIGN FINANCE	S 05° 12' E 117° 40'	Approx. 100 NM West of UJUNT PANDANG (JAVA SEA)	VI	UJUNG PANDANG	UJUNG PANDANG	
28 (31)	17	KARANG KOKO	3840	S 07° 28' E 113° 07'	SELAT MADURA	IV	SURABAYA	SURABAYA	ON REEF
29 (32)	18	KARANG MAS	3940	S 07° 41' E 114° 26'	SELAT MADURA	IV	SURABAYA	PANARUKAN	ON REEF

NO.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
30 (33)	19	PU. SEKALA	4326	S 06°56' E 116°15'	Approx. 80NM North of LOMBOK	IV	KALIANGAT	LEMBER	
31 (34)	20	PU. TREWANGAN	Included in MASTER PLAN	S 08° 20' E 116° 00'	NW LOMBOK (LOMBOK STRAIT)	IV	BENOA	LEMBER	
32 (35)	-	TG. SEDIHING	4185	S 08° 49' E 115° 33'	Approx. 20 NM East of BENOA	IV	BENOA	BENOA	
33 (36)	-	PU. MEDANG	4210	S 08° 08' E 117° 24'	North SUMBAWA (FLORES SEA)	IV	BENOA	LEMBER	ON REEF
34 (37)	21	TG. NAROE	Included in MASTER PLAN	S 08° 10' E 118° 58'	NE SUMBAWA (FLORES SEA)	IV	BENOA	LEMBER	
35 (38)	-	TG. SASAR	Included in MASTER PLAN	S 09° 15' E 119° 57'	North point of SUMBA (NUSA TENGGARA)	IV	KUPANG	KUPANG	
36 (39)	-	TG. KURONG	5800	S 10° 08' E 123° 27'	Off KUPANG	IV	KUPANG	KUPANG	
37 (40)	-	PASITANETE	5630	S 05° 45' E 120° 30'	Approx. 75 NM SE of UJUNG PANDANG (South TELUK BONE)	VI	UJUNG PANDANG	UJUNG PANDANG	
38 (41)	22	KUDINGARENG LOMPO	4930	S 05° 09' E 119° 16'	Entrance to UJUNG PANDANG Port	VI	UJUNG PANDANG	UJUNG PANDANG	
39 (42)	23	TG. LERO	5040	S 04o 03' E 119° 36'	Approx. 70 NM North of UJUNG PANDANG (Entrance to PAREPARE Port)	IV	UJUNG PANDANG	UJUNG PANDANG	ON REEF

No.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
40 (43)	-	BALIKPAPAN	4730	S 01° 17' E 116° 49'	East of KALIMANTAN (MAKASSAR STRAIT)	V	BALIKPAPAN	BALIKPAPAN	TOP OF TAKONG HILL
41 (44)	-	PASANGKAYU	Under Construc-tion at FOREIGN FINANCE	S 01° 10' E 119° 20'	Approx. 40 NM SW of DONGGAL (MAKASSAR STRAIT)	VI	UJUNG PANDANG	DONGGALA	
42 (45)	-	MANGKALIHAT	4890	N 00° 60' E 118° 59'	Approx. 190 NM NE of BALIKPAPAN (MAKASSAR STRAIT)	V	SAMARINDA	SAMARINDA	
43 (46)	-	KARANG MALALUNGUN	5160	N 01° 56' E 118° 27'	Approx. 100 NM SE of TARAKAN	V	SAMARINDA	TARAKAN	ON REEF
44 (47)	-	TG. ARANG	5310	N 03° 37' E 117° 52'	North TARAKAN Is. PU. BUNYU	V	TARAKAN	TARAKAN	
45 (48)	-	SALANDO	5140	N 01° 21' E 120° 49'	Approx. 250 NM West of MANADO (CELEBES SEA)	VII	MENADO/BITUNG	BITUNG	ON SALANDO REEF
46 (49)	-	TALISEI	5390	N 01° 54' E 125° 06'	Approx. 20 NM NE of MENADO	VII	MENADO/BITUNG	BITUNG	
47 (50)	-	MAYU	Under Construc-tion at FOREIGN FINANCE	N 01° 19' E 126° 23'	Approx. 75 NM East BITUNG	VIII	AMBON	TERNATE	
48 (51)	-	GORONTALO	5490	N 00° 30' E 123° 04'	TELUK TOMINI	VII	MENADO/BITUNG	BITUNG	ON BANK
49 (52)	-	WALEA	5530	S 00° 25' E 122° 26'	TELUK TOMINI	VII	MENADO/BITUNG	BITUNG	ON REEF

No.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
50 (53)	-	WANGI-WANGI	5580	S 05° 16' E 123° 32'	Approx. 105 NM SE of KENDARI (West BANDA SEA)	VI	KENDARI	KENDARI	
51 (54)	-	PU. BUAYA	6341	S 00° 51' E 131° 12'	SORONG Port (SELAT DAMPIER)	IX	SORONG	SORONG	
52 (55)	-	TG. NUSANIVE	5920	S 03° 48' E 128° 06'	South point of AMBON Is. (BANDA SEA)	VIII	AMBON	AMBON	
53 (56)	-	CILACAP	4100	S 07° 47' E 109° 03'	South CENTRAL JAWA ISLAND	IV	CILACAP	CILACAP	
54 (57)	24	GOSONG ETNA	1710	S 05° 18' E 106° 54'	Approx. 50 NM from Tg. Priok (JAWA SEA)	III	Tg. PRIOK	Tg. PRIOK	Short Term Plan (Offshore LH)
55 (58)	25	CORYFORT	-		Approx. 180 NM SSE of PONTIANAK (SELAT KARIMATA)	III	PONTIANAK	PONTIANAK	do
56 (59)	-	GOSONG PYRAMID		N 02° 25' E 101° 21'	SELAT BERNALA	II	DUMAI	DUMAI	Visual Aids for Long Term Plan
57 (60)	-	GOSONG MALATAYUR		S 03° 48' E 113° 38'	JAWA SEA	V	BANJARMASIN	BANJARMASIN	Visual Aids for Long Term Plan
58 (61)	-	SELATAN PU ABO (TAKATALLU)		S 03° 04' E 117° 43'	SELAT MAKASSAR	V	BANJARMASIN	BANJARMASIN	Visual Aids for Long Term Plan
59 (62)	-	SIBALD BANK		S 05° 47' E 117° 07'	JAWA SEA	VI	UJUNG PANDANG	UJUNG PANDANG	Visual Aids for Long Term Plan

No.	STP# No.	Name of Location	No. of Existing Lighthouse	Position (LAT/LON)	Area	KANWIL	DISTRICT NAVIGASI	Coast Station Nearby	Remarks
60 (63)	-	Tg. SOLAH		S 08° 27' E 137° 40'	IRIAN	IX	MERAUKE	MERAUK	Visual Aids for Long Term Plan
61 (64)	-	CITY OF CARLISLE BK		S 03° 49' E 106° 26'	JAWA SEA	III	Tg. PRIOK	JAKARTA	Visual Aids for Long Term Plan
62 (65)	-	GRIEG REEF		S 01° 06' E 108° 34'	SELAT KARIMATA	III	PONTIANAK	PONTIANAK	Visual Aids for Long Term Plan
63 (66)	-	KR BESAR		N 01° 38' E 118° 32'	SELAT MAKASSAR	V	SAMARINDA	TARAKAN	Visual Aids for Long Term Plan
64 (67)	-	NEAR BURU IS		S 03° 42' E 126° 16'	SELAT BANDA	VIII	AMBON	AMBON	Visual Aids for Long Term Plan
65 (68)	-	KARIUM JAWA		S 05° 52' E 110° 26'	JAWA SEA	III	SEMARANG	SEMARANG	Visual Aids for Long Term Plan
66 (69)	28	-DOANG DOANGAN		S 05° 25' E 117° 56'	JAWA SEA	VI	UJUNG PANDANG	UJUNG PANDANG	Visual Aids for Long Term Plan
67 (70)	27	Tg MANTIGI		S 05° 43' E 112° 41'	JAWA SEA	IV	S. BAYA	S. BAYA	Visual Aids for Long Term Plan

Notes: - Nos. in ( ) give the serial number of stations shown in Fig. 4-3-1-(1)/5 inclusive of the existing 3 stations.

- # ... STP = Short Term Plan.

(D) Criteria for Facility Plan of Electronic Aids to Navigation

(a) Medium-wave radiobeacon station

Both of the directional and omni-directional radiobeacons shall follow the following standards:

a) Radiobeacon transmitter shall be in a tri-unit system of two in use with one stand-by.

b) The output power of a radiobeacon transmitter shall be 1 kW PP.

c) Power supply; engine-generator system, provided that the stations, for which fuel supply conditions may be unfavourable, use solar cells and other power sources. In both cases, secondary batteries shall be used for the stabilization of power supply.

d) Antenna system; A combination of a loop antenna with a goniometer shall be used for the directional radiobeacon, and a vertical antenna, terminating on support mast of loop antenna, for the omni-directional radio beacon.

e) Telecommunication facilities shall be installed for the communications at the office controlling the operation.

(b) Radar beacon (Racon) station

a) A dual system shall be applied with the automatic change-over unit.

b) The output power of a transmitter shall be 5 W for coastal installation and 200 mW for navigational danger.

c) The antenna shall be an omni-directional, high gain type.

d) The antenna mast for coastal installation will be an independent iron tower, and that for navigational danger shall be co-use of a light tower.

e) Power supply; A combination of solar cells and other sources and batteries will be used for coastal installation, provided that some installations will be power-supplied by lighthouses'. A combination of solar cells and other sources and batteries will be used for navigation danger.

f) Remote monitoring; The installations for both coastal and navigation dangers shall be fitted with the transmitters for remote monitoring.

(E) Facility and Equipment Planning

(a) Medium-wave Radiobeacon Station

- Facility Planning

a) Service Range

MF radiobeacons are used by audio nul system and the ranges to be covered by are dependent on the types of services, i.e., directional and non-directional.

(i) Directional radiobeacon: -

The minimum receiving sensitivity is defined as 5 uV/m at the point of 3 degrees from the audio nul point (i.e., 87 degrees from the maximum field strength). The service range shall be defined as the range where the field strength becomes equivalent to the minimum receiving sensitivity of a receiver. The field strength is calculated usually using the Millington method. With those factors taking into account, the daytime service range of directional radiobeacon has been defined as 100 nautical miles.

(ii) Non-directional radiobeacon: -

The minimum receiving sensitivity of omni-directional radiobeacon is defined as 100 uV/m according to the Radio Regulations (1979 Geneva). The daytime service range has been defined as 200 nautical miles.

The details of calculations are given in **APPENDIX-13** together with Millington Diagram and an example of field measurement.

b) System Configuration

The medium-wave radiobeacon consists of the directional and omni-directional performances, with the former for use by a simple type of receiver while the latter by a radio direction finder.

The system mainly comprises the radiobeacon transmitter, goniometer, antenna, power supply and other associated facilities. A schematic equipment configuration and a site plan are given respectively in **APPENDIX-19** for reference.

The stations will be on the automatic operation with remote monitoring linked to the relevant monitoring stations.

- Equipment Planning

a) Major Specifications of MF Radiobeacon

Transmitting Frequency:	One of the frequencies for MF radiobeacon allocated for Region III
Output Power:	1,000 W (pp) at 80% modulation 250 W

Modulation Frequency:	Main transmission 10 frequencies in 500 - 1,100 Hz Modulation 300 - 2,700 Hz
Oscillation:	Xtal Spot Oscillator
Side Band Used:	Upper Side Band
Frequency Band:	1.5 kHz
Speed:	10 bau
Environment:	Ambient temperature: 0°C - +50°C Relative Humidity: 40 - 90%
Configuration:	Tri-unit system for automatic operation except antenna and power supply system

b) Equipment Configuration

The tri-unit system will be employed for the radiobeacon transmitters, one for operation and the other for stand-by and the last for back-up, to feed the output to the loop antenna through a goniometer or to the vertial antenna via automatic tuning unit.

The composition and scale of power supply may dependent on local geographic conditions together with the potential operational reliability to be involved. Careful studies shall be made before reaching a decision on the system to be employed; commercial power

source, engine generator, solar cell and so on. The associated telecommunication equipment also play a role for the automatic operation of the system.

A schematic diagram for MF radiobeacon station is shown in **APPENDIX-19** for reference.

(b) Radar Beacon (Racon) Station

- Facility Planning

Racon is a short range aids to navigation indicating the information on vessels marine radar display.

There are various types of racons available and proposed: swept frequency, fixed frequency, frequency agile, etc. The swept frequency racons are still in wider use, while the frequency agile racons are in experimental use.

a) Service Range

The service range may extend as far as a line of sight. However, the service range of racon and the frequency for reception are dependent on the performances of both racon and marine radar as well as type of racon.

It will, therefore, be necessary to make a general survey for marine radar performance and other necessary conditions before the site conditions and specifications will be defined.

Most of the vessels in coastal waters are equipped onboard X-band radar equipment. The standard characteristics of marine radar equipment may be summarized as follows: -

Standard Characteristics of Marine Radar

Frequency	9,375 - 9,410 MHz
Output	10 kW
Sensitivity	Max. -95 dBm
Antenna Directivity	Horizontal 1 - 2°
	Vertical 20°
Antenna Evolution	20 rpm
Pulse Width	0.08 us, 0.4 us
Band Width	10 MHz
Antenna Height	5 - 15 m

The height of racon antenna may be around 15 - 30 meters, and the output power will be in the range of 200 - 50 mW.

Under the above conditions, the racons to mark landfalls should cover approximately 15 -20 N.M. while those to indicate hazardous areas approximately 1.5 - 3 N.M.

In view of the fact that the marine radars using S-band may increase, due consideration should also be given to this, while paying attention to the progress in development of newer types of racon.

b) System Configuration

A typical configuration of Racon comprises the dual transceiver system installed on a tower. The schematic equipment configuration of racon for reference is shown in **APPENDIX-19.**

With regard to the field installations, the structures of lighthouses and such constructions are considered to be most suitable objects for their easy identification by vessels.

- Equipment Planning

a) Major Specifications

A standard system may be referenced to that given below:

Landfall Marking:
Dual system with automatic changer
Output power: 5W
Service Range: 10 - 20 N.M.

Danger Marking:
Dual system with automatic changer
Service Range: 5 N.M.

b) Equipment Configuration

A typical configuration of equipment composition is given in **APPENDIX-19** for reference.

However, due to the recent remarkable development in the electronic field, it is easily envisaged smaller-sized equipment may be available not in the distant future, and this will constitute newer concept of equipment configuration.

(2) Improvement Plan

1) Visual Aids to Navigation

For the purpose of ensuring efficient and reliable operation of visual aids to navigation, improvement needs to be carried out for the existing navaids:

a. Improvement in luminous range
b. Group monitoring of buoys for improvement in maintenance
c. Electrification of navaids currently using propane gas as their energy source
d. Automatization of lighthouse

a) Improvement in Luminous Range

Electrification for the improvement in luminous range should be implemented, converting from gas sources, for the lighted aids, which the luminous ranges of existing ones are insufficient due to wider traffic lanes, and which are installed at ports and harbours having city lights behind, possibly causing background flares problems.

Construction of higher tower should also be planned for the improvement, taking into account rehabilitation of the existing old facilities.

The number of planned lights is as follows:

Types of Navaids	No. of Units
Lighthouse	14
Light beacon	30

The site location of the improvement and rehabilitation plan is shown in **Fig. 4-3-1-(2)**, and their details are listed in **Table 4-3-1-(2)/1**, together with the existing situations in a form of comparison.

b) Group Monitoring of Buoys for Improvement in Maintenance and Operation

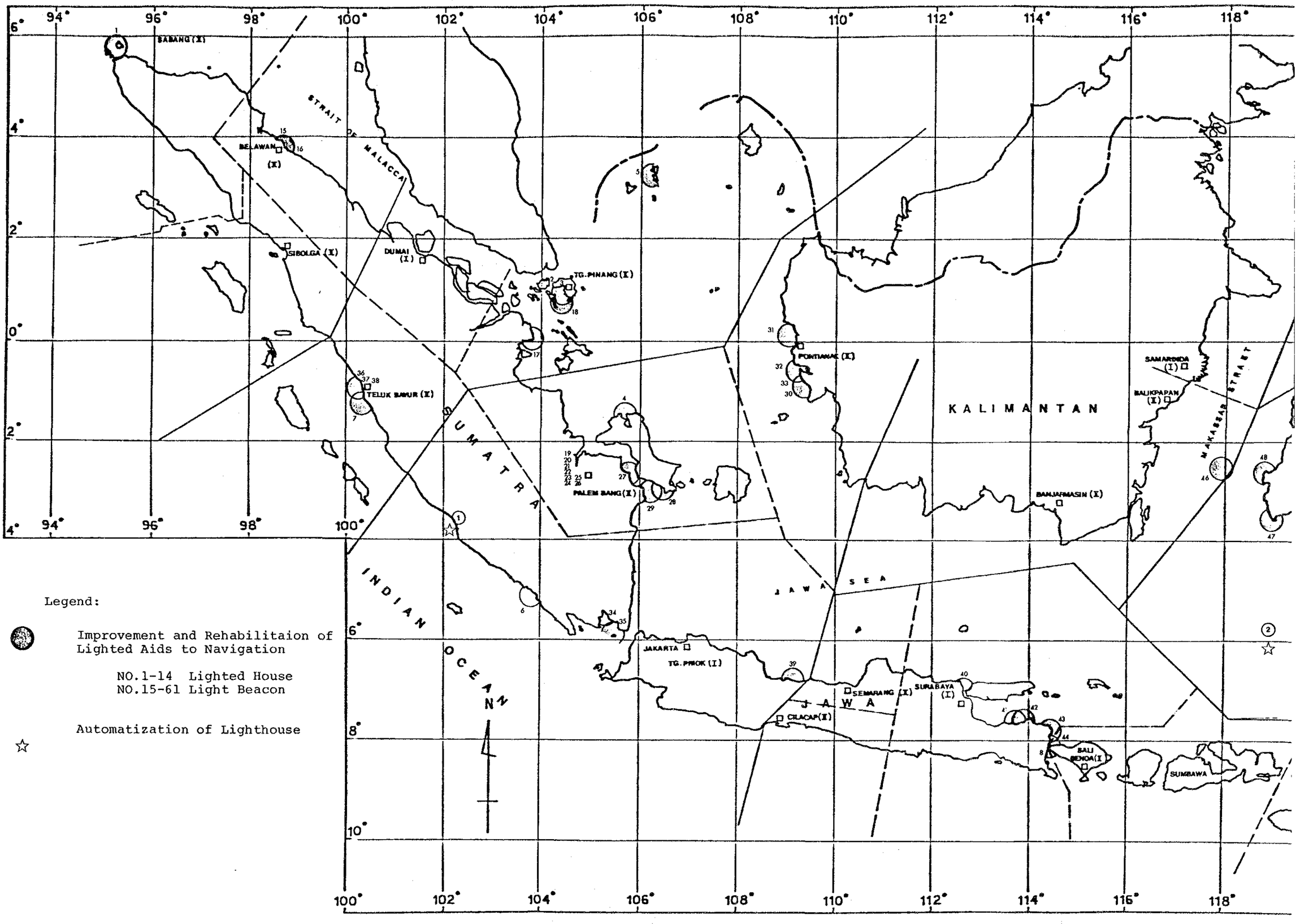
A number of ports in Indonesia consist of those having quite long approach channels through dredged shallow coast or of those running through narrow channels surrounded by islands. Approaches to those ports are narrow and bent, long in distance and rather complicated.

Lighted buoys are installed in those channels and water areas indicating navigable waters, turning points and location of navigation dangers in order to secure the safety of ships at sea and to promote the navigation efficiency.

The recent development in enlargement in size of ships and in their speed-up as well as increase in traffic volume have collectively brought the necessity of establishing a reliable maintenance and operation system for the purpose of ensuring operational and functional performances.

In this plan, a grouped remote monitoring system is introduced for the lighted buoys in the following ports, where there exists heavy traffic in complexed routes, so as to carry out effective maintenance of navaids:

Port Area	No. of Units
Surabaya port	17 Lighted buoys
Dumai port	31 "
Belawan port	7 "
Total	55 Lighted buoys



Legend:

Improvement and Rehabilitaion of Lighted Aids to Navigation

NO.1-14 Lighted House
NO.15-61 Light Beacon

☆ Automatization of Lighthouse

106° 108° 110° 112° 114° 116° 118° 120° 122° 124° 126° 128° 130° 132° 134°

6° 4° 2°

PINANG (I)

PONTIANAK (I)

KALIMANTAN

SAMARINDA (I)

BALIKPAPAN (I)

MAKASSAR STRAIT

CELEBES SEA

MENADO (I)

MOLUCCA SEA

HALMAHERA

SORONG (I)

CERAM SEA

SULAWESI

BANJARMASIN (I)

SERAM

AMBON (I)

KENDARI (I)

LEM BANG (I)

JAWA SEA

LUWUK PANDANG (I)

BANDA SEA

JAKARTA

TG. PRIOK (I)

SEMARANG (I)

SURABAYA (I)

J A W A

CILACAP (I)

BALI BENOA (I)

SUMBAWA

FLORES

NUSA TENGGARA

SUMBA

TIMOR

TIMOR SEA

SAWU SEA

KUPANG TENAU (I)

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FIG.4-3-1-(2) IMPROVEMENT AND REHABILITATION OF LIGHTED AIDS & AUTOMATIZATION OF LIGHTHOUSE

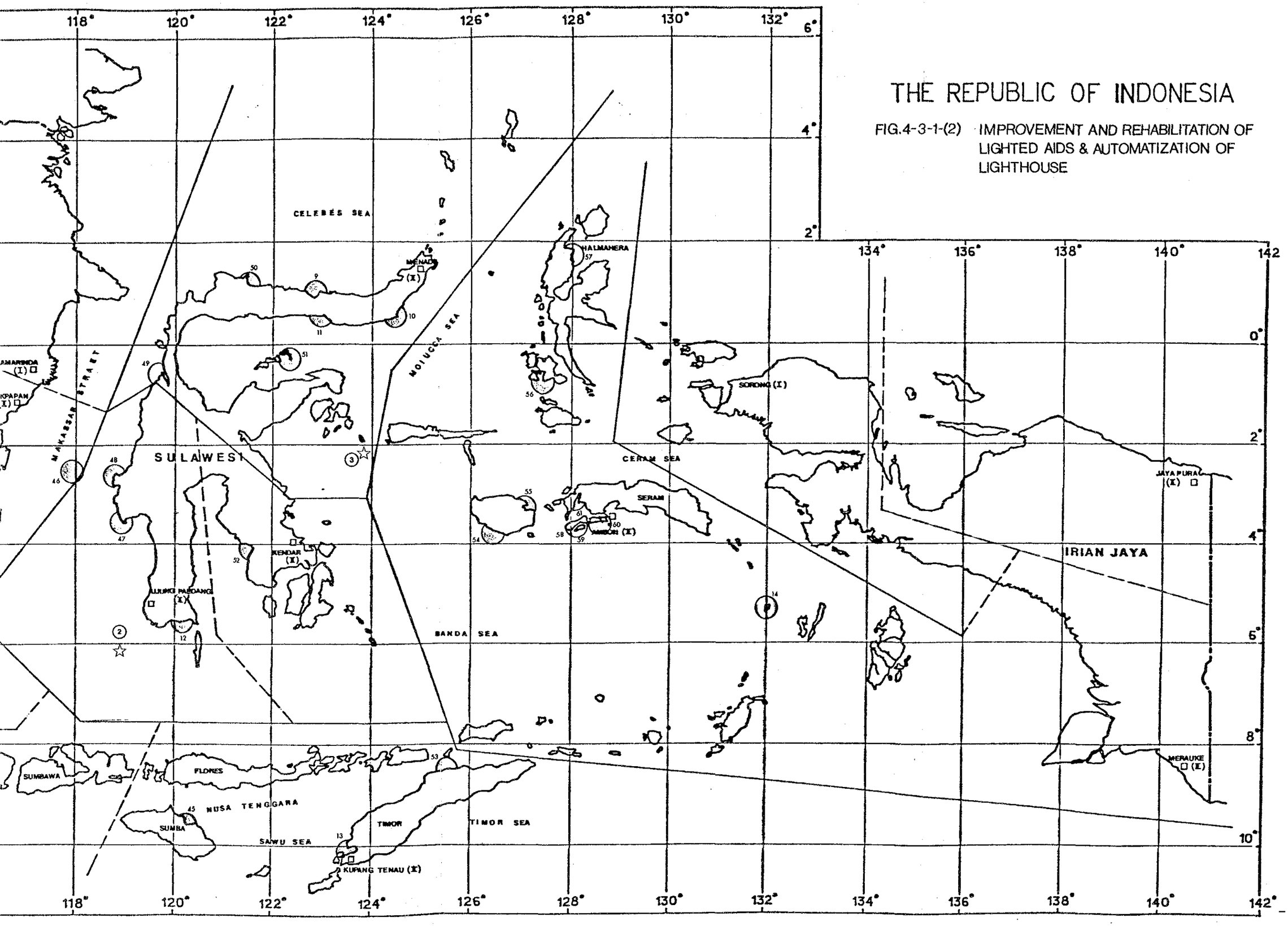

Table 4-3-1-(2)/1 Plan for Improvement and Rehabilitation of Lighted Aids

(Lighthouses)

No.	No. (List of Light)	Name	Location	Power Source		Range	
				Present	Improve-ment	Present	Improve-ment
1	20	SABANG BAY	N 05-53.2 95-18.6	A	E	7	10
2	1040	Tg. PINANG	N 00-56.5 104-26.0	P	E	6	10
3	1050	Tg. PINANG	N 00-56.0 104-26.5	P	E	4	10
4	1530	PENYUSU	S 01-31.5 105-41.0	P	E	8	15
5	2222	TAREMPA	N 03-13.0 106-13.0	A	E	6	15
6	2460	PISANG	S 05-07.5 103-51.0	A	E	12	15
7	2560	NYAMUK	S 01-16.0 100-18.0	A	E	13	20
8	4040	BANYUWANGI	S 08-12.5 114-23.0	A	E	7	10
9	5340	HULAWA	N 00-58.5 122-54.0	A	E	12	15
10	5470	PONDANG	N 00-26.0 124-28.5	A	E	6	10
11	5490	GORONTALO	N 00-29.5 123-03.5	A	E	12	15
12	5620	BULUKUMBA	S 05-34.0 120-11.4	A	E	7	15
13	5770	KUPANG	S 10-10.0 123-34.5	A	E	13	15
14	5883	KOER	S 05-18.6 132-00.4	A	E	7	15

Remarks: A ..... Acetylene Gas
E ..... Electricity
P ..... Propane Gas

(Light Beacons)

No.	No. (List of Light)	Name	Location	Power Source		Range	
				Present	Improve-ment	Present	Improve-ment
15	430	BELAWAN	N 03-47.3 98-43.1	E	E	6	15
16	440	BELAWAN	350m from No. 430	E	E	6	15
17	921	Tg. DATUK	N 00-00.5 103-48.3	A	E	12	18
18	1071	PANGKIL	N 00-49.0 104-21.1	P	E	7	15
19	1330	PALEMBANG RIVER (Front)	S 02-13.4 104-55.6	P	E	5	10
20	1340	- do - (Rear)	S 02-15.3 104-54.6	P	E	8	10
21	1420	- do -	S 02-31.3 104-56.0	P	E	6	10
22	1421	- do -	S 02-34.3 104-56.3	P	E	6	10
23	1430	- do -	S 02-46.0 104-57.0	P	E	6	10
24	1440	- do -	S 02-46.0 104-56.5	P	E	8	10
25	1450	- do -	S 02-47.6 104-55.9	P	E	8	10
26	1460	- do -	S 02-54.7 104-52.9	P	E	8	10
27	1611	Tg. TAPA	S 02-40.8 105-47.0	A	E	6	15
28	1650	TOBOALI	S 03-01.0 106-27.0	E	E	5	10
29	1681	GOSONG MELVIL	S 03-02.4 106-15.1	A	E	7	15
30	2031	PADANG TIKAR	S 0-39.5 109-14.9	A	E	7	10

(Light Beacons)

No.	No. (List of Light)	Name	Location	Power Source		Range	
				Present	Improve-ment	Present	Improve-ment
31	2040	Me. KAPUAS KECIL (Front)	N 0-04.4 109-10.1	E	E	10	15
32	2041	TELOK AIR	S 0-40.9 109-22.1	P	E	8	10
33	2044	- do -	S 0-45.2 109-28.8	P	E	8	10
34	2310	TELUK BETUNG	S 05-28.0 105-16.5	A	E	7	10
35	2380	SEBUKU	S 05-51.0 105-32.0	A	E	7	10
36	2590	TELUK BATUR	S 01-00.5 100-22.5	A	E	7	10
37	2591	- do -	S 01-00.1 100-22.1	P	E	4	10
38	2592	- do -	S 01-00.0 100-22.2	P	E	6	10
39	3070	TEGAL	S 06-51.1 109-08.2	E	E	6	15
40	3490	Uj. PIRING	S 07-02.0 112-41.0	A	E	7	15
41	3900	BESUKI	S 07-43.5 113-41.5	E	E	5	15
42	3920	PANARUKAN	S 07-42.0 113-55.5	A	E	7	15
43	3940	KARANGMAS	S 07-40.3 114-26.3	A	E	9	15
44	4070	Tg. PASIR	S 08-05.8 114-26.1	A	E	8	10
45	4320	WAINGAPU	S 09-38.5 120-15.5	E	E	5	15
46	4660	AMBO	S 02-32.3 117-57.0	A	E	12	15

(Light Beacons)

No.	No. (List of Light)	Name	Location	Power Source		Range	
				Present	Improve-ment	Present	Improve-ment
47	5070	MAJENE	S 03-33.0 118-58.0	E	E	4	15
48	5100	MAMUJU	S 02-40.5 118-53.0	P	E	6	15
49	5111	DONGGALA	S 00-39.6 119-44.5	P	E	4	15
50	5320	LEOK	N 01-12.0 121-26.0	P	E	2	15
51	5530	WALEA	S 00-25.0 122-25.5	A	E	7	15
52	5671	KOLAKA	S 04-03.3 121-34.4	E	E	3	15
53	5817	DILLY	S 08-32.9 125-33.8	E	E	12	18
54	5890	LEKSULA	S 03-46.7 126-30.9	P	E	2	15
55	5900	NAMLEA	S 03-16.5 127-05.7	E	E	2	15
56	5912	LABUHA	S 00-37.7 127-28.3	E	E	2	15
57	5913	TOBELO	N 01-43.5 128-00.5	P	E	2	15
58	5933	Tg. WINITU	S 03-42.0 128-09.7	A	E	4	15
59	5934	Tg. SIKULA	S 03-43.2 128-05.2	A	E	7	15
60	5940	SAPARUA	S 03-35.2 128-37.5	P	E	2	15
61	5950	PIRU	S 03-04.0 128-11.5	P	E	2	10

c) Electrification from Propane Gas

There is the total number of 95 lights currently energized by propane gas as shown in **Table 4-3-1-(2)/2.**

The electrification is planned for the total number of 54 lights as given in **Table 4-3-1-(2)/2** due to increasing difficulties in acquiring propane gas in Indonesia.

Table 4-3-1-(2)/2 Propane Gas-operated Lights and Electrification Plan

KANWIL / Type of Lights	I	II	III	IV	V	VI - IX	Total	Electrification Plan	
								Already Planned	Plan
Lighthouse	0	2	1	0	0	0	3	3*	0
Light Beacon	8	14	30	0	2	0	54	21**	33
Lighted Buoy	3	19	12	0	4	0	38	17***	21
Total	11	35	43	0	6	0	95	41	54

Notes: * Electrification planned in improvement in luminous range.
(3 out of 14, **Table 4-3-1-(2)/1**)

** Electrification planned in improvement in luminous range.
(21 out of 47, **Table 4-3-1-(2)/1**)

*** Electrification planned in buoy group monitoring.
(17 out of 55, see b) above)

d) Automatization of Lighthouse

General world-wide trend in the field of aids to navigation includes the automated operation of lighthouses.

A large number of lighthouses in Indonesia are situated in isolated islands and areas, and uninhabited remote areas, and involve such problems as health, medical treatment, supply of goods as well as education of the personnel's children.

It is, therefore, desirable to plan for improvement in the living environment of personnel through the introduction of automated operation of lighthouses and itinerary maintenance system for them.

This plan is made for the following three lighthouses, and especially they have unfavourable living environment, which needs to be demanded and improved:

a. Tikus lighthouse, located about 5 NM from Bengkul.
b. De Bril lighthouse, located in an isolated island, about 70 NM from Ug. Pandang.
c. Buang Buang lighthouse, where poisonous snakes live.

Table 4-3-1-(2)/3 gives a list of these lighthouses, and **Fig. 4-3-1-(2)** shows their locations.

Table 4-3-1-(2)/3 Automatization Plan for Lighthouses

	No. (List of Lights)	Name	Location
1	2490	TIKUS	S 03-50.5 E102-11.0
2	4910	DE BRIL	S 06-05.0 E118-54.5
3	5560	BUANG BUANG	S 02-04.3 E123-55.0

2) Supporting/Logistic Facilities

(A) Supporting/Logistic Facilities

There have been observed during the 1st and 2nd field and site surveys that most of the Districts of Navigation are lack of supporting/logistic facilities, and this has brought up the current situations, where maintenance works have not been sufficiently carried out.

It is most desirable that the facilities are collectively to be sited preferably within the same areas as Districts of Navigation. Accordingly, necessary sites need to be incorporated possibly in port development plans.

The plan in this study is formulated for all the Districts of Navigation except Dumai and Tg. Priok, for which the existing plans include the sites' move to other areas as a part of the respective port development plans with the necessary funds allocated.

The long term improvement plan for supporting/ logistic facilities is summarized in **Table 4-3-1-(2)/4**, and detailed in **Table 4-3-1-(2)/5**.

Table 4-3-1-(2)/4 Long Term Improvement Plan for Supporting Facilities

Item / Facilities	No. of District of Navigation for which Plan is established		Required areas· equipment·No.
Workshop	21		9,200 m^2
Equipment	21	6	Equipment List A*
		15	" B*
Open Storage	16		8,000 m^2
Store House	15		935 m^2
Jetty	16		16 places
Dry Dock	6		6 places

Notes: see **APPENDIX-25** for details.

Table 4-3-1-(2)/5 Improvement Plan for Supporting/Logistic Facilities and Equipment

Already developed; ◎ New establishment; ○ Improvement

Facilities / District of Navigation	Workshop m^2	Equipment list A and B	Open Storage m^2	Store House m^2	Jetty Type A and B	Dry Dock	Remarks
DUMAI						○	*
TG. PINANG	○ 170	○ B	◎ 700	◎ 70	◎ A		***
BELAWAN	○ 260	○ B		○ 70			
SABANG	○ 160	○ B	◎ 400	○ 90	◎ B		
TG. PRIOK							*
PALEMBANG		○ A				○	
PONTIANAK		○ A	◎ 700	○ 160	◎ A	○	
TLK BAYUR	○ 260	○ B	◎ 700	◎ 100	◎ A		*
SIBOLGA	◎ 240	○ B	◎ 400	○ 40	◎ B		
SURABAYA							
SEMARANG	○ 340	○ B	◎ 700	◎ 160	◎ A		**
BENOA	○ 160	○ B	◎ 400	◎ 120	◎ B		
CILACAP	○ 160	○ B		◎ 120			
KUPANG	○ 320	○ A	◎ 700	◎ 240	◎ A		
UG. PANDANG	◎ 160	○ B	◎ 700	◎ 140	◎ A		*
KENDARI	◎ 240	○ B	◎ 400	◎ 120	◎ B		
SAMARINDA		○ A				○	
BALIKUPAPAN	◎ 240	○ B	◎ 400	◎ 120	◎ B		
BANJARMASIN	○ 340	○ A	◎ 700	◎ 240	◎ A		
MANADO/BITUNG	◎ 400	○ B	◎ 700	◎ 160	◎ A		
SORONG		○ A	○ 1300	◎ 280			
JAYAPURA	○ 300	○ A	◎ 700	○ 190	◎ A	○	
AMBON	○ 320	○ B	○ 700	◎ 160	◎ A		
MERAUKE	○ 300	○ A	◎ 700	○ 160	◎ A	○	
Total	(17) 4370	A (8) B (13) (21)	(17) 11,000	(19) 2,740	A (11) B (5) (16)	6	

Remarks: * Site movement is planned because of port development project dealing with Maritime Sector Development Program (MSDP).

** Site movement is planned because of city ring road program of Semarang and MSDP Project.

*** Site movement will be planned according to the operational need in the future.

( ) shows number of units.

The facilities are planned according to the criteria given below:

Item / Facility	Scale Criteria	
	1st Class District of Navigation	2nd Class District of Navigation
Workshop (incl. office)	1,000 m^2	400 m^2
Open Storage	3,000 m^2	500 m^2
Store House	500 m^2	100 m^2
Jetty	Type A (Length: 100 m Draught: 5.5 m	Type B (Length: 25 m Draught: 3 m

Remarks: 2nd Class Districts of Navigation in Palembang, Pontianak, Jayapura and Merauke will have the space areas of 1,000 m^2 for their workshops since the same size of installations as 1st Class' will be fitted due to their geographical inconvenience.

The installations for 1st and 2nd Class Districts of Navigation are detailed in **APPENDIX-25.**

(B) Gas Plant

In the world only a few countries have completely changed over from gas to electric sources. The majority uses a mix of gas and

electricity for their aids to navigation. Some have not changed to electricity for their light buoys.

In Indonesia, although some difficulties in the supply of acetylene gas have been experienced, which is only a temporary constraint, the policy to be followed is that about 350 of the existing beacons and buoys with acetylene will be maintained and further increase of such aids will be carried out up to 30% of those existing (about 105 units).

All aids using propane gas will be converted totally, either to acetylene or electricity (solar cells, wave activated, etc.).

The total number of 314 of lighthouses, light beacons and lighted buoys are presently acetylene gas-energized in Indonesia.

Acetylene gas is produced at the gas plant situated in Tg. Priok, and delivered by the supply vessels despatched twice a year from 1st Districts of Navigation to each District of Navigation stored in gas cylinders for the field supply.

However, the existing gas plant built in 1951 is rather old and has low efficiency in production. Furthermore, the production capability may be insufficient depending on the operational allocation of supply vessels, and some of lights have had lights off troubles because of gas shortage.

For the above reasons, establishment of a new gas plant is considered necessary to increase the production capabilities of acetylene gas.

A gas plant to be planned should have almost doubled production capacity as that of existing one with the view of future increase in number of gas energized navaids taken into consideration.

As regards the location-wise of the new gas plant, due to the fact that Tg. Priok/Jakarta lies almost in the centre of Indonesia and also from the viewpoint of Aids to Navigation Management Activities and personnel recruitment, the establishment in Tg. Priok/Jakarta is considered appropriate.

The main performances of a gas plant are as given below:

Site area:	5,000 m^2
Gas filling capability:	20 m^3/H
Gas filling pressure:	25 ATM
Gas holder capacity:	10 m^3
Compressor:	Motor compressor, High pressure

(C) Buoy Maintenance Facility

Considerable number of buoys, presently playing one of the important roles as aids to navigation, are installed throughout the country, and are in operation under the management and control of the total number of 24 Districts of Navigation.

Maintenance of these buoys are being carried out by buoy tenders, which belong to the respective bases, each having its own service area for buoys.

The maintenance system currently in practice for buoys is such that biannual services are provided on board buoy tenders at sea, and they have been re-installed at the locations immediately after completion of the on-board services, which include at-site painting on buoy bodies without allowing sufficient time for drying-up. This obviously leads to shortening of their life time, since painting may easily come off especially in water and rust cleaning may not be sufficiently carried out under such conditions.

One approach of maintenance to prolong the life time of buoys, at least as long as 20 years, is to deploy a total replacement system on regular basis: a buoy body and its mooring equipment are all taken on shore for rust cleaning, painting, repairs and checks at the base so as to provide the adequate maintenance and repair, which were not possible to carry out at sea. It brings about prolongment of the life span and improvement of the operational performances, thus increasing navigation safety of ships.

Buoys removed for the maintenance services includ-

ing lighting devices and mooring chains and sinkers are to be checked and repaired either at buoy bases or buoy open storages, and they will be re-installed by buoy tenders in a form of the complete replacement at the respective positions on a scheduled basis.

The replacement cycle may vary according to the conditions under which buoys are sited and positioned. It may, however, be set at two years in principle. Under favourable conditions such as in calm waters and within bays and harbours, 3 - 4 years cycle may be reasonable, while under adverse environment like fast current waters, areas where introduce servere tear and wear of mooring chains and marine microorganism sticks on the buoy bodies, the cycle may need to be only one year. Deployment of this system will improve the reliability of aids to navigation and facilitate the effective maintenance.

Buoy tenders, allocated to five 1st Class Districts of Navigation, have carried out the at-sea maintenance services both for buoys under the control of their own areas and for those of 2nd Class Districts of Navigation within their own territories on a biannual basis.

Calculation is made on the current work loads for the buoy tenders covering the total number of lighted buoys (L.B.) and unlighted small buoys (U.L.B.) excluding 137 non-property lighted buoys, and approximate estimate for the effective ships operational days per year may be made as given below:

1st Class District of Navigation	Work Load of Buoy Tender
Dumai	191 days per year
Tg. Priok	180
Surabaya	129
Samarinda	132
Sorong	80
Total	712

Dumai has the highest number of 191 due to the high density of buoy installations covering Dumai, Tg. Pinang, Belawan and Sabang. Any future increase in the number of buoys and other aids to navigation around those areas will inevitably creates extra burden of work loads.