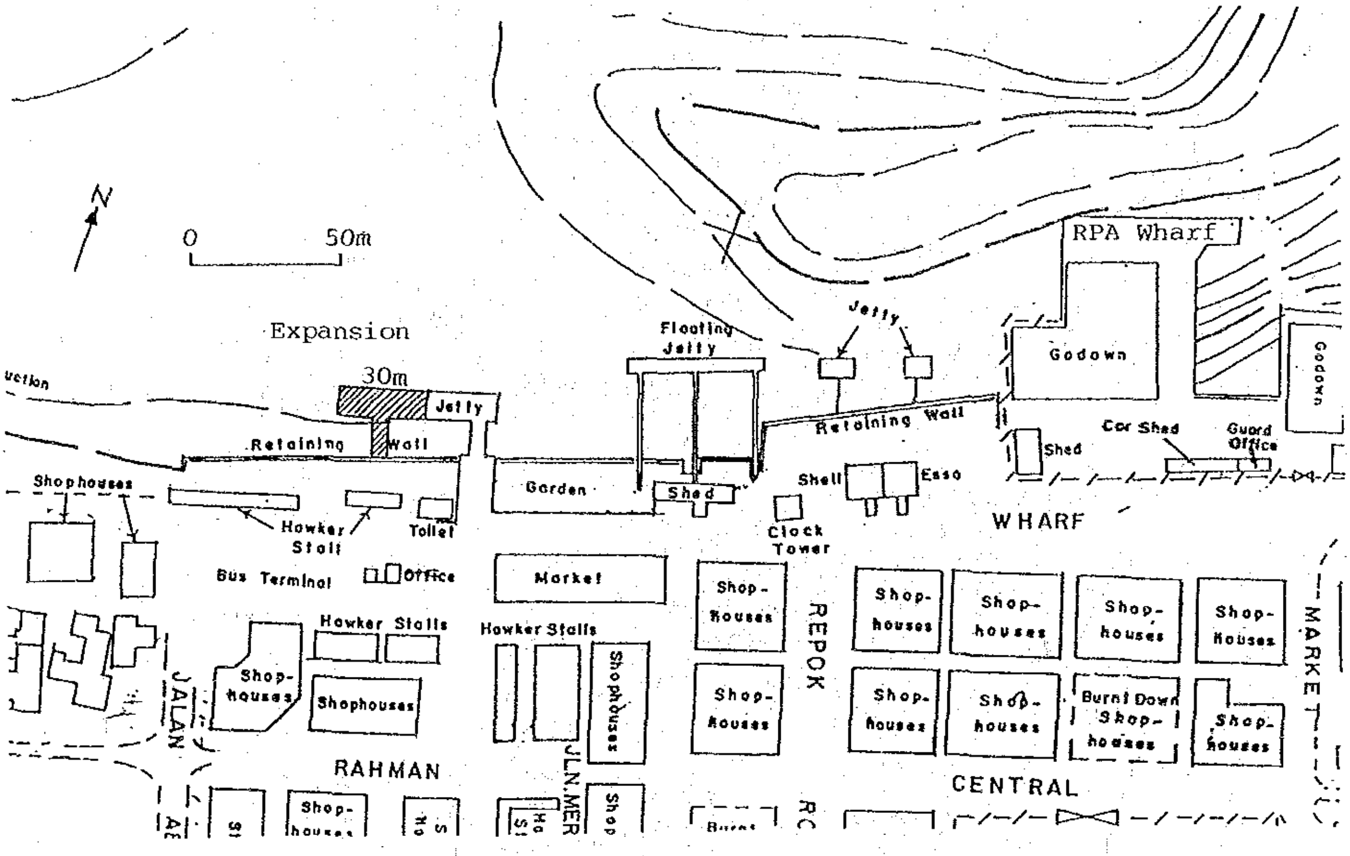


Figure-5.3.3.3 Expansion Plan of Existing Coastal Cargo Wharf at Sarikei

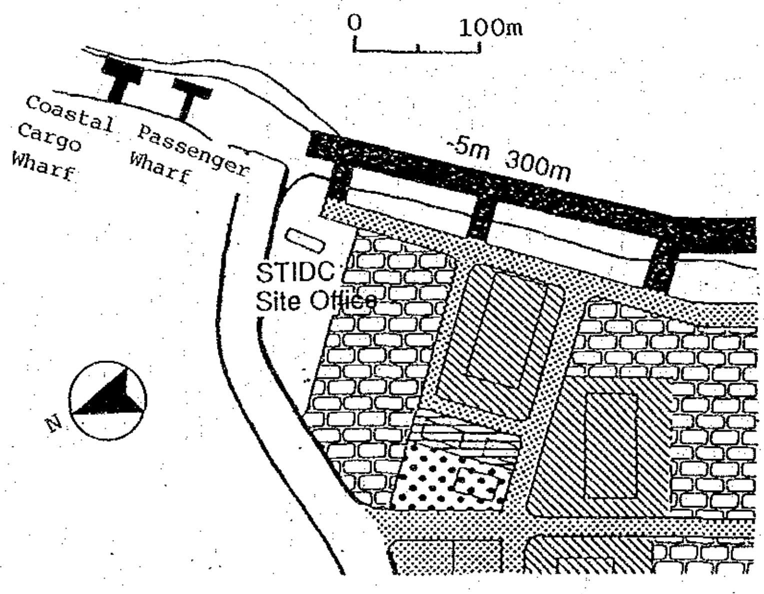


Figure-5.3.3.4 Plan for Coastal Cargo Wharf and Passenger Wharf at Tg. Sebubal

5.4 Preliminary Facility Plan for Passenger Boat Service

5.4.1 Vessels

we set design vessels for coastal and riverine transportation according to the "Master Plan Study for Coastal and Riverine Transport in Sarawak" as follows:

Table-5.4.1.1 Dimension of Design Vessel for Passenger Boat Service

	Passenger	Full Draught	Length
Coastal Service	164	2m	35m
Riverine Service	40 - 70	1 - 2m	20 - 30m

5.4.2 Existing facilities

Table-5.4.2.1 shows the existing facilities for passenger boats.

Table-5.4.2.1 Existing Passenger Boat Wharf

WHARF	LENGTH	STRUCTURE
Sibu	140m	Pontoon
Sarikei	50m	Pontoon
Bintangor	20m	Pontoon

5.4.3 Required berth length

We calculated the required berth length based on the future frequency shown in **Table-5.1.3.2**

(1) Sibu

The total departures and arrivals of coastal and riverine passenger boats a day is expected to be 70.5 and 81.5 round trips in 1997 and 2010, respectively, and will increase by 6 and 17 round trips from 1990.

The main reason why the passenger boat wharves are congested is that idling boats are mooring at the wharves. Therefore, we recommend preparing idling wharves and separating embarkation/disembarkation wharves.

At present, the maximum number of boats alongside a wharf is three, even if they moor up to an hour before their actual sailing time. Disembarking the passengers does not take more than 15 minutes per ship, and it takes about the same time to discharge the small amount of cargo they may carry from time to time .

So, we assume that 6 boats embark or disembark simultaneously at one wharf and that the number of boats which moor at the wharf simultaneously is the same as half of the daily round trips.

Therefore, 6 embarkation/disembarkation berths at the each existing wharf and, 12 and 15 idling berths at the each existing wharf will be required in 1997 and 2010, respectively.

(2) Sarikei

The total departures and arrivals of riverine passenger boats a day is expected to be 24 and 30 round trips in 1997 and 2010, respectively, and will increase by 5 and 12 round trips from 1990.

One berth for coastal passenger service between Kuching and Sarikei, and a couple of berths for riverine service between Sarikei-Sibu and Sarpikei-Tg. Sebubal will be required.

(3) Bintangor

The total departures and arrivals of riverine passenger boats a day is is expected to be 23 an 28 round trips in 1997 and 2010, respectively, and will increase by 4 and 9 round trips from 1990.

A couple of berths for riverine service between Sarikei-Bintangor-Sibu will be required.

(4) Tg. Sebubal

Passenger boat service will be operated to/from Sarikei. Therefore, one berth is required.

5.4.4 Facility layout

(1) Sibu

Figure-5.4.4.1 shows the plan for improvement of the Upstream and Downstream Expressboat Wharves which can accommodate 6 boats for embarkation/disembarkation and 7 idling boats. Moreover 10 and 16 berths for idling boats will be required in 1997 and 2010, respectively. The possible location of the idling berth is in front of Lee Hua Hotel or on Igan River.

(2) Sarikei

The existing facility (50m pontoon) will be enough for the future demand. No expansion will be required up to 2010.

(3) Bintangor

The existing facility (20m pontoon) will be enough for the future demand. No expansion will be required up to 2010.

(4) Tg. Sebubal

30m-long pssenger boat wharf will be required (pleases see **Figure-5.3.3.4**).

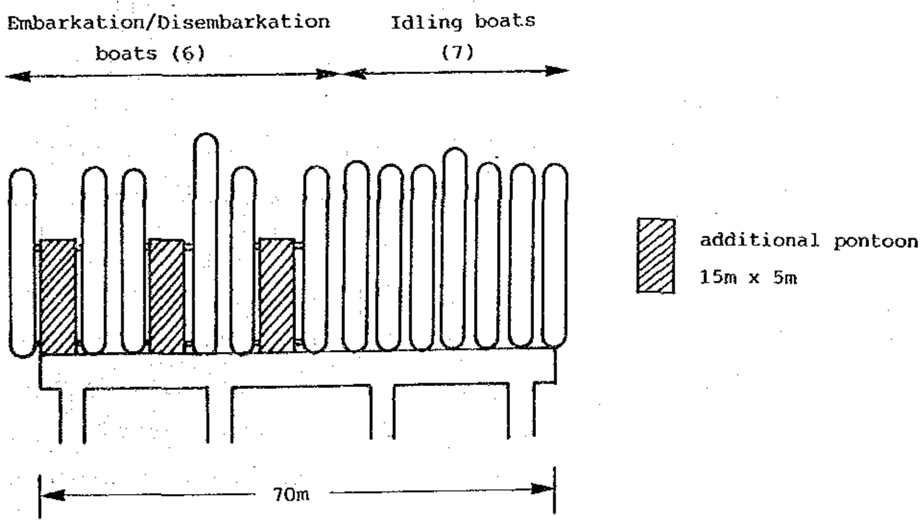


Figure-5.4.4.1 Improvement Plan of the Upstream and Downstream Express Boat Wharves at Sibu Center

6. NAVIGATION AIDS

6.1 Present Situation of the Waterways within Rajang Port

6.1.1 Profile of the waterways

(1) Distance of the waterways within Rajang port area

Rajang port consists of four wharves and an anchorage i.e. Sibu, Sungei-Merah, Bintangor, Sarikei and Tg. Manis, all lying in the Rajang delta through which the river meanders into the South Chine Sea.

Sibu, the core of the port, lies 73 miles east of the Rajang estuary to form the innermost recess of the waterway. Sungei-merah, a tanker berth at an oil depot, lies two and a half miles below Sibu along the Igan river which branches at the Sibu crotch from the Rajang river. The remaining three ports, Bintangor, Sarikei and Tg. Manis lie below Sibu along the mainstream of Rajang river.

There are two navigable waterways on which seagoing vessel proceed to Sibu: the Paloh river route and the Rajang river route. They join at Tg. Leba-an junction from which one route leads to Sibu.

Figure-7.1.1.1 shows the location of the five ports with mileage from estuary to each port.

The route to Sibu, via Paloh estuary, 62 miles above the mouth, is almost exclusively used by seagoing vessels. The maximum size of navigable vessels is restricted to a ship's length of 120m and draft of 5.7m, by the natural conditions of the channel, although a 136m vessel once reached Sibu. Vessels usually take seven to eight hours to proceed from the mouth to Sibu. Moreover, they usually have to anchor before shoals for four to five hours until the tide rises, and they can proceed on their final destination.

In the case of the Rajang route, larger vessels with a 8.8m draft that have cleared entrance shoals are able to reach Tg. Manis anchorage. The route beyond Tg. Manis is used by smaller seagoing vessels, mainly bound for Sibu from Singapore. Additionally, many express ferry boats serve as main public carriers in this area. The maximum size of navigable vessels in this area is restricted to a length of 61m and draft of 4m. With riverine ports, where waterways are long, narrow, shallow and winding, as in the Rajang port, mariners commonly face long hours navigating complex and problematic circumstances.

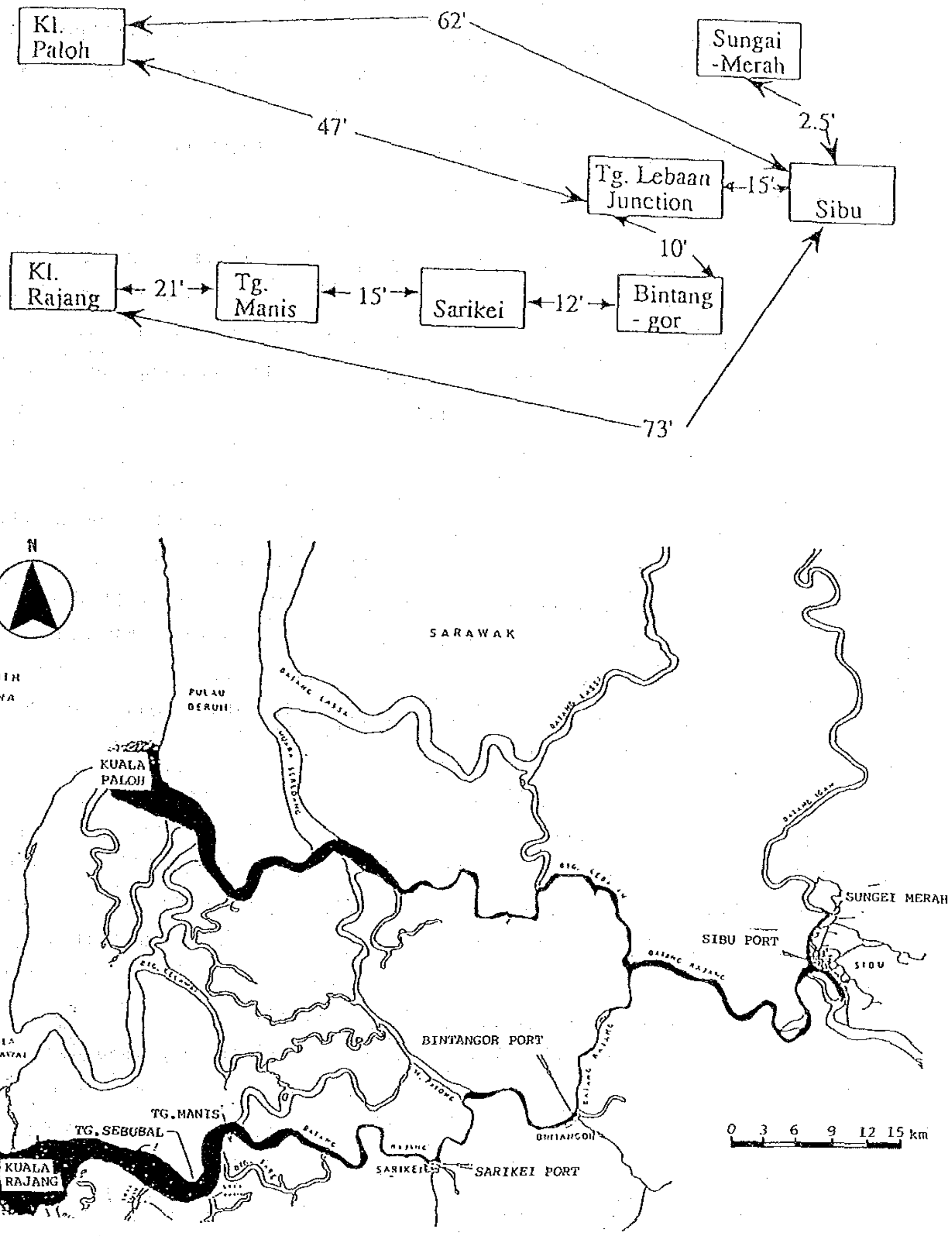


Figure-6.1.1.1 Location of the five ports with mileage

(2) Navigable width of the waterways

One of the difficulties of ship handling in riverine waterways is closely related to the navigable width of the waterways, owing to such matters as:

- Velocity of flow is accelerated in those narrow lanes particularly;
- Uniform stream is being disturbed in either direction or velocity;
- When vessels are affected by sidewise wind/flow force, their leeway increases and course keeping stability decreases remarkably;
- Naturally, vessels alter their course frequently along curved lanes and they deviate more or less from the intended course on almost all such occasion, and adjusting the course to the proper one within restricted room is particularly difficult;
- A lack of water room also raises the possibility of vessels colliding during head-on, crossing, overtaking/overtaken situations.

As stated above, narrow waterways have inherent characteristics that decrease a vessel's maneuverability and jeopardize safe navigation.

Considering that the controlling depth on the routes is deeper than three fathoms, according to chart datum, and having studied both the Paloh and Rajang routes, waterways with navigable width of less than 300m are distributed over the whole port area, as is listed below. The underlined legs, in particular, are narrower than 100m.

1) Rajang route

i. Api Api Spit - Tg.Delima - Tg.Manki - <u>Rocks Reach</u> - <u>Tg.Pinang</u> - <u>Sarikei</u> - <u>Tg.Nyelong</u> - <u>Tg.Burong - Tg.Sahat - Tg.Payang</u> - Tg.Tikus - Bintangor - <u>Lubok Batu - Lubok Balat - Tg.Pendam</u> (30 miles leg)

ii. Tg.Ensurei

iii. <u>Tg.Binjei</u>

iv. Telok Selalo - Tg.Sadit - Tg. Banyok - Tg.Damit - Tg.Engkilo - Sibu (5 miles leg)

2) Paloh rote

i. <u>Fairway light buoy</u>

ii. <u>Tg.Gelang</u>

iii. Tg.Pangai NE - E

iv. Telok Telia - Telok Sah (5 miles leg)

v. Tg.Kamis - Tg.Singat - Tg.Leba-an (10 miles leg)

3) Igan route (Sungei Merah)

Tg.Engkilo NE - Tg.Peka - Sungei Merah (5 miles leg)

(3) Depth of the waterways

In September 1990, the Study Team carried out the topographical, bathymetrical survey on the Sibu area and the other four port areas concerned, including the sounding works from Tg.Manis to the Rajang estuary. The results obtained are stated in detail in **I.1. Natural Conditions.**

On the other hand, the Team studied a matter of the river depth to estimate the optimum size of vessels to be placed in Rajang port service, as stated in **2.4.**

Putting the said information with the latest chart datum (1977), the matter of concern on depth of the waterways from a viewpoint of navigation safety is as follows:

1) Rajang route

i) The first barrier for seagoing vessels entering the Rajang route is two shoals lying off the estuary. The waterway is placed between a vast shoal of Bohari Bank, extending westward from Tg.Jerijeh and a long spit of Wong Sand, spreading WNW-ward from Tg.Selalang. Consequently, these shoals reduce this narrow waterway even further.

According to the latest sounding results of the Study Team, the shallowest area of the Bohari Bank was 0.5m deeper than recorded earlier and had shifted substantially westward. On the other hand, the shallow foot of Wong Sand had disapperared from the survey area and probably shifted southward or eroded.

Due to the activities of the Rajang stream and ocean current, it seemed that the depth of the waterway has become deeper than before. The same activities, however, also created new problems by shifting the important leading buoy position.

ii) Vessels bound for the inner Rajang ports proceed on the recommended course for three miles to pass the aforesaid shoals of three fathoms, according to chart datum. As for the deep-draft seagoing vessels, once they have cleared the shoals on a favourable tide of three to five metres, the waterway is then deep enough for them to proceed up to Tg.Manis anchorage.

iii) Sailing upstream beyond Tg.Manis anchorage is restricted to smaller vessels not exeeding a length of 60m and/or draft of 4m.

Critical shoals on the waterway to Sibu for those smaller vessels still exist at the following points:

Location	Depth
- Sarikei (2c. North of Si.Nyelong junction)	2.0 fm.
- Tg.Burong (2-3c. NE)	2.3 fm.
- Tg.Payang (1.15.M E)	2.0 fm.
- Lubok Bulat (5c. N)	2.1 fm.
- Tg.Pendam	1.1 fm.

2) Paloh route

i) Estuary; A bar with a depth in 1981 of two and a half metres fronts the Paloh estuary between three miles and five and three-quarters miles NW of Tg.Pasir. Although this bar is shallower than that of fronting the Rajang estuary, once a vessel has crossed it taking a favourable tide, the route to Sibu via Muara Seredeng, Loba Semah and Tg.Leba-an is much easier to navigate and has fewer dangerous areas. Consequently, ever since this route opened for use in 1962, larger vessels have been able to reach Sibu.

ii) In the vicinity of Tg.Gelang; Tg.Gelang is situated 25 miles above the estuary. A shoal with less than two fathoms over it blocks the waterway between Tg.Gelang and its opposite bank, and another shoal with less than two and a half fathoms over it lies within two and a half miles of it.

Vessels without under keel clearance have to anchor before those shoals to wait for a favourable tide.

iii) In the vicinity of Tg.Leba-an junction; Tg.Leba-an is situated 47 miles above the Paloh estuary. According to pilots' opinions a spit is expanding from the left bank of Rajang river, consequently the waterway is getting narrower and shallower.

iv) In the vicinity of Tg.Binjei; Tg.Binjei is situated eight and a half miles above the Tg.Leba-an junction on the left bank of the Rajang river. Three detached shoals, covered by three metres, four metres and four point six metres, respectively, of water lie in midchannel between three quarters and two and three quarters cables north of Tg.Binjei. Depths of less than five and a half metres extend three quarters of a cable NE of the points, making off Tg.Binjei the hardest to pass on the Paloh route.

3) Igan route

The Igan route which leads to the Sungei Merah oil depot, branchs from Tg.Engkilo on Rajang river. Its entrance waterway is obstructed by a shoal ledge that extends from the Sibu side bank, with covered by two point one (2.1) fathoms, lying three-quarters of a cable NE of Tg.Engkilo.

Although a narrow channel, 30m wide with a depth of over five and a half metres lies close off Tg.Engkilo, vessels of 3,000DWT oil tanker, which trade from/to Sungei Merah, need to maintain a draft of less than five metres and have to pass the aforementioned shoals while a favourable tide is rising.

(4) Bends of the waterways

When vessels are proceeding on a meandering riverine waterway, they frequently alter course to maintain a position in a fairway with enough depth. This occurs continuously with the number of occasions surpassing the number of bends in the river.

A frequent curve on the Rajang port waterway amounts to occurrences of at least 124 times, 84 times and 10 times on the Rajang, Paloh and Igan routes, respectively,

While altering course, a vessel behaves in an arc; thus, the steering action must begin some distance before the exact altering point. If the ship's handler misjudges the distance known as the "advance", which mainly varies by the degrees of the altering course, the vessel will deviated from the intended course and slide into a zigzag pattern.

Furthermore, in a riverine waterway, the view from the mariner's side is obstructed by curved banks, islands and points jutting out into the river. This lack of unobstructed visibility could place vessels in dangerous situations where they do not have time to react defensively to movements by other vessels.

The following **Table-6.1.1.1** classified the major critical turning points on the Rajang port waterways into three levels, primarily by turning angles of more than 30 degrees 45 and 60 degrees, while taking into account the width and depth of the points as well.

Table-6.1.1.1 Major Critical Turning Points

Rajang Route

>30°	>45°	>60°
	Tg.Sebubal E (58)	
Mani Bank (34)		
	Tg.Manis N (57)	
	Tg.Sepler (52)	
	Tg.Api Api (46)	
	Tg.Delima S (55)	
	Tg.Delima E (51)	
Tg.Delima NE (24)		
Tg.Manki W (35)		
Tg.Manki N (37)		
Rocks Reach (42)		Rocks Reach (62)
Rocks Reach (39)		Rocks Reach (54)
Tg.Pinang NW (30)	Tg.Pinang S (55)	
Below Sarikei (35)	Sarikei (57)	
	Sarikei (53)	
Tg.Nyelong SW (28)		
Tg.Nyelong N (40)	Tg.Nyelong NE (52)	
Tg.Burong SW (31)	Tg.Burong SE (56)	
Tg.Sahat S1 (27)	Tg.Sahat S2 (44)	
Tg.Sahat S3 (29)	Tg.Sahat S4 (44)	
		Tg.Payang Bn (85)
	Tg.Payang W.Bn (41)	
Tg.Payang E (29)		
Loba Bunut Laut (28)		
Rumah Bunut S (25)		
Tg.Tikus NW (27)	Tg.Tikus SW (44)	
	Bintangor NE (56)	
Si.Tekap (39)		
Kg.Bundong (24)		
	L.B.Ulus (46)	
Si.Salemas (37)		
Pu.Salemas SW (30)		
Pu.Salemas N (24)		
Lutok Batu NW (23)		
Lutok Batu E (30)		
	Lutok Bulat NW (50)	
Lubok Bulat (40)		
Lubok Bulat (30)		
	Tg.Pendam S.Bn (45)	
	Tg.Pendam Bn (47)	
	Tg.Kunnjit NE (55)	
	Tg.Ensurei S (50)	
Tg.Ensurei SE (35)		
	Tg.Binjei NW (45)	
Tg.Binjei NE (35)		Tg.Binjei (70)
	Pulau Selalo SW (50)	
	Tg. Sadit (45)	
Tg.Banyok (30)		
Total number 30	25	4

( ): turning angles

Paloh Route

>30°	>45 °	>60°
Tg.Jakak NE (40)		
Tg.Balan S (42)		
Tg.Kelai S (30)		
		Tg.Kelai Se (63)
	Tg.Mekakong NW (48)	
	Tg.Mekakong N (47)	
Tg.Mekakong E (32)		
		Tg.Gelang S (65)
	Tg.Gelang S (48)	
Tg.Gera-am NE (36)		
	Tg.Panga-i NE (50)	
	Tg.Panga-i E (47)	
	Tg.Jemlai SW (43)	
Tg.Jemlai SE (35)		
		Tg.Jemlai NE (65)
Si.Semah SE (35)		
Tk.Telia B'wl' (40)		
		Tk.Telia W (63)
	Tk.Telia (45)	
Tk.Telai SSE (33)		
Tg.Penasu W (40)		
Tg.Penasu S (37)		
Tg.Penasu SE (37)		
Tg.Penasu E (34)		
	Tg.Kamiss (48)	Tk.Sah (91)
	Tg.Singat NE (50)	
Si.Lemangan NW (43)		
Si.Lemangan SW (42)		
		Si.Lengan E (70)
Saw Mill (35)		
Church (42)		
Tg.Leba-an N (27)		
Tg.Leba-an W (40)		
		Tg.Leba-an SW (69)
Total number 19	9	7

(5) Weather and tide

1) System of meteorological observations

The meteorological observations in the State of Sarawak are being carried out by five weather stations that are annexed individually to five corresponding State Air Port Terminals. They mainly have been serving as aids for air navigation.

Based on weather station records, the general weather conditions of the Rajang delta are shown in 1.2 Meteorology.

Mariners approaching or leaving a port are particularly concerned about the weather and tide in and around the port because of their significance for safe maneuvering in the port. In the case of Rajang port waterways, the nearest available weather information only comes from Sibu airport, 130km from the estuary; thus, mariners have no access to reliable weather information except through self observation or pilots' opinions.

2) Wind

Generally, the wind velocity of a port area is one and a half times to two times that of inland wind velocity. On the open sea, wind velocity can be more than double velocity in the harbour entrance.

Although existing wind data is not so serious, a well-experienced pilot issued the following warning:

- In particular, when a NE monsoon is prevailing, vessels proceeding on a narrow waterway of the estuary are affected by strong leeway, which makes it difficult for vessels to keep on very restricted course;
- Even in the innermost riverine port of Sibu, an anchored vessel once was blown by a gust, and dragging anchor, then crashed into another staying vessel.

3) Visibility

No visibility records are available in this area. According to a pilot:

- At Sibu, in early mornings following very hot days, a dense fog occasionally sets in over the river surface;
- Another pilot said visibility at Tg.Manis was almost clear all the time. In the worst conditions, visibility was restricted to two to three miles.

4) Tide

In October 1990, the Study Team carried out tidal observations at Tg.Manis and its vicinity and results are shown in **I.2.4.4 Oceanography** in detail. In addition to this, existing data on tide are available from the Government issued tide table, charts, sailing directions and practical information from pilots.

Summing up, the maximum drift of current attains five knots and its range varies five metres, making the Rajang port a difficult area to navigate without exact knowledge of the tide.

Thus, reliable information on tidal currents and ranges is important for vessels attempting critical portions of the river.

(6) Other obstacles to sailing

1) Wrecks

i) A stranded wreck (MV.Million) lies on Wong Sand of the Rajang estuary two and a half miles WNW of Tg.Selalang Lighthouse, just on the south side of the fairway.

When a NE monsoon is prevailing, the wreck, which lies on lee-side of the waterway is a particular danger for passing vessels.

ii) Another wreck (MV.Mano) lies three and a half miles above Tg.Jerijeh South Becon, just 200m south of the waterway axis.

The track, which lies north of the wreck is being used by all large seagoing vessels trading in the Tg.Manis port area. The weather and sea condition of this portion of the route is almost the same as that of the open sea.

The two wrecks (MV.Million, MV.Mano) and the surrounding conditions have a direct influence on safe navigation in the Rajang port area.

iii) According to chart MAL.7215, BA.1948, the two wrecks lie NE mid-channel off Tg.Manis. For small vessels bound for upstream ports beyond Tg.Manis, the two wrecks are at a depth that dose not make them obstacles for vessels to proceed. However, a watch on their positions, particularly their depths, shall be maintained.

iv) A capsized vessel lies on the spit of the left bank of the Rajang river about a half mile above the Tg.Leba-an junction.

Although the navigable width of this area is about 450m, the wreck is conspicuous but not a serious obstacle to other vessels so far. A watch on the wreck's movement or changes in the river bed shall be continued.

v) A stranded wreck, whose masts and derrick posts break through the water surface, lies on the Bagus spit west end 3.1 miles 211° of Tg.Sedi

Lighthouse. The wreck lies 900m NNW from the leading course line of Paloh estuary, and is visible on a clear day or detectable by radar.

2) Drifting logs

Drifting logs and pieces of wood are plentiful in the entire port area. Thus, it likely can be assumed that the situation is similar beneath the river surface. Muddy conditions provide zero visibility, so these "hidden" logs are especially dangerous obstacles for older vessels and have been impeding small vessel traffic, in particular.

6.1.2 Traffic volume/density of vessels

Navigation safety in a waterway is much influenced by traffic volumes and the density of the waterway.

According to **I.3.5**, the number of calling vessels at Rajang port gradually increased year by year with the development of the delta area, and consequently the rate of growth for the last 10 years almost has attained 40%.

To estimate the number of called vessels by each route, we divided the total number of called vessels in 1989, based on the GRT distribution of vessel in 1989, into two routes on the assumption that:

- Vessels of more than 2,000 GRT took the paloh route;
- Vessels of less than 2,000 GRT took the Rajang route; with the exception of those that at Sungei Merah.

The result, vessel traffic volume by route, is shown in **Figure-6.1.2.1.**

From the viewpoint of traffic density, we convert every calling vessel into a specific size of vessel, reasoning that a vessel underway in a waterway would occupy a certain space, which is proportional to a square of her length, i.e. a double-length vessel would occupy four times the space of model vessel, and on the assumption that:

- The model size in both routes is 2,500 GRT,
- The length of called vessels is estimated based on Japanese MOT statistics.

The result, vessel traffic density by route, is shown in **Figure-6.1.2.2.**

Judging from the above accounts, neither traffic volume nor the density is heavy in the Rajang port area so far. However, we maintain that the localized focus of the marine casualities has related to places such as Tg.Manis and the Sibu port area, where traffic is jammed.

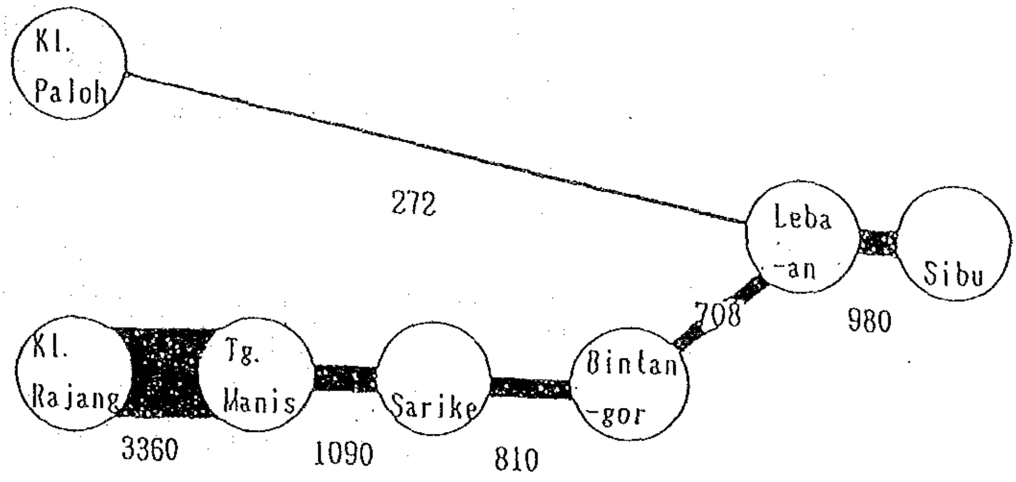


Figure-6.1.2.1 Traffic Volume

No. of passing vessels by route, 1989

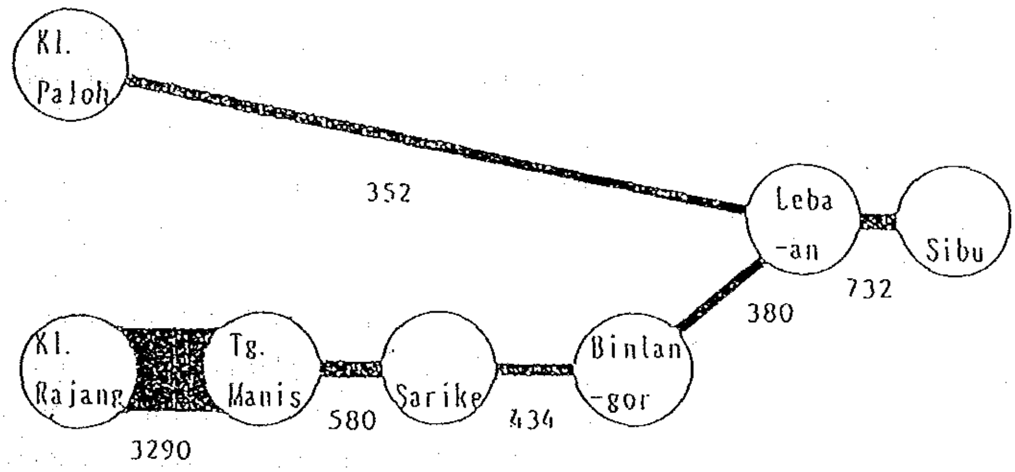


Figure-6.1.2.2 Traffic Density

No. of passing vessels converted into 2,500GT by route, 1989

6.1.3 Existing traffic regulations in the waterways

The existing regulations related to the subject are found in "The Merchant Shipping (Ports and Rivers) Regulations, 1961", under section 277 of "the Merchant Shipping Ordinance, 1960".

It consists of 60 articles and provided certain stipulations on traffic safety in the following section:

- Part IV Anchoring, Mooring and Berthing,
- Part V Regulation Traffic and Obstructions,
- Part VI Safety in Port,
- Part VII Floating Logs and Timber Rafts, and
- Seventh Schedule Special Provisions Pertaining to Rajang River Port

However, ample stipulations to cope with all existing situations have not yet been provided, and leave the issues to the notice of the Marine Department and pilots, as the envoy or interpreter of the authority concerned. For example, there are no stipulations on:

- the maximum size of navigable vessels,
- night navigation, and
- special traffic rules in specific areas of the waterways.

Aiming at updating regulations a study is now underway among the officials concerned.

6.1.4 Pilotage system

Taking on a pilot is not compulsory and is left to the vessel's option in the Rajang port areas. The licensed pilots in service, seven at Kuching, two at Sibu and six at Sarikei, are permanently stationed at the Marine Departments corresponding to each service area. These pilots are:

- holders of the Master Mariner Certificate of foreign or local trade service conforming to "the STCW convention, 1978";
- well-experienced in sea service in the area;
- qualified by the Government after at least six months of training under a chief pilot's guidance;
- and between 30 to 60 years old.

There are no pilot stations at the harbour entrances; thus each time the pilots receive a vessel's request, they take a speed boat from the Sibu/Sarikei office to the vessel staying off the estuary.

In 1990, in the case of Paloh route piloting, 10 to 12 seagoing vessels requested pilot service on a monthly basis, out of a total of 809 vessels that called at Sibu port throughout the year.

The work demands on the two pilots at Sibu do not appear particularly heavy. However, based on our experience, two pilots might be required to man a single vessel during a long leg that could take more than eight hours to pass through, such as the Paloh route.

Accordingly, the plan of the Marine Department to add another pilot at Sibu is quite reasonable.

6.1.5 Navigation marks

There are two lighthouses, 15 light beacons, seven light buoys and 10 leading lights in the State of Sarawak, and all of them are under control of the Kuching Marine Department.

The routine upkeep of these marks is carried out by three patrol boats of the Marine Department through an inspection of all marks every three months and annual maintenance for buoys.

We observed almost all of the navigation marks within the Rajang port area by a speed boat, and our remarks are as follows;

- The painting of important Buoys were discoloured, i.e. Kl.Rajang outer and inner buoys, Kl.Paloh outer and inner buoys, MV.Million and MV.Mano wreck buoys.
- The buoyage system of IALA (International Assosiation of Lighthouse Authorities), which has been widely accepted in international ports in recent year, should be complied with in this area; in particular, the top marks and light characteristic are problems.
- Some important Transit Marks/Heading Marks were obscured by thick woods and low height; they also were leaning because of an eroded base, i.e. Blatok, Tg. Engkilo, Leba-an South, Leba-an NE, Leba-an NW, Sg.Barong, Tg.Manis, Sg.Sepler, Salah-Salah A, B, and C.
- Some of the notice boards were leaning, probably because of eroded bases, i.e. Sg.Nyibong "Narrow Passage", Tg.Manis Anchorage, Muara Payang, Tg.Leba-an "15 Miles to Sibu".
- There was no lamp on the Kl.Paloh wreck.
- To assure navigation safety, additional navigation marks such as lateral marks, cardinal marks, isolated danger marks and notice boards

should be installed in critical portion of the waterways.

In response to these matters, we have included our proposal in **6.2.1 Navigation marks.**

6.1.6 Results of marine casualties

(1) Classification by type and location

According to the Sea Protests, which were collected in the Kuching Marine Department, the number of marine casualties in the Rajang delta in the past seven years reached 175.

In the table below we have looked at the past five years only and have classified the 128 marine casualties that happened within the Rajang port area over this period by type.

Table-6.1.6.1 Marine Casualties in the Rajang Port

	GRT	'86	'87	'88	'89	'90	Total	%	
Grounding	>500	-	1	0	1	1	3	2.3	13.2
	<500	-	1	4	8	1	14	10.9	
Collision	>500	0	2	4	7	3	16	12.5	40.6
	<500	3	4	13	10	6	36	28.1	
Fire	>500	-	-	-	0	2	2	1.6	3.2
	<500	-	-	-	1	1	2	1.6	
Sinking	>500	0	0	1	1	2	4	3.1	31.2
	<500	3	9	6	11	7	36	28.1	
Others	>500	0	0	1	2	1	4	3.1	11.7
	<500	2	1	0	3	5	11	8.6	
Total	>500	0	3	6	11	9	29	22.7	100
	<500	8	15	23	33	20	99	77.3	

As the **Table-6.1.6.1** indicates, grounding, collision and sinking, which are related closely to waterway conditions and/or circumstances, compose 85% of all casualties; thus, these three can be regarded as the typical marine casualties in the Rajang waterways.

On the other side, the locations, where the typical casualties happened within the two major routes, are assumed as follows:

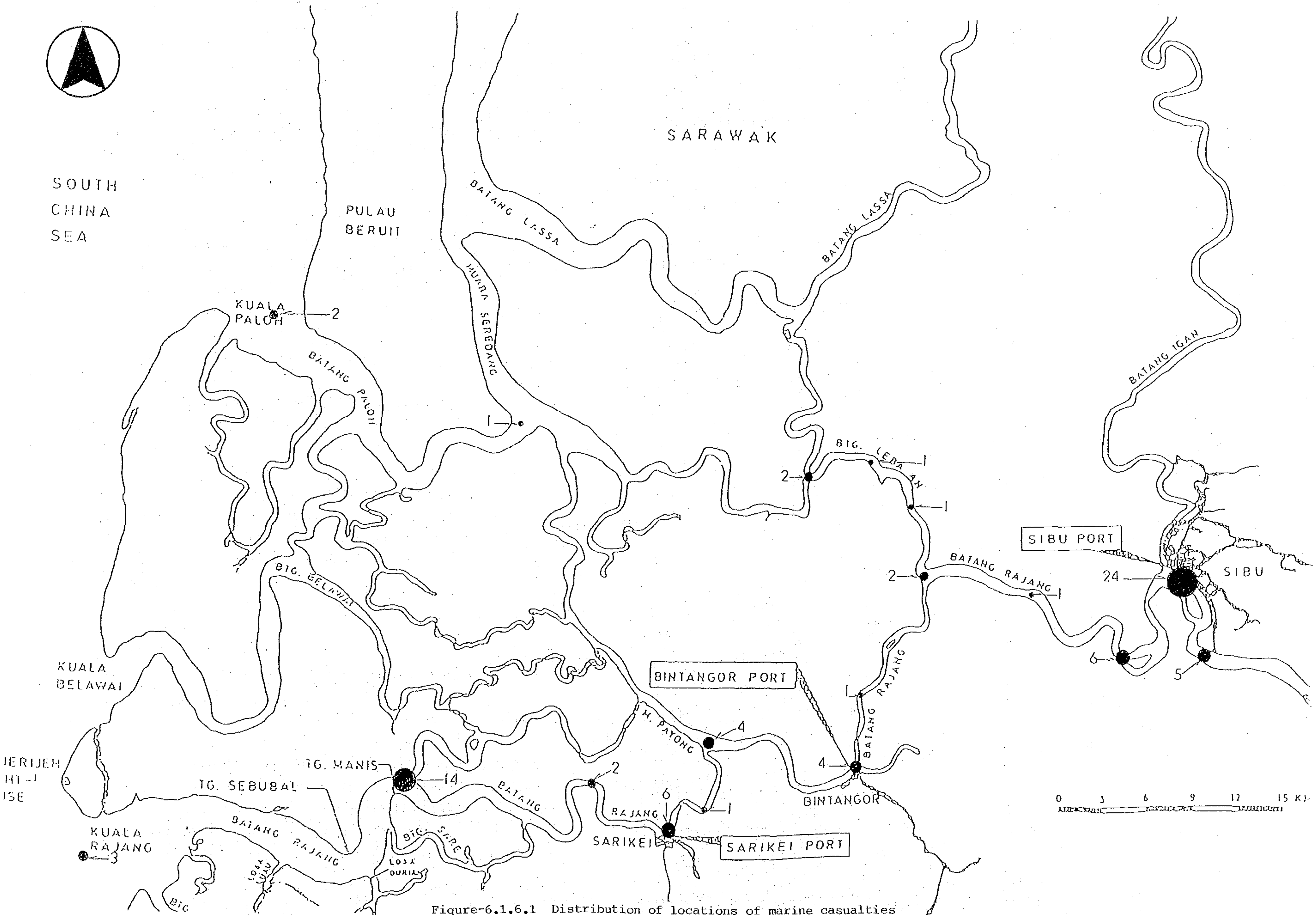


Figure-6.1.6.1 Distribution of locations of marine casualties

- between the Rajang estuary and Tg.Leba-an ------------------ 35(43.7%)
- between the Paloh estuary and Tg.Leba-an ------------------ 9(11.3%)
- between Tg.Leba-an and Sibu ---------------------------------- 36(45%)

From these figure, we conclude that about 90% of the typical casualties within the Rajang port area have happened between the Rajang estuary and Sibu.

The distribution of those locations is shown in **Figure-6.1.6.1.**

(2) Consideration of the results

Although we have outlined the various difficulties for seagoing vessels to proceed on the Rajang port waterways, in particular, the number of marine casualties, in fact, is not serious so far.

The major reason that the actual number of casualties is relatively small is the low traffic volume and density in this area; further, experienced shiphandlers have maintained vessel operations through careful maneuvering.

However, the distinctive features of the Rajang port casualties still can be found in places where:

- traffic is jammed,
- the waterways are junctured,
- the waterway is particularly narrow, shallow and sharply curved.

Navigating the inherent natural conditions in the Rajang waterways has been a serious burden for even well-experienced mariners; thus, in our view, there is plenty of room to improve waterway conditions on navigation marks and incidental facilities and to create a promising port.

6.2 Planning Navigation Aids

In connection with the navigation safety the two fundamental risks are: collision and running aground.

Normally, a vessel is capable of avoiding collision and grounding through its own resources.

Nevertheless, experience has shown that in certain cases "shore-based service" is required for assistance; for example, in areas with a high traffic density, in channels, in circumstances where visibility is reduced and in difficult meteorological or hydrological conditions.

Thus, to ensure the greatest degree of safety and lighten the mariners' burden, with as little reform of natural conditions as possible, the following measures should be considered.

6.2.1 Navigation marks

(1) Racons (Transponders)

Although radar primarily is used to avoid collisions and for short range coastal navigation, it is also often used for making landfall. In places where the landfall is flat and featureless, racons can be useful for locating a particular point. Racons may be considered similar to radio beacons, but the information appears on a vessel's radar screen, simplifying their location relative to the vessel's position.

They are used primarily for identifying selected navigation marks. In certain areas, they can also be used for the identification of important points on a featureless coastline.

Thus, at least one racon annexed to one major lighthouse of the estuaries should be highly effective, i.e. Tg.Jerijeh of the Rajang estuary and Tg.Sedi of the Paloh estuary.

(2) Buoys

Throughout the Rajang port area, the waterways are fairly narrow and shallow, relative to large seagoing vessels, and mariners need a more accurate position and a greater monitoring of vessel behaviour. Navigable waterways must be indicated by lighted buoys fitted with efficient radar reflectors and placed sufficiently close together.

In **Appendix-II.6.2.1**, we have indicated the minimum essential buoy arrangement such as lateral, cardinal, isolated danger and safe water marks conforming to the IALA new buoyage system.

Buoys should be lighted when placed off the estuaries, the critical portion of the waterway and near the wharves in particular.

(3) Leading marks/heading marks

The existing 12 leading marks should be remodeled with higher towers, stable solid foundations and solar electrification. The trees surrounding the marks as shown in **Appendix-II.6.2.1**, should be cut down.

(4) Notice boards

Notice boards, which alert vessels to critical turning points, junctions, "reduce speed", and mileage to the berths, should be remodeled and/or placed at additional, conspicuous points with stable foundations as shown in **Appendix-II.6.2.1.**

(5) Maintenance and reliability

1) The energy source for the mark itself should be reliable to ensure continuity of service in a very hostile environment. Thus, the back-up system of energy source and solar electrification for remaining lighted marks should be executed.

2) A prerequisite for a reliable and trouble free operation is regular preventive maintenance. Nevertheless, when an incident does occur, maintenance personnel must be available to restore normal conditions with the least possible delay; careful thought must be given to the means by which such personnel may be rapidly transported to the site of the incident.

3) An incident procedure is also important, whereby the Marine Department and the mariners or pilots are quickly informed on any accident to a navigation mark. In the case of an interruption to service due to routine maintenance, this can be accomplished in advance by means of "Notices" to mariners. When the interruptions are due to an accident or equipment failure, the mariners or pilots should be informed by radio.

4) Periodical confirmation, relocation and dissemination of the existing buoys position.

The Kl.Rajang inner buoy at the south end of the Bohari Bank of the Rajang estuary, a very important signal for vessels approaching or leaving the Rajang port, is apparently shifting with the movement of the Bank.

The shift of the Buoy from its original position on the chart datum might result in false information for passing vessels, thereby increasing the chance of potential sea casualty.

A countermeasure against the shifting of a buoy might be to replace the buoy with a beacon, which the hard stratum could support.
However, there are complications concerning the Rajang estuary:

* The two shallows of the Bohari Bank and the Wong Sand have been

changing their shape and depth owing to the characteristic natural activities of the estuary. Accordingly, the placement of a port hand lighted beacon with a solid foundation at the present south end of the Bohari Bank, which would necessitate fixing the port hand boundery of the entrance waterway, is not advisable under the circumstances.

* Should a vessel collide with a fixed beacon by mishandling, serious damage would occur to both the vessel and the beacon.
* The construction of a lighted beacon on an offshore site is very troublesome work involving heavy expenditures. Also, at this point in time it would not be advisable to fix the actual position of the beacon because the increase in the number of calling vessels cannot yet be determined.

Having taken the circumstances into consideration, we recommend the following practical countermeasures:

* The placement of a port hand lighted buoy, which conforms to the IALA Bouyage System, at the present south end of the Bohari Bank.
* Correcting the chart datum on the position of the new buoy.
* Implementing periodical sounding in and out of the waterway to confirm the buoy position, and relocating the buoy whenever it is necessary.
* Disseminating the exact buoy's position as soon as it becomes available.

6.2.2 Other safety back-up facilities

(1) Tug boats

With regard to the manoeuvrability of a large seagoing vessel in the turning basin of an internal port, the main engine and the rudder are incapacitated. A tug boat to assist the vessel, in the final phase of the manoeuvre, is indispensable as the lateral and turning force source. Thus, the Rajang Port Authority will need to have on-hand a capable tug boat fleet to maintain safe and efficient use of the wharves by the time the facilities are completed.

According to accepted wisdom, the total necessary towing (pushing) force to move the vessel athwartships on the assumption that

- lateral velocity of vessel : 0.15 m/s
- underkeel clearance : 10% of vessels draft

- wind velocity : 10 m/s from wharf
- tidal drift : 0.2 knot from wharf

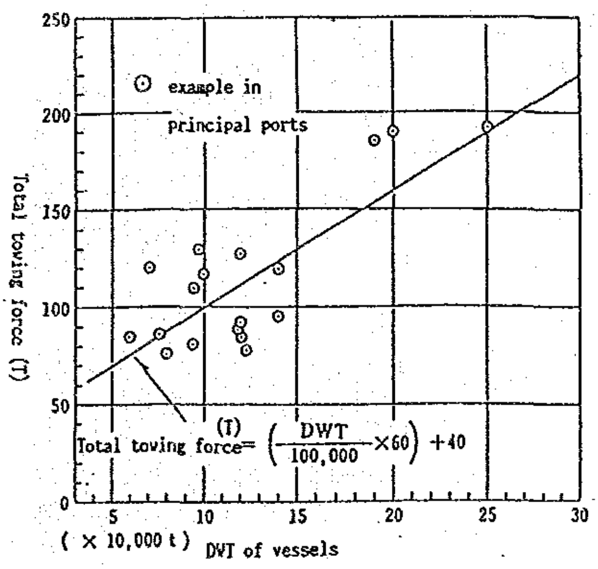
is given by the empirical formula below

Total Towing Force (ton) = (DWT of vessel ÷ 100,000 x 60) + 40 (ton)

Thus, in the case of the Tg.Manis new port area, where the maximum vessel is estimated at 30,000DWT (80% loaded), the towing force needs to be 54 tons at maximum.

The towing force of a tug boat by propulsion type per 100ps is given in **Table-6.2.2.1.**

Table-6.2.2.1 The Towing Force of a Tug Boat by Propulsion Type



Propulsion type	Towing force/100ps
F.P.P	1.1
F.P.P nozzle	1.3
C.P.P	1.3
C.P.P nozzle	1.4
V.S.P	1.0
Z	1.3

From the above account, the tug fleet for the Tg.Manis new port area should be composed of two Z type tug boats (**Photo-6.2.2.1**) with power of 2,000ps each. In addition, the tug boats should be capable of not only the assisting the vessel in manoeuvring but also be capable of casualty rescue, fire-fighting, containing oil spills, removing drifting logs, transporting pilots and for incidental matters of navigation safety.

Considering the vast area of the Rajang port, it would be desirable to allocate two 2,000ps tug boats at Tg.manis and one 1,000ps at Sibu for optimum safety and efficiency.

However, as a compromise to possible budget constraints, we recommend allocating one 2,000ps tug and one 1,000ps tug at the Tg.Manis new port site.

(2) Meteorological and hydrological observation facilities

Direction and force of the wind, current measurement and state of the tide should be observed at suitable sites; we therefore recommend that: an anemometer, anemoscope, barometer and tidal gauge should be placed at Tg.Manis, the Rajang estuary, the Paloh estuary, Tg.Gelang, Telok Teliu, Sarikei, Bintangor, Tg.Leba-an and Sibu. The meteo burst technology would be the most effective and economical medium of communication between the master station (Tg.Manis) and each unmanned observatories. Data transmitted to the traffic control authority should be disseminated at the vessel's request.

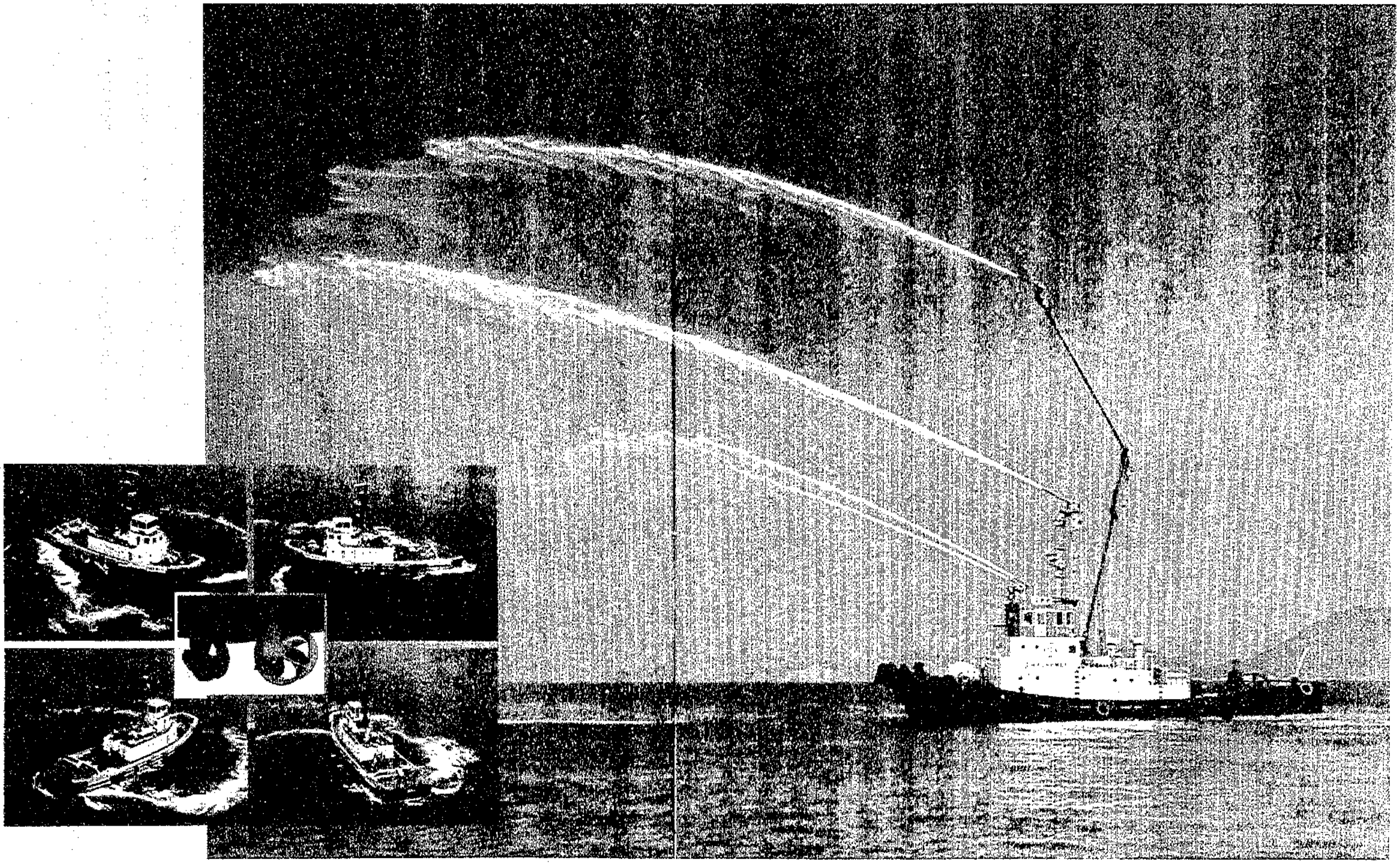


Photo-6.2.2.1 Z Type Tug Boat

6.2.3 Exclusion of obstacles

(1) Wrecks

i) MV.Million and MV.Mano, both wrecks lying and blocking the track of the Rajang estuary, should be removed.

ii) The latest status of the two wrecks, lying in mid-channel off north Tg.Manis, should be confirmed as to whether the waterway is clear of five metres depth of water by chart datum.

iii) The wreck, of which only the masts are visible, lying north of the Paloh estuary waterway needs no removal because of its position is conspicuous.

(2) Sunken rocks

i) The conditions, in particular, the position and the bottom quality of sunken rocks shoals known as the Sarikei Rocks should be confirmed and any shallow parts less than five metres by chart datum should be removed.

ii) Three detached shoals lying off Tg.Binjei, which are the most dangerous obstacles to proceeding, should be removed if their shallow parts are less than seven metres by chart datum.

(3) Drifting logs

Drifting logs and other floating obstacles should be routinely cleaned, for example, by multipurpose tug boats.

6.2.4 Readjustment of traffic control system

(1) Partial revision of traffic regulations

Although a study for updating regulations is now underway among authorities, we recommend that the revisions should set new standards in the following points:

- definition of vessels --i.e. "large vessels", "waterway vessels", "miscellaneous vessels" and "raft",
- definition of "waterway", "anchorage" and "port limit",
- definition of a large vessel's obligation to the authorities of prior notification of entry and departure, with reference to information on ship's name, size, cargoes, ETA, etc.

- designation of the waterway/anchorage/wharf for the large vessels,
- restriction on entering/leaving/proceeding in the port at night, except under specified conditions,
- priority of large vessels to proceed in the waterway,
- restriction on anchoring within the waterways in principle,
- restriction on overtaking/parallel proceeding within specified waterways,
- traffic separation scheme in the waterways off Tg. Binjei,
- priority of departing vessels in possible meetings at the fairways of the estuaries,
- designation of the preferred/secondary waterways at critical junctions i.e. Tg.Leba-an, Tg.Payang, Tg.Singat, near the Pulau Selalo, and Tg.Engkilo,
- restriction on the maximum proceeding speed in specified sections of the waterways,
- restriction on the length/width and the operation of rafts,
- preservation of the environment of the waterways.

(2) Introduction of VTS

Vessel traffic services are the services used to organize vessel traffic in areas where necessary. The service includes all the navigational facilities (material, personnel, procedures) placed at the disposal of vessels using the port.

VTS meets, simultaneously, the requirments of the vessel and port. The aims are to provide for:

- safe navigation and navigation assistance in the port area in the interests of both port and users,
- the regulation of movements to facilitate an efficient traffic flow in the port areas,
- the handling of data relating to vessels involved,
- the coordination of actions in case of casualties.

To carry out all the tasks aforementioned, VTS should comprise:

- a communications facilities,
- data acquisition facilities,
- data processing and dissemination facilities.

It's important to note that the Rajang port:

- has the long access waterways,
- is associated with river traffic, and seagoing/waterway vessels use the same waterway
- is subject to tidal range, which impose special conditions of entry
- is requiring more supervision and regulation in future.

Therefore, it ideally should have:

- a watchtower, which provides for a general view over as much of the new port area as possible,
- a radar surveillance facility, which covers the new port area with the possibility of automatic tracking of vessel echoes,
- communication facilities of visual/radio links between the watch-tower and vessels and be capable of;
  - controlling one-way traffic for the large vessels between the fairway entrance and the Tg.Manis anchorage,
  - designating the anchorage/wharves for the large vessels,
  - observing and disseminating vessels' movements,
  - collecting and disseminating weather/tidal information,
  - requesting action from all the rescue and emergency services in case of casualties,
  - storm warning and emergency unmooring recommendations to vessels, if necessary,
  - controlling pilots, tug boats, line handling boats and linesmen

However, completing this system requires a huge expense and a long training period of capable personnel; as a result, we recommend that the project should be implemented in a practical manner in line with the actual development of the port.

(3) Introduction of a compulsory pilot system

1) Necessity of a compulsory pilot system

In addition to the placement of a sufficient number of navigation marks, a compulsory pilot system would contribute to securing a safe and sound growth of the Rajang port traffic.

The compulsory pilot system requires that certain vessels, navigating in areas with a high traffic density, in channel, in circum-stances where visibility is reduced, or in difficult meteorological or hydrological conditions, entrust maneoeuvring of the vessel to a licenced pilot. This system has been widely accepted in main ports and difficult waterways around the world as an effective way of ensuring the safe and smooth flow of vessel traffic.

In the case of the Rajang port waterways:

* As stated in **5.1 Present Situation of the Waterway within Rajang Port,** the waterways have inherent characteristics of a complex and problematic nature, making the Rajang port a difficult area to navigate for seagoing vessels calling at Rajang for the first time.
* With the development of the Port and Delta area, either the size or number of calling vessels will show a tendency to grow.
* To prevent the foreseeable sea casualties likely to occur to vessels unfamiliar with local conditions, compulsory piloting should be adopted instead of optional piloting.
* To keep the whole port area safe against the environmental pollution caused by a wrecked vessel.
* To keep a smooth and effective flow of vessel traffic.
* To ensure that mutual communication/understanding is maintained between a vessel, a tug boat and line handling men.

As well, the Rajang port has sufficent meanings to implement the compulsory pilot system.

2) The necessity of double pilots manning a single vessel between Sibu and Kl.Paloh

Vessels usually take seven to eight hours to navigate the 73 mile stretch from Sibu to Kl.Paloh; frequently they must wait four to five hours for a favorable tide. In addition, a pilot spends at least three hours going and returning to/from a vessel, thus the working hours of a pilot at on the Paloh waterway reach 10 to 15 hours in one shift.

The present practice of demmanding each pilot to work more than eight hours in one shift should be improved; implementing a pilot shift system at the half leg of the waterway would be a good solution. However, a pilot station for relief is currently not available and therefore a double pilot method should be adopted instead.

3) The types of vessels that should adopt the compulsory pilot

Having considered the present situation of the waterways in the Rajang port, the calling vessel's dimensions and their maneuvering characteristics, the following types of vessels should adopt the compulsory pilot. (a usual practice in main ports of the world)

* Vessels used interstate trading ------------------ more than 500GRT
* Vessels trading within the state of Sarawak ------ more than 1,000GRT
* Vessels carrying dangerous cargoes (oil tanker) ---more than 300GRT

However, the following vessels should be exempted:

* Malaysian Navy Ships
* Malaysian Government Vessels
* A similar vessel manoeuvred by a captain, who has called the Rajang port more than 10 times in the last year and has been endorsed by the Maritime Authority.

4) The required number of pilots

Presupposing aforesaid conditions in (2), (3), and on the following detailed assumption, a estimation of the required number of pilots in 1997 is shown in the **Table-6.2.4.1.**

Table-6.2.4.1 Calculation of required pilots

(1997)

Item Wharf	Sibu	S.Merah	Bintangor	Sarikei	Tg.Manis
A. No.of calling vessels	602	347	72	257	1084
B. vessels≥2,000GRT(P)	364	120	-	-	-
BB.vessels<2,000GRT(R)	238	227	72	257	1084
C. Piloting frequency(P)	728	240	-	-	-
CC. " (R)	476	454	144	514	2168
D. Monthly frequency (P)	60	20	-	-	-
DD. " (R)	40	38	12	43	180
E. Daily frequency (P)	2	0.7	-	-	-
EE. " (R)	1.3	1.3	0.4	1.4	6
F. Pilot's work hours(P)	10-15(7+3+t)	10-15(7+3+t)	-	-	-
FF. " (R)	9(6+3)	10(7+3)	7(5+2)	5.5(4+1.5)	4(2+2)
G. No.of duty pilots (P)	2 x 2	0.7 x 2	-	-	-
GG. S/B " (P)	2	0.7	-	-	-
GGG. off " (P)	2	0.7	-	-	-
H. No.of duty pilots (R)	1.3	1.3	0.4	1.4	3
HH. S/B " (R)	0.65	0.65	0.2	0.7	1.5
HHH. off " (R)	0.65	0.65	0.2	0.7	1.5

t: wating hours for tide rising

S/B: Stand by

R: Rajang Route

P: Paloh Route

Number fo requird pilots for the Paloh waterway (Sibu) : G + GG + GGG = 11
---------------- " --------------- Rajang ------- (Sarikei): H + HH + HHH = 15

* Among the calling vessels from the above table, the number of vessels that required compulsory pilot by wharf would be a half of those less than 1,000GRT, and all those more than 1,000GRT ------------------- A
* Among vessels calling at Sibu/Sg.Merah:
  vessels more than 2,000GRT taking the Paloh waterway ----------- B
  vessels less than 2,000GRt taking the Rajang waterway ----------- BB
* The required frequency of piloting a year of 1997 by waterway and by wharf is double the number of calling vessels:
  the Paloh waterway ------------------ Bx2 ---------------------- C
  the Rajang waterway ----------------- BBx2 ---------------------- CC
* Monthly mean frequency of piloting:
  the Paloh waterway ------------------ C÷12 --------------------- D
  the Rajang waterway ----------------- CC÷12 --------------------- DD
* Daily mean frequency of piloting:
  the Paloh waterway ------------------ D÷30 --------------------- E
  the Rajang waterway ----------------- DD÷30 --------------------- EE
* Required hours for piloting service by wharf and by waterway:
  the Paloh waterway -- F
  the Rajang waterway --- FF
* Required number of Paloh pilots on duty --------------------------- G
  --------------- " -------------- stand by --- Gx½ ---------------- GG
  --------------- " -------------- off duty --- Gx½ ---------------- GGG
* Required number of Rajang pilots on duty --------------------------- H
  --------------- " -------------- stand by --- Hx½ ---------------- HH
  --------------- " -------------- off duty --- Hx½ ---------------- HHH

* The number of calling vessels in 1997 is based on the **Table-6.2.4.2.**

Table-6.2.4.2 GRT Distribution of Ships for International Trade (1997)

WHARF / GRT	Sibu	S.Merah	Bintang.	Sarikei	Tg.Manis		
					Timber	Coal	Anchor
Below 1000	218	374	65	223	6	15	35
1000 - 1999	129	40	39	145	3	12	17
2000 - 2999	152	120	-	-	18	-	112
3000 - 3999	144	-	-	-	45	-	289
4000 - 4999	14	-	-	-	40	-	253
5000 - 5999	38	-	-	-	15	-	92
6000 - 6999	16	-	-	-	7	1	46
7000 - 7999	-	-	-	-	1	3	2
8000 - 8999	-	-	-	-	1	3	6
9000 - 9999	-	-	-	-	3	2	17
10000 - 14999	-	-	-	-	4	8	22
15000 - 19999	-	-	-	-	4	-	22
Over 20000	-	-	-	-	1	-	6
Total	711	534	104	368	148	44	919

6.2.5 Conclusion

Summing up, a planning navigation aids is shown in **Table-6.2.5.1** and **Figure-6.2.5.1.**

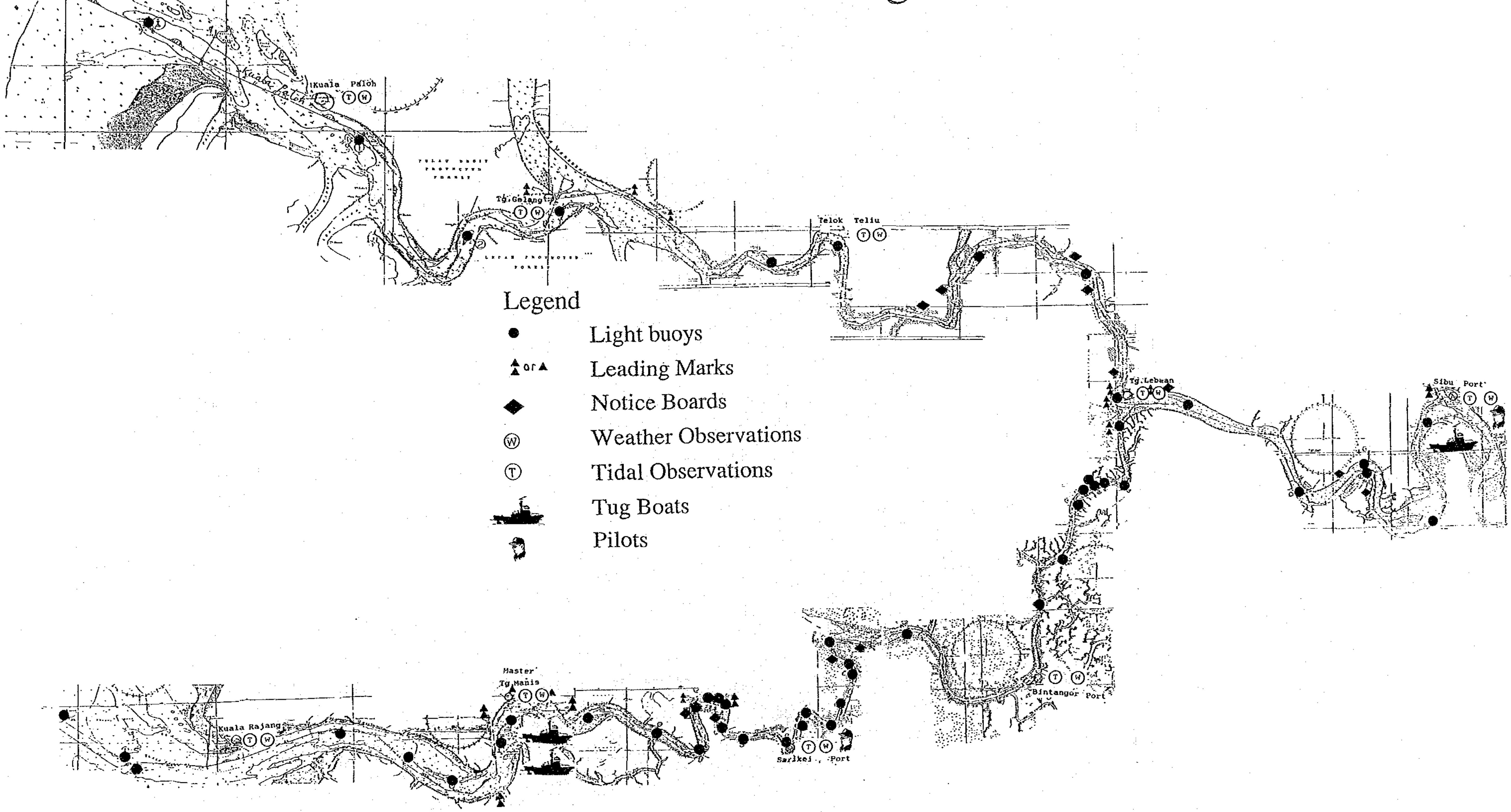
Table-6.2.5.1 A Planning of Navigation Aids

ITEM	CONTENTS
1. Navigation marks	
1.1 Lighthouses	
(1) Solar electrification	Tg.Jerijeh
(2) Installation of Racon	Tg.Jerijeh, Tg.Sedi
(3) Back-up of energy source	Remaining Lighthouses
1.2 Light-Beacons(Heading mark)	
(1) Renewal(Tower, Foundation, Solar charger)	Tg.Sekumong-1, Tg.Manis Anchorage-1,
(2) Back-up of energy source	Remaining light-beacons
1.3 Transit light-beacons (Leading mark)	
(1) Renewal(Tower, Foundation, Solar charger, cutting trees)	Tg.Gelang-1, Blatok-2, Tg.Leba-an-2, Tg.Engkilo-1, Tg.Manis-3 Salah Salah-3
(2) Back-up of energy source	Remaining transit light-beacon
1.4 Light buoys	
(1) Renewal/additionally placing, based on the IALA Maritime Buoyage System	Safe water marks-3, Lateral marks-17, Cardinal mark-6, Isolated danger mark-3 (As shown in Figure-6.2.5.1 and Appendix-II.6.2.1)
1.5 Buoys	
(1) Additionally Placing	the Paloh route-4, the Rajang route-18 (As shown in Figure-6.2.5.1, Appendix-II.6.2.1)
1.6 Notice Boards	
(1) Renewal/additionally placing	12 places (As shown in Figure-6.2.5.1 and Appendix-II.6.2.1)

2. Other back-up facilities/equipment 2.1 Tug boats	2,000ps Z-type -2, 1,000ps Z-type -1,
2.2 Weather/Tide observation facilities (1) Weather instrument/Tidal guage (2) Meteor burst system	Kl.Rajang-1, Tg.Manis-1, Kl.Paloh-1, Tg.Gelang, Tg.Leba-an, Tg.Engkilo, Sibu-1, Bintangor-1, Sarieki-1, Tg.Manis (master), Others (remote)
2.3 VTS facilities	Planning
3. Exclusion of obstacles 3.1 Wrecks	MV.Million, MV.Mano
3.2 Sunken rocks	off Tg.Binjei
3.3 Drifting logs	
4. Compulsory pilot system	Sibu(11), Sarikei(15)

Figure-6.2.5.1

A Plan of Navigation Aids



7. ROUGH COSTS AND PRELIMINARY CONSTRUCTION PROGRAM FOR MASTER PLAN

7.1 Rough Costs

Table-7.1.1.1 shows rough costs for the Master Plan.

Table-7.1.1.1 Rough Costs for Master Plan

Cost Items	Cost
Sibu South	58
Wharf	34
Transit Shed/Open Storage Yard	11
Others	10
Reclamation	3
Sarikei	7
Wharf	7
Sungei Merah	3
Jetty	3
Tg.Manis Timber Products Terminal	181
Wharf	106
Transit Shed/Open Storage Yard	40
Others	26
Reclamation	9
Tg.Manis Coal Terminal	31
Wharf	27
Others	2
Reclamation	2
Cargo Handling Equipment (except coal)	19
Cargo Handling Equipment (coal)	6
Navigation Aids*	33
Tugboats	19
Others	14
Miscellany**	17
TOTAL	355

* Exclusion of obstacles are not included.

** Land acquisition costs are included.

7.2 Preliminary Construction Schedule for Mater Plan

The working schedule of various projects in the Master Plans are shown in **Table-7.2.1.1.**

Table-7.2.1.1 Construction Schedule (Mater Plan)

Description	Q'ty	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. F/S by JICA	L.S.																				
2. E/S (D/D & Survey)	L.S.																				
3. Tender for Construction	L.S.																				
4. Sungei Merah Oil Jetty	L.S.																				
5. Timber Products Terminal																					
1) Deep Wharf (-10m)	800 m																				
2) Shallow Wharf (-5m)	300 m																				
3) Container Stock Yard	126,500 m²																				
4) Transit Shed / C.F.S.	39,200 m²																				
5) Admi. Building	1,000 m²																				
6) Maintenance Shop	1,000 m²																				
7) Washing Facilities	900 m²																				
8) Open Storage Yard	21,200 m²																				
9) Port Road	90,000 m²																				
10) Parking & Paved Area	47,800 m²																				
11) Green Area	7,400 m²																				
12) Reclamation	335,000 m²																				
6. Coal Terminal																					
1) Deep Wharf (-10m)	200 m																				
2) Shallow Wharf (-5m)	235 m																				
3) Coal Stock Yard	50,000 m²																				
4) Port Road	10,000 m²																				
5) Reclamation	60,000 m²																				
7. New Terminal at Sibu South																					
1) Wharf (-6m)	440 m																				
2) Container Stock Yard	27,000 m²																				
3) Transit Shed	12,500 m²																				
4) Admi. Building	1,000 m²																				
5) Maintenance Shop	700 m²																				
6) Washing Facilities	400 m²																				
7) Open Storage Yard	10,000 m²																				
8) Port Road	28,400 m²																				
9) Parking Area	20,000 m²																				
10) Reclamation	100,000 m²																				
8. Sarikei Expansion																					
1) Wharf (-5m)	75 m																				
2) Dredging	1,800 m²																				
9. Cargo Handling Equipment	L.S.																				
10. Coal Handling Equipment	L.S.																				
11. Navigation System	L.S.																				
12. Mobilization	L.S.																				

8. RECOMMENDATIONS OF PORT MANAGEMENT AND OPERATIONS

Concerning the implementation of the Mater Plan, it is important that the projected port facilities are used rationally and efficiently; this can be accomplished by improving port management and the operation system.

Since recommendations on port management and operations for the Master Plan are basically same as in the Short-term Plan, please refer to 5. **RECOMMENDATIONS ON PORT MANAGEMENT OPERATIONS, SHORT-TERM PLAN, VOLUME III.**

The main recommendation items are as follows:

(1) *Efficient use of wharves*

(2) Restructuring the tariff system

(3) Reinforcement of the port management body (RPA)

(4) Reinforcement of management of the port limits

REFERENCE

Plan for Timber Products Terminal in Accordance with Sarawak State's Policy on Timber Processing

Sarawak State has a policy that 50 percent of logs produced in the state be exported unprocessed in 2010. According to this policy, logs would be still exported and handling volume at the timber products terminal would reduce. Consequently, scale of required port facilities would also reduce. In this part, we show facility plan corresponding to the policy.

(1) Cargo handling volume at the timber products terminal

i) Export of Timber logs and products from Rajang Port

(1000m3)

Year	Factory	Log Production	Log Consumption	Processing Output			Products Export Through Rajang Port Wharf			Log Export
				S/T	O/P	C.	S/T	O/P	C.	
2010	TPZ	4,340	906	255	407	38	255	407	38	2170
	Private		1264	571	245	34	571	245	0	
	(total)		2170	826	652	72	826	652	38	

S/T: Sawn Timber O/P: Other Timber Products C.: Wood Chips

ii) Cargo handling volume at the timber products terminal by commodity

And cargo handling volume at the timber products terminal and Tg.Manis anchorage would be as follows (cargo volume at Sibu, Sarikei, Bintangor, Sungei Merah and the coal terminal would be the same as those for 100% processing policy shown in **Table-5.1.1.5**).

(1000 FT/Y, 1000 TEU/Y)

Commodity	Tg.Manis Timber T.	Tg.Manis Anchorage	Total Rajang Port
EXPORT			
Timber Log	0	2170	2170
Timber Prod.	1037	0	1037
Plywood/etc.	385	0	385
Sawn Timber	575	0	575
Wood Chips	76	0	76
Coal	0	0	600
Palm Oil	0	0	40
Agr. Prod.	6	0	74
Petroleum Prod.	0	0	322
Others	0	0	50
Container(t)	540	0	675
Container(TEU)			
Laden	27000	0	38200
Empty	0	0	0
Pallet(t)	1	0	21
(total)	1584	2170	4989
IMPORT			
Motor Veh.	12	0	59
Food	4	0	119
Feed/Fertilizer	0	0	138
Petroleum Prod.	6	0	595
Others	8	0	294
Container(t)	10	0	391
Container(TEU)			
Laden	800	0	36200
Empty	5600	0	5600
Pallet(t)	1	0	80
(total)	41	0	1676
T O T A L	1625	2170	6665
Riverine			
Timber P.(in)	816	0	816
Coal(in)	0	0	1100
Container(t)	0	0	0
Container(TEU)			
Laden	0	0	0
Empty(out)	0	0	24500
Empty(in)	20600	0	24500

iii) Handling volume at each wharf at the timber products terminal

Wharf	Commodity	Volume 1000FT/Y TEU/Y (2010)
Deep-Water Wharf (-10.0m)	Timber Products (Export)	1,037
	Containers (Ex & Im)	33,400
	Others (Ex & Im)	38
Shallow Wharf (- 5.0m)	Timber Products (In)	816
	Empty Containers (In)	20,600
Anchorage	Logs - (Export)	2,170

(2) Required Berth Number

i) Berth number and berth occupancy of the deep-water wharf (-10.0m)

Commodity	Av.Ship Size (DWT)	Volume (1000t, TEU/Y) 2010	Berth Occupancy 2010	Berth Nos 2010
Timber P.	5,000	1,075	41	3
Containers	10,000 (500 TEU)	33,400		

ii) Berth number and berth occupancy of the shallow-water wharf (-5.0m)

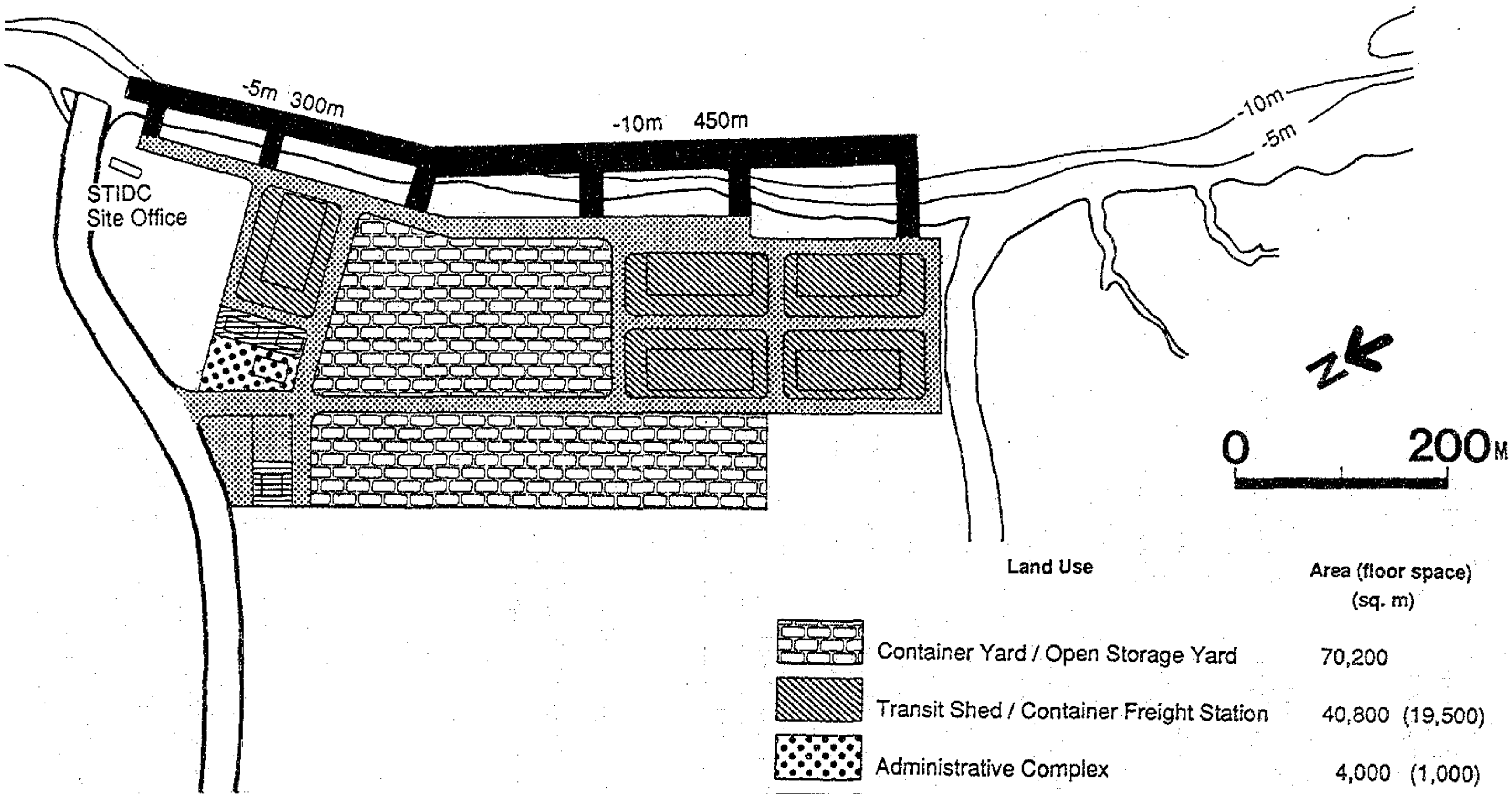
Commodity	Av.Ship Size (DWT)	Volume (1000t, TEU/Y) 2010	Berth Occupancy 2010	Berth Nos 2010
Timber P.	1,000	816	55	5
Empt.Con.	50m-barge (48 TEU)	20,600		

(3) Required Storage Capacity at Timber Products Wharf

Storage Area Category	Commodity	Annual Throughput (1000FT, TEU) 2010	Storage Area (m^2) 2010
Transit Shed	Sawn timber (high grade) plywood dowel moulding others	645	10,300
Container Freight Station	Sawn timber (high grade) plywood dowel molding furniture	575	9,200
Open Storage Area	sawn timber (Other)	405	10,800
Container Yard		54,000	59,400
T O T A L			89,700

(4) Layout Plan

Following figure shows a layout plan of the timber products terminal.



Land Use	Area (floor space) (sq. m)	
Container Yard / Open Storage Yard	70,200	
Transit Shed / Container Freight Station	40,800	(19,500)
Administrative Complex	4,000	(1,000)
Utility (Maintenance/Washing)	3,900	(1,900)
Road and Others	48,100	
Total	167,000	

Timber Products Terminal

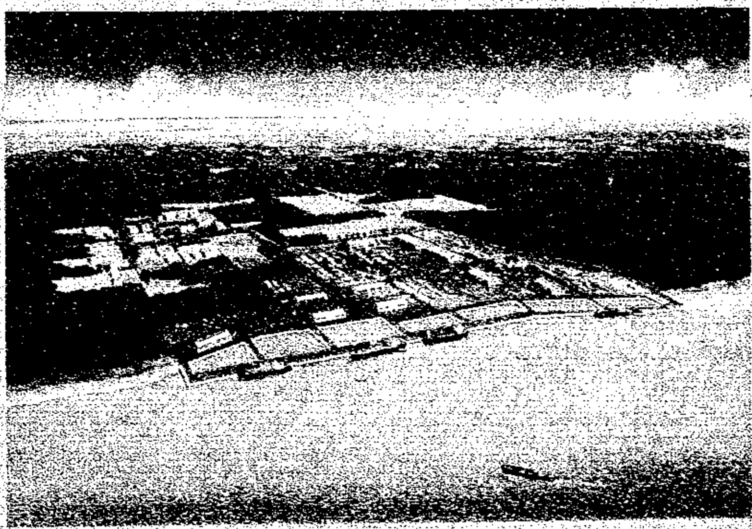
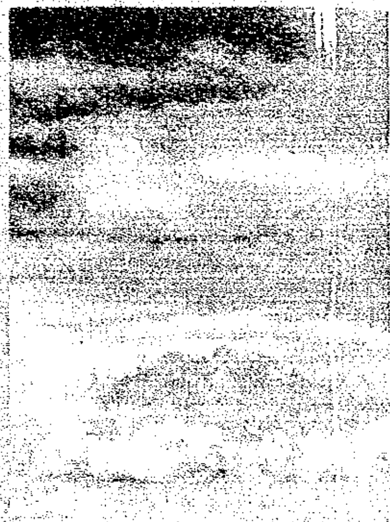
MASTER PLAN Terminal Layout

(50% of Logs Processed)

(5) Rough Cost

Rough costs for this plan are estimated as follows:

Facility	Quantity	Unit Price (Ringgit)	Amount (M.Ringgit)
Timber Wharf(-10.0m)	450m	85,884	38,600
Timber Wharf(-5.0m)	300m	70,344	21,100
Timber Wharf Bridge	270m	53,215	14,400
Transit Shed/CFS	19,500m^2	582	11,300
Container Storage Yard	59,400m^2	120	7,100
Open Storage Yard	10,800m^2	106	1,100
Road	25,600m^2	113	2,900
Other Paved Area	22,500m^2	106	2,400
TOTAL			98,900

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