## 4.3 Container Cargo Handling System

The most suitable cargo handling system is selected among various kinds of handling systems. There are three typical types of systems; 1) Chassis System, 2) Straddle Carrier System and 3) Transfer Crane System.
There are also many kinds of variations of these systems. The main characteristics of these three systems are explained below.

### 4.3.1 Chassis System

Under this system, containers are directly unloaded onto chassis, using a portainer or a shiptainer. After containers are placed on chassis, they are pulled to the container yard by a tractor.

The advantages of this system are;

(1) Containers can be moved out speedily at any time.

(2) Container yard does not require heavy-duty pavement.

(3) Probability of container damage will be reduced.

On the other hand, the disadvantages of this system are;

(1) The same number of chassis as containers, are required.

(2) Vast container yard is needed.

### 4.3.2 Straddle Carrier System

Under this system, containers are directly unloaded onto the apron, using a crane, and then moved to the container yard, using a straddle carrier.

The advantages of this system are;

(1) The crane's operation time can be reduced.

(2) Container yard can be smaller than that of chassis system.

On the other hand, the disadvantages of this system are;

(1) The number of cargo-handling times will be increased.

(2) Probability of container damage will increase.

### 4.3.3 Transfer Crane System

Under this system, containers are directly unloaded onto chassis, moved to the container yard and then stacked in a few layers by transfer crane.

The advantages of this system are;

(1) The utilization of land space is more efficient than that of the other systems.

(2) It is easy to automate and/or computerize this system.

On the other hand, the disadvantages of this system are;

(1) It may take a lot of time to remove stacked containers, particularly those in the bottom layers.

(2) The number of cargo-handling times will increase, thus probability of container damage may increase.

(3) The path of the transfer crane must be determined and specially reinforced.

### 4.3.4 Selected System

A tire-mount transfer crane system has been selected as the most suitable system, considering total area required, total amount of initial investment and ease of operation and management. The comparison of cargo handling system is summarized in Table 4-10, and a container terminal area required by each cargo-handling system is also summarized in Table 4-11.

In order to get an image of the scale, preliminary layout of main facilities for each alternative is shown in Fig. 4-10 to Fig. 4-12 in the same scale.

As described in Table 4-11, chassis system requies a very wide area, nearly 22 ha for one terminal, therefore it seems unadvisable to secure such a wide space within the Port of Manila, which is suffering from an insufficient port space. Straddle carrier system needs a relatively wide space and frequent maintenance, thus this system also stands at a disadvantage at the Port of Manula in that respect. Tire-mount transfer crane system is the most space-saving system, and then recommendable as the best alternative.

Table 4-10 Comparison of Handling Systems

| | Chassis system | Straddle carrier system | Transfer crane system |
|---|---|---|---|
| (a) Land utilization | large | medium | small |
| (b) Height of stack | low | medium | high |
| (c) Efficiency of container crane | low | high | medium |
| (d) Working hour for taking in/our container | short | medium | long |
| (e) Damage ratio of container | low | high | medium |
| (f) Required skill of driver | low | high | medium |
| (g) Term for training of driver | none | long | medium |
| (h) Maintenance cost | small | large | medium |
| (i) Running cost | low | high | medium |
| (j) Required skill for repair | low | high | medium |
| (k) Amount of investment (machinery) | medium | small | large |
| (l) Amount of investment (container yard) | medium | large | medium |
| (m) Scale of repair shop | small | large | - |
| (n) Experience of handling | none | none | yes |
| (o) Automation of operation | low | medium | high |

Table 4-11 Container Terminal Area Required by Each Cargo-handling System

Unit: $m^2$

| Cargo-handling System | Transfer Crane | Straddle Carrier | All Chassis |
|---|---|---|---|
| Total Area | 105,000 | 147,900 | 217,200 |
| (Length x Width) | (300 x 350) | (300 x 493) | (400 x 543) |
| Marshaling Yard | | | |
| Sub-total | 54,900 | 97,800 | 161,600 |
| Slot Area | 26,900 | 59,900 | 96,250 |
| Others | 28,000 | 37,900 | 65,350 |
| (Length x width) | (300 x 183) | (300 x 326) | (400 x 404) |
| Apron | 15,900 | 15,900 | 21,200 |
| (Length x Width) | (300 x 53) | (300 x 53) | (400 x 53) |
| Backyard | | | |
| Sub-total | 34,200 | 34,200 | 34,400 |
| CFS | 2,500 | 2,500 | 2,500 |
| Head Office | 1,000 | 1,000 | 1,000 |
| Reair Shop | 1,000 | 1,000 | 1,000 |
| Others | 29,700 | 29,700 | 29,900 |
| (Lenght x Widht) | (300 x 114) | (300 x 114) | (400 x 86) |

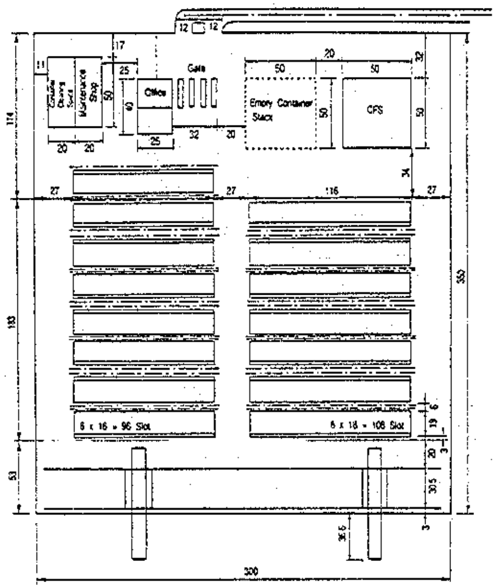


Figure 4-10 Short Term Plan Transfer Crane System

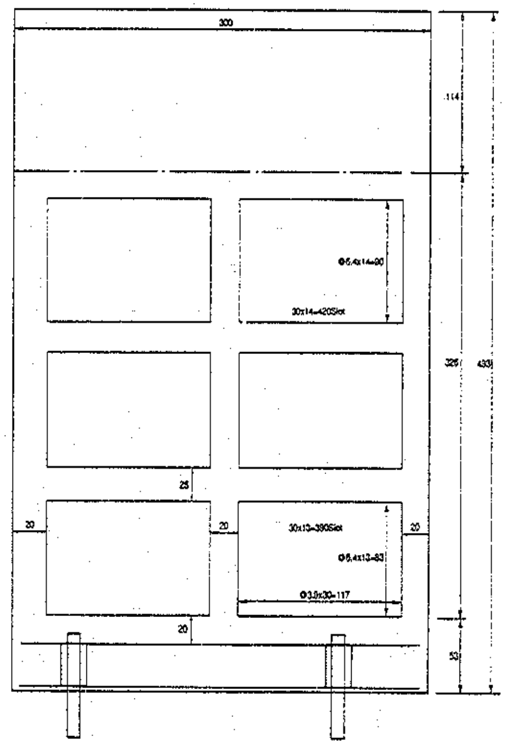


Figure 4-11 Straddle Carrier System

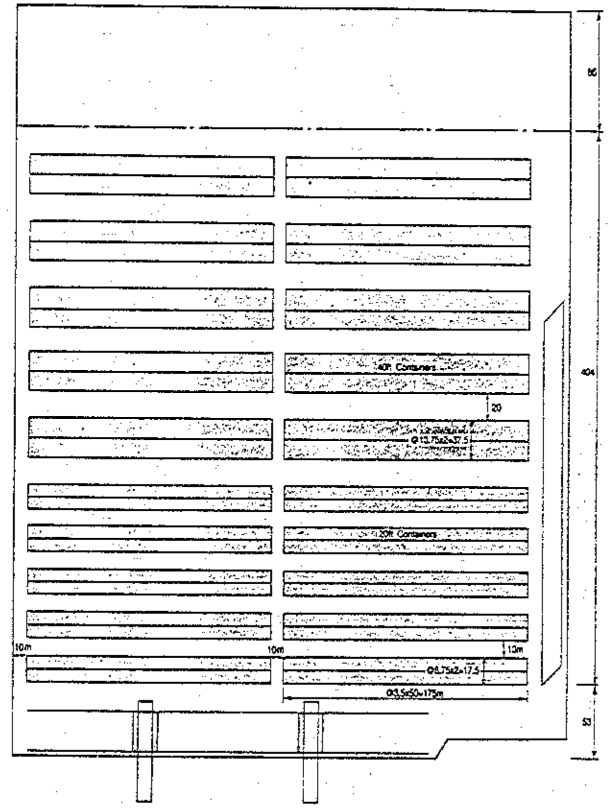


Figure 4-12 All Chassis System

## 4.4 Required Scale and Quantity of Port Facilities

### 4.4.1 Berth Dimensions

The vessel size which will call the Port of Manila and Port of Batangas in the target year is already mentioned in Part I of Chapter 11.6. Thus, in this section, the depth and length of berth for accommodating the average standard vessel is dealt with.

According to Technical Standards for Port and Harbors in Japan, the depth of the berth is 1.1 times the full load draft in order to facilitate a vessel's berthing. The length of berth is generally determined by the over all length of the vessel and the mooring method for a single berth. The angle of the mooring rope to the marginal wharf is normally between 30 and 40 degrees. The following is used to compute the berth length.

$$L = LOA + ( B \times 1.73 \sim 1.19 )$$

(1) International Container Berths

Container vessels calling MICT and South Harbor in the target year are 30,000 DWT with 237 meters LOA, 11.6 meters draft and 30.7 meters beam, and 13,000 DWT with 153 meters LOA, 8.4 meters draft and 23 meters beam respectively.

So, berth depths at MICT and South Harbor are approximately computed as 12.8 meters and 9.2 meters respectively. Further-more, the berth lengths at MICT and South Harbor are 274 meters and 180 meters respectively.

Considering the result of the above calculation, the depth of berth at MICT is determined as 13.0 meters. On the other hand, the length of berth is assumed as 300 meters in order to cope with accommodating the larger sized vessels in future.

In addition, at the South Harbor, the depth and length of berth are 10.0 meters and around 180 meters respectively.

(2) Domestic Container Berths

1) Container Berths

Domestic container vessels calling North harbor in the target year is 12,500 DWT with 145 meters LOA, 8.3 meters draft and 21.6 meters beam.

So, the depth of berth for the container vessel is approximately computed as 9.1 meters. Further-more, berth length is 169 meters.

Considering the result of the above calculation, the berth depths is determined as 10.0 meters. In addition, the berth lengths is assumed as around 180 meters.

2) RO/RO Berths

There are two types of domestic RO/RO vessels calling North Harbor in the target year. One is 13.700 GRT with 195 meters LOA, 7.5 meters draft and 24.0 meters beam, the other is 3,000 GRT with 113 meters LOA, 4.9 meters draft and 18.9 meters beam.

So, the berth depths for 13,700 GRT and 3,000 GRT are approximately computed as 8.3 meters and 5.4 meters respectively. Further-more, berth length is 224 meters for the former and 145 meters for the latter.

But, the depth and length of RO/RO vessel is different from the kind of the size of vessels due to the length or shape of rampway. In this case, the Study Team assumed that there is no quaywall for bow or stern berthing.

Therefore, according to the Technical Standards, berth depths for 13.700 DWT and 3,000 DWT are determined as 9.0 meters and 6.0 meters respectively. In addition, berth lengths for the former and latter are determined as a 220 meters and 140 meters respectively.

4.4.2 Break Water

(1) Port of Manila

1) South Harbor

The South Harbor is effectively protected by both offshore breakwater and long south breakwater in terms of inrush of rough wave into the port. New international container terminals proposed by the Study, can be also sheltered by the above two breakwaters. There will be no need to take breakwater extension into account on condition that new international container terminals are planned within the water area surrounded by the above two breakwaters. The existing breakwater alignment is shown in Fig. 4-13.

2) MICT

The degree of calmness in front of the present MICT's wharves is secured by both offshore and west breakwater. New international container terminals proposed by the Study are also sheltered by the above two breakwaters, but the fourth container terminal (the fartherest terminal from the present MICT) will have insufficient degree of calmness due to its distant location from the coast. According to the simulation analysis of calmness described in Chapter 2 of Part I, 400 m extension of the offshore breakwater is necessary in order to keep the occurrence frequency above wave height 0.5 m within range of less than 5 %. The Study recommends the same length of offshore breakwater extension in case of the high case (I) scenario in the target year 2010.

3) North Harbor

The degree of calmness in front of finger piers at the North Harbor is effectively secured by the existing north breakwarter. In addition, the Smoky Mountain Development and Reclamation Project will also effectively function when it is completed, in order to protect port facilities within the North Harbor against the inrush of rough wave from the Manila Bay. However, the on-going ADB's project which will provide the North Harbor with three domestic RO/RO terminals, proved to need 500 m extension of the north breakwater to secure the calmness. As a result, the extension work of that breakwater is now under construction. After completion of the extended breakwater, all port facilities at the North Harbor, including planned facilities up to the year 2010, are effectively protected against the inrush of rough wave. The breakwater extension plan at the North Harbor is shown in Fig. 4-14.

(2) Naic/Cavite New Port

The Naic/Cavite New Port is placed in very shallow water area, accordingly proposed international container terminals must be planned rather offshore about 500 to 1,000 m from the coast in order to balance the dredging and reclamation. This results in planning quite a long breakwater to secure the calmness at the port, even though the construction cost of breakwaters amounts to much. According to the simulation analysis of calmness described in Chapter 2 of Part I, total 2,020 m length of offshore breakwater is necessary to keep the occurrence frequency above wave height 0.5 m within range of less than 5 %. The Study recommends the following breakwater alignment;

1) The main breakwater is 1,200 m long and parallel to the Naic coast line.
2) The subordinate breakwater is 820 m long and extended toward the north from the end of the container terminal's access road.

The alignment of breakwaters at the Naic/Cavite New Port is shown in Fig. 4-15.

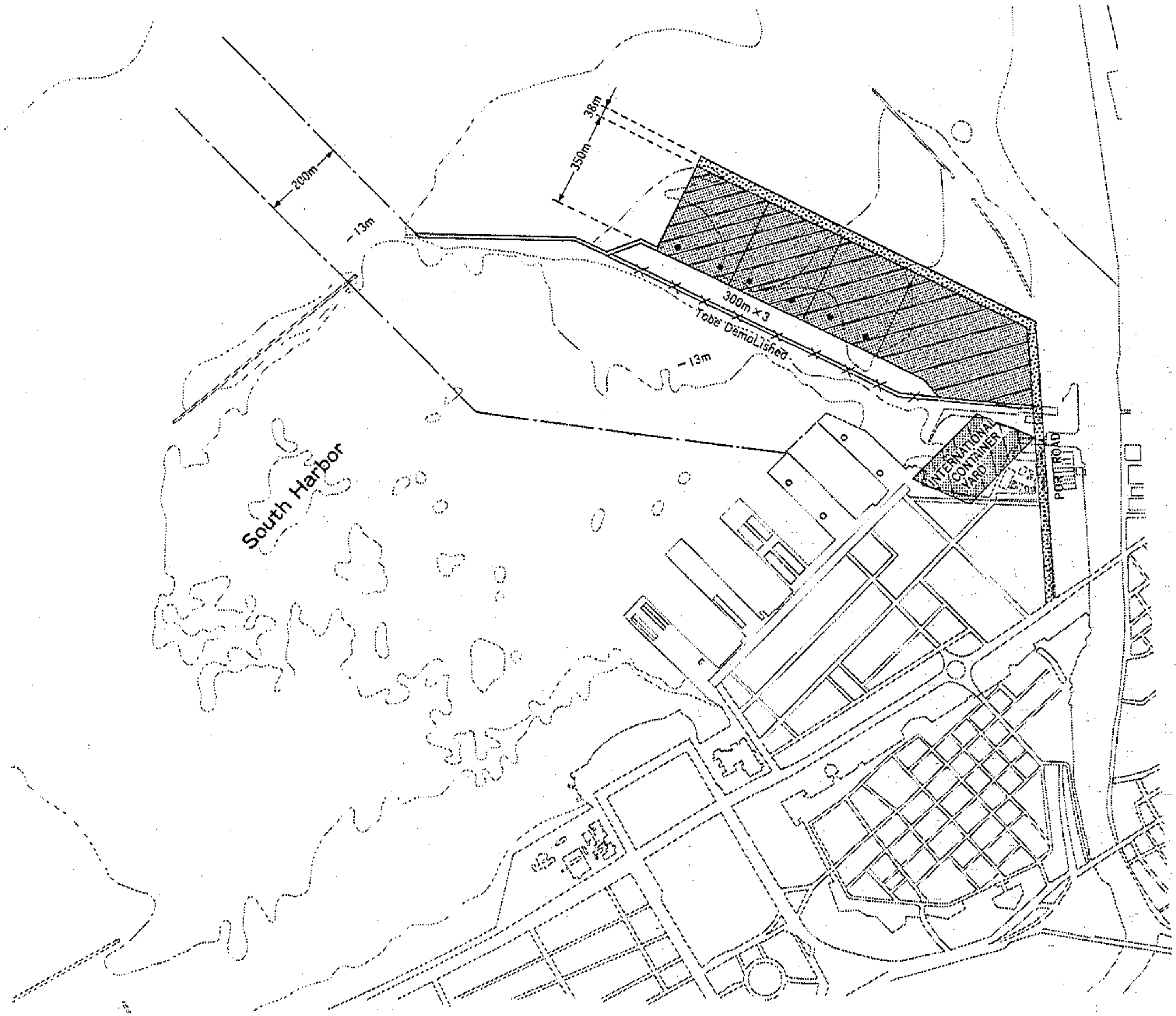



Figure 4-13 Existing Breakwater at South Harbor

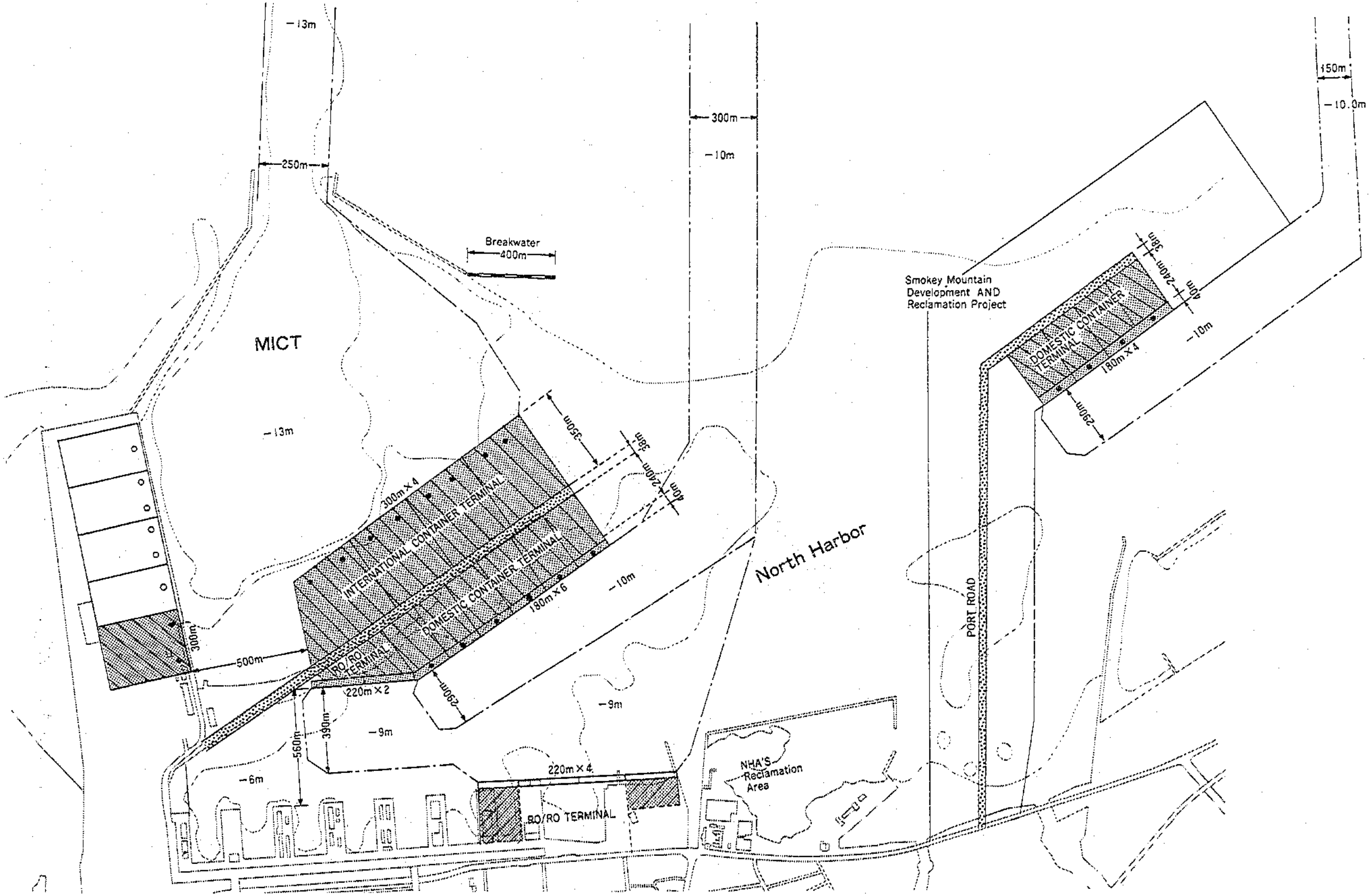



Figure 4-14 Existing Breakwaters at MICT in High Case I

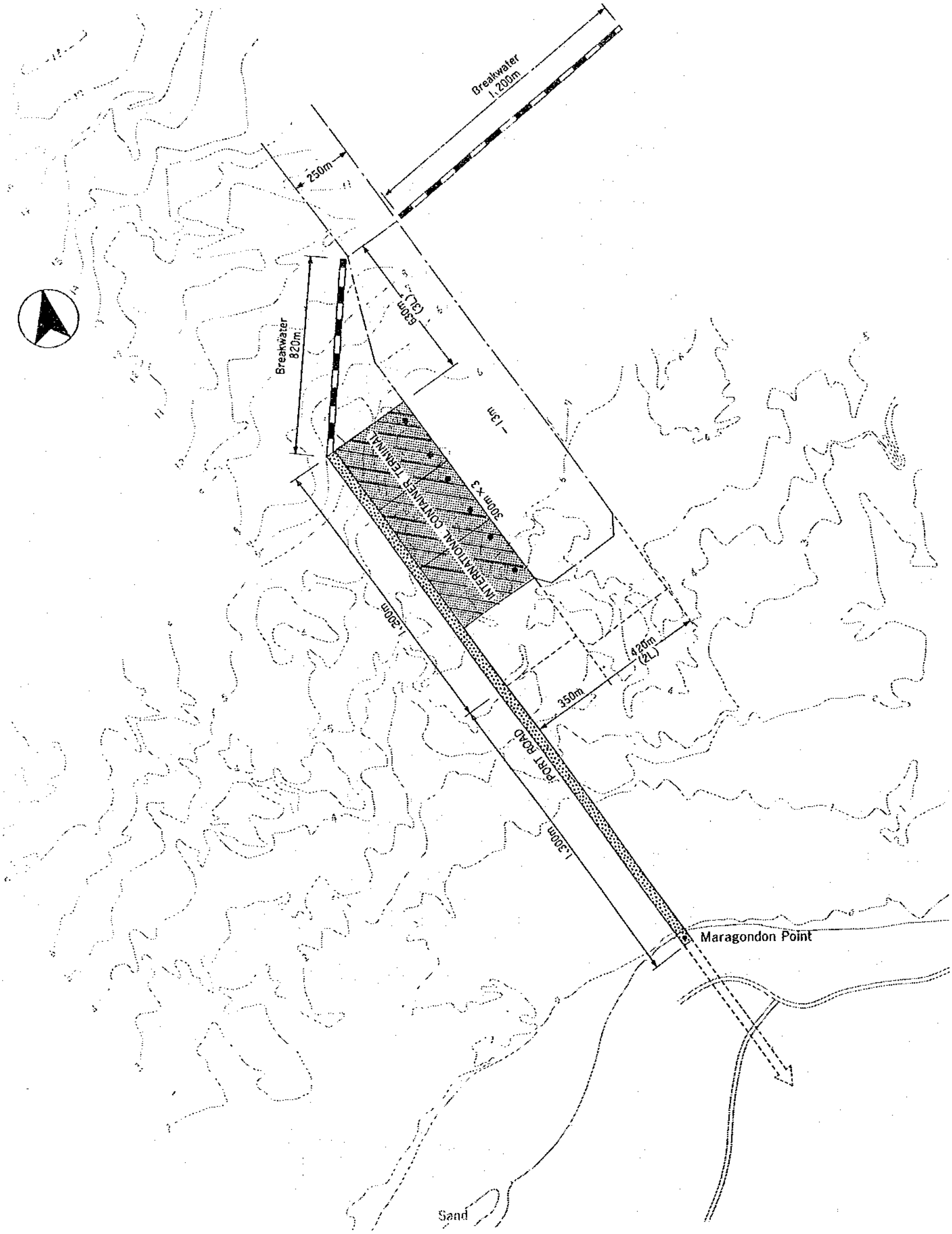



Figure 4-15 Alignment of Breakwaters at Naci/Cavite New Port

### 4.4.3 Container Crane

Existing container cranes at MICT are designed for Panamax type vessels and there seems to be no significant problem with their mechanical specification. Container Cranes of newly-built berths shall have equivalent specifications to that of the existing cranes, or better specifications than existing ones. Considering the world wide trend of upsizing of container cranes, the major specifications of the cranes are decided as follows.

| | | |
|---|---|---|
| Rated Capacity (under the spreader) | : | 30 LT |
| Outreach | : | 36 m |
| Rail span | : | 32 m |
| Main hoist speed/Loaded | : | 45 m/min |
| Main hoist speed/Spreader | : | 120 m/min |

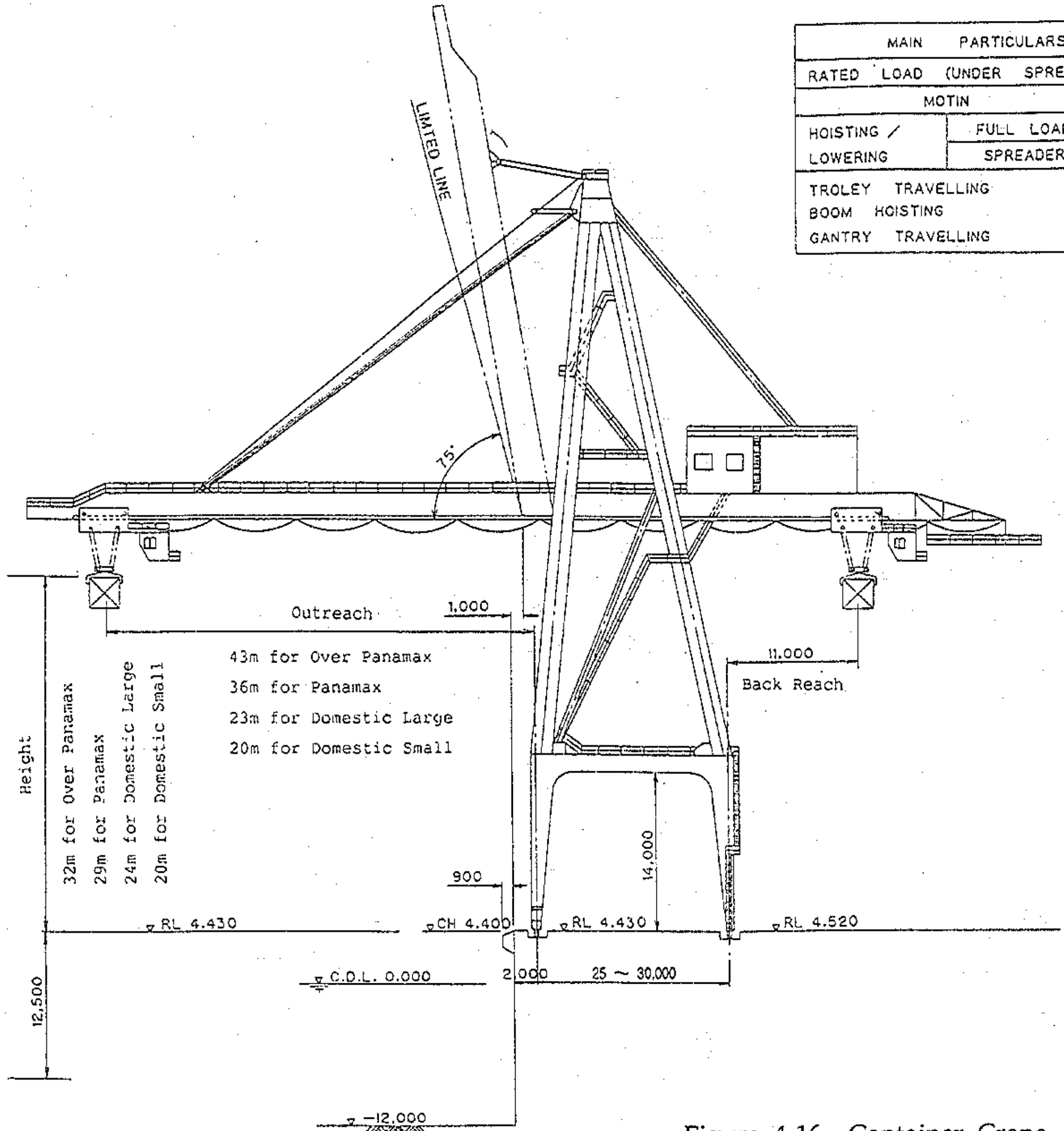
In addition, taking into account the possible shipcalls of post-Panamax type vessels to the Philippines, the Study recommends that the Port of Manila should introduce at least one over-Panamax type gantry crane into one international container terminal. The major specifications of the crane of this type are as follows.

| | | |
|---|---|---|
| Rated capacity (under spreader) | : | 40 LT |
| Outreach | : | 43 m |
| Rail span | : | 25 - 30 m |
| Main hoist speed/Loaded | : | 45 m/min |
| Main hoist speed/Spreader | : | 120 m/min |

The total number of container cranes of each port master plan is summarized in Table 4-12, and the major specifications of container cranes are shown in Fig. 4-16.

Table 4-12 Number of Container Cranes at Each Port

| Port | Berth | | Number of Container Cranes | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Medium Case | | High Case(I) | | High Case(II),(III) | |
| South Harbor | New Berth | 1(-13m) | | | Over Panamax | 2 | | |
| | " | 2 | | | Panamax | 2 | | |
| | " | 3 | | | " | 2 | | |
| MICT | On Going Berth | 4(-13m) | Panamax | 1 | Panamax | 1 | Panamax | 1 |
| | " | 5 | " | 2 | " | 2 | " | 2 |
| | New Berth | 1 | Over Panamax | 2 | Over Panamax | 2 | Over Panamax | 2 |
| | " | 2 | Panamax | 2 | Panamax | 2 | Panamax | 2 |
| | " | 3 | " | 2 | " | 2 | " | 2 |
| | " | 4 | | | " | 2 | " | 2 |
| North Harbor | New Berth | 1(-10m) | Domestic Large | 1 | Domestic Large | 1 | Domestic Large | 1 |
| | " | 2 | " | 1 | " | 1 | " | 1 |
| | " | 3 | " | 1 | " | 1 | " | 1 |
| | " | 4 | " | 1 | " | 1 | " | 1 |
| | " | 5 | " | 1 | " | 1 | " | 1 |
| | " | 6 | " | 1 | " | 1 | " | 1 |
| | New Berth | 7 | | | Domestic Large | 1 | Domestic Large | 1 |
| | " | 8 | | | " | 1 | " | 1 |
| | " | 9 | | | " | 1 | " | 1 |
| | " | 10 | | | " | 1 | " | 1 |
| S.Point or Naic | New Berth | 1(-13m) | | | | | Over Panamax | 2 |
| | " | 2 | | | | | Panamax | 2 |
| | " | 3 | | | | | " | 2 |
| Batangas | On Going Berth | 1(-10m) | Domestic Large | 1 | Domestic Large | 1 | Domestic Large | 1 |
| | New Berth | 1(-10m) | " | 1 | " | 1 | " | 1 |
| | " | 2 | | | " | 1 | " | 1 |
| Total | | | 17 | | 30 | | 30 | |




| MAIN PARTICULARS | | |
|---|---|---|
| RATED LOAD (UNDER SPREADER) | | 35.6T |
| MOTIN | | SPEED (m/min) |
| HOISTING / LOWERING | FULL LOAD | 45 |
| | SPREADER | 120 |
| TROLEY TRAVELLING | | 125 |
| BOOM HOISTING | | 8 min |
| GANTRY TRAVELLING | | 45 |

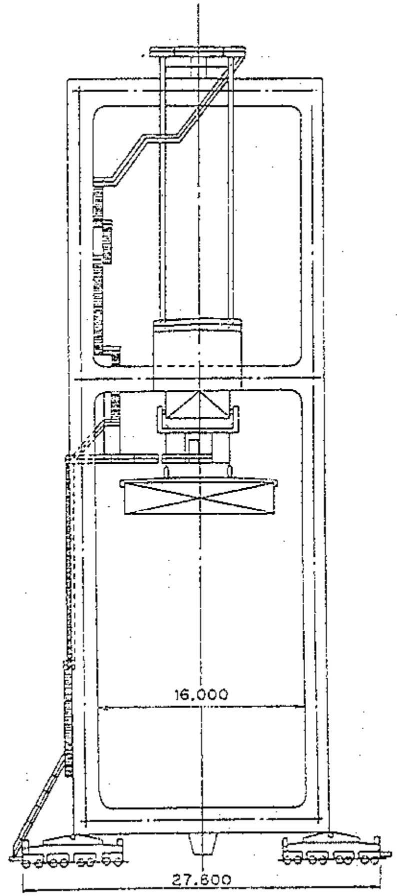



Figure 4-16 Container Crane

### 4.4.4 Container Yard Facilities

(1) Marshalling Yard

Required storage number of containers in marshalling yard (Ml) is calculated as follows:

$$Ml = My \times Dt \times p \, / \, Dy$$

where:

| | | |
|---|---|---|
| My | : | Annual Container throughput (TEUs/year) |
| Dt | : | Average dwelling time (days) |
| p | : | Peak ratio |
| Dy | : | Annual operating days (days/year) |

Required number of ground slots (Ns) is calculated as follows:

$$Ns = Ml \, / \, H$$

where: H : Average stacking height (layers)

1) International Container Berths

Using above formula, the number of ground slots (Ns) per berth at South Harbor, MICT and Port of Batangas is calculated as 745, 1,358 and 525 respectively in medium case scenario and the figure is shown in Table 4-13 to 4-15. Average dwelling days is assumed on the basis of data in the container yard of Japan. The figure of import and export dwelling days is almost equivalent to 75% of total dwelling days.

Table 4-13 Required Ground Slots of South Harbor (-10m)

(Medium Case) Foreign

South Harbor, 1 Berth (-10m) Transfer Crane System

| Target Year 2010 | Unit | Loaded Container | | | | Empty Cot. | Total |
|---|---|---|---|---|---|---|---|
| | | Import | Export | Reefer | Tranship | | |
| Annual Container Throughput (My) | TEUs | 88,100 | 24,900 | 0 | 0 | 42,600 | 155,600 |
| Average Dwelling Days (Dw) | Days | 4.0 | 3.0 | 0.0 | 0.0 | 6.0 | |
| Peak ratio (P) | | 1.3 | 1.3 | 0 | 0 | 1.3 | |
| Annual operating days (Dy) | Days/year | 360 | 360 | | | 360 | |
| Required Storage Number (M1) | TEUs | 1,273 | 270 | 0 | 0 | 923 | 2,465 |
| Average Stacking Height (h) | Layers | 3.0 | 3.0 | 1.0 | 3.0 | 4.0 | |
| Required Ground Slots (Ns) | Slots | 424 | 90 | 0 | 0 | 231 | 745 |

Ml=My x Dt x p/Dy, Ns=Ml/H

Table 4-14 Required Ground Slots of MICT (-13m)

(Medium Case) Foreign

MICT, 1 Berth (-10m) Transfer Crane System

| Target Year 2010 | Unit | Loaded Container | | | | Empty Cot. | Total |
|---|---|---|---|---|---|---|---|
| | | Import | Export | Reefer | Tranship | | |
| Annual Container Throughput (My) | TEUs | 122,400 | 127,300 | 0 | 0 | 57,000 | 306,700 |
| Average Dwelling Days (Dw) | Days | 4.0 | 3.0 | 0.0 | 0.0 | 6.0 | |
| Peak ratio (P) | | 1.3 | 1.3 | 0 | 0 | 1.3 | |
| Annual operating days (Dy) | Days/year | 360 | 360 | | | 360 | |
| Required Storage Number (M1) | TEUs | 1,768 | 1.379 | 0 | 0 | 1,235 | 4,382 |
| Average Stacking Height (h) | Layers | 3.0 | 3.0 | 1.0 | 3.0 | 4.0 | |
| Required Ground Slots (Ns) | Slots | 589 | 460 | 0 | 0 | 309 | 1,358 |

Ml=My x Dt x p/Dy, Ns=Ml/H

Table 4-15 Required Ground Slots of Port of Batangas (-10m)

(Medium Case) Foreign

Port of Batangas, 1 Berth (-10m) Transfer Crane System

| Target Year 2010 | Unit | Loaded Container | | | | Empty Cot. | Total |
|---|---|---|---|---|---|---|---|
| | | In | Out | Reefer | Tranship | | |
| Annual Container Throughput (My) | TEUs | 47,500 | 35,200 | 0 | 0 | 31,200 | 113,900 |
| Average Dwelling Days (Dw) | Days | 4.0 | 3.0 | 0.0 | 0.0 | 6.0 | |
| Peak ratio (P) | | 1.3 | 1.3 | 0 | 0 | 1.3 | |
| Annual operating days (Dy) | Days/year | 360 | 360 | | | 360 | |
| Required Storage Number (M1) | TEUs | 686 | 381 | 0 | 0 | 676 | 1,743 |
| Average Stacking Height (h) | Layers | 3.0 | 3.0 | 0.0 | 0.0 | 4.0 | |
| Required Ground Slots (Ns) | Slots | 229 | 127 | 0 | 0 | 169 | 525 |

Ml=My x Dt x p/Dy, Ns=Ml/H

2) Domestic Container Berths

In addition, the number of ground slots (Ns) at North Harbor and Port of Batangas is calculated using the above formula. Required storage capacity of domestic container yards is shown in Table 4-16 to 17.

Table 4-16 Required Ground Slots of North Harbor (-10m)

(Medium Case) Domestic

North Harbor, 1 Berth (-10m) Straddle Carrier System

| Target Year 2010 | Unit | Loaded Container | | | | Empty Cot. | Total |
|---|---|---|---|---|---|---|---|
| | | In | Out | Reefer | Tranship | | |
| Annual Container Throughput (My) | TEUs | 47,500 | 57,300 | 0 | 0 | 22,200 | 127,000 |
| Average Dwelling Days (Dw) | Days | 4.0 | 3.0 | 0.0 | 0.0 | 6.0 | |
| Peak ratio (P) | | 1.3 | 1.3 | 0 | 0 | 1.3 | |
| Annual operating days (Dy) | Days/year | 360 | 360 | | | 360 | |
| Required Storage Number (M1) | TEUs | 686 | 621 | 0 | 0 | 481 | 1,788 |
| Average Stacking Height (h) | Layers | 3.0 | 3.0 | 1.0 | 3.0 | 4.0 | |
| Required Ground Slots (Ns) | Slots | 229 | 207 | 0 | 0 | 120 | 556 |

Ml=My x Dt x P/Dy, Ns=Ml/H

Table 4-17 Required Ground Slots of Port of Batangas (-10m)

(Medium Case) Domestic

Port of Batangas, 1 Berth (-10m) Straddle Carrier System

| Target Year 2010 | Unit | Loaded Container | | | | Empty Cot. | Total |
|---|---|---|---|---|---|---|---|
| | | In | Out | Reefer | Tranship | | |
| Annual Container Throughput (My) | TEUs | 58,700 | 42,700 | 0 | 0 | 21,500 | 122,900 |
| Average Dwelling Days (Dw) | Days | 4.0 | 3.0 | 0.0 | 0.0 | 6.0 | |
| Peak ratio (P) | | 1.3 | 1.3 | 0 | 0 | 1.3 | |
| Annual operating days (Dy) | Days/year | 360 | 360 | | | 360 | |
| Required Storage Number (M1) | TEUs | 848 | 463 | 0 | 0 | 466 | 1,776 |
| Average Stacking Height (h) | Layers | 3.0 | 3.0 | 1.0 | 3.0 | 4.0 | |
| Required Ground Slots (Ns) | Slots | 283 | 154 | 0 | 0 | 116 | 553 |

Ml=My x Dt x P/Dy, Ns=Ml/H

(2) Container Freight Station (CFS)

Required area of CFS (S) is calculated as below:

$$S = ( W \times D \times p ) / ( w \times r \times T )$$

| | | | |
|---|---|---|---|
| where: | W | : | Cargo volume treated in CFS (tons) |
| | D | : | Average dwelling time (days) |
| | p | : | Peak ratio |
| | w | : | Average stacking weight on unit area in CFS (tons/m2) |
| | r | : | Effective use ratio of floor area in CFS |
| | T | : | Annual operating days (days/year) |

The ratio of LCL containers is very low in general but that of North Harbor is very high. It was around 4%, 5% and 20% in 1991 at MICT, South Harbor and North Harbor and is assumed to be at the same level in future at South Harbor and MICT. The ratio of LCL containers at North Harbor is assumed to be half (10%) of the above level.

Another parameters are assumed as follows:

D = 10 days, p = 1.3, w = 1.0 or 2.0 ton/m2, r = 0.75, T = 250day

Table 4-18 to 22 show the required area of CFS in medium case.

Table 4-18 Required Area of CFS, South Harbor (-10m)
(Medium Case)

1 berth Foreign

Required area of CFS

| | | |
|---|---|---|
| Number of loaded containers (a) | TEUs | 113,000 |
| Unit cargo volume (b) | Ton/TEU | 9.3 |
| LCL cargo ratio (c) | % | 5 |
| LCL cargo volume W=axbxc | Ton/Year | 52,545 |
| Average dwelling time (D) | Days | 10 |
| Peak ratio (P) | | 1.3 |
| Average stacking weight (w) | Ton/m2 | 1.0 |
| Effective use ratio (r) | | 0.75 |
| Annual operating days (T) | Days/year | 250 |
| Required Area of CFS (WxDxP/(wxrxT)) | Square m. | 3,643 |

Table 4-19 Required Area of CFS, MICT (-13m)
(Medium Case)

1 berth Foreign

Required area of CFS

| | | |
|---|---|---|
| Number of loaded containers (a) | TEUs | 249,700 |
| Unit cargo volume (b) | Ton/TEU | 10.3 |
| LCL cargo ratio (c) | % | 4 |
| LCL cargo volume W=axbxc | Ton/Year | 102,876 |
| Average dwelling time (D) | Days | 10 |
| Peak ratio (P) | | 1.3 |
| Average stacking weight (w) | Ton/m2 | 1.0 |
| Effective use ratio (r) | | 0.75 |
| Annual operating days (T) | Days/year | 250 |
| Required Area of CFS (WxDxP/(wxrxT)) | Square m. | 7,133 |

Table 4-20 Required Area of CFS, Port of Batangas (-10m) (Medium Case)

1 berth Foreign

Required area of CFS

| | | |
|---|---|---|
| Number of loaded containers (a) | TEUs | 82,700 |
| Unit cargo volume (b) | Ton/TEU | 9.3 |
| LCL cargo ratio (c) | % | 5 |
| LCL cargo volume W=axbxc | Ton/Year | 38,455 |
| Average stacking weight (w) | Days | 10 |
| Peak ratio (P) | | 1.3 |
| Average stacking weight (w) | Ton/m2 | 1.0 |
| Effective use ratio (r) | | 0.75 |
| Annual operating days (T) | Days/year | 250 |
| Required Area of CFS (WxDxP/(wxrxT)) | Square m. | 2,666 |

Table 4-21 Required Area of CFS, North Harbor (-10m) (Medium Case)

1 berth Domestic

Required area of CFS

| | | |
|---|---|---|
| Number of loaded containers (a) | TEUs | 104,800 |
| Unit cargo volume (b) | Ton/TEU | 20.7 |
| LCL cargo ratio (c) | % | 10 |
| LCL cargo volume W=axbxc | Ton/Year | 216,936 |
| Average dwelling time (D) | Days | 10 |
| Peak ratio (P) | | 1.3 |
| Average stacking weight (w) | Ton/m2 | 2.0 |
| Effective use ratio (r) | | 0.75 |
| Annual operating days (T) | Days/year | 250 |
| Required Area of CFS (WxDxP/(wxrxT)) | Square m. | 7,520 |

Table 4-22 Required Area of CFS, Port of Batangas (-10m)
(Medium Case)

1 berth Domestic

Required area of CFS

| | | |
|---|---|---|
| Number of loaded containers (a) | TEUs | 101,400 |
| Unit cargo volume (b) | Ton/TEU | 20.7 |
| LCL cargo ratio (c) | % | 10 |
| LCL cargo volume W=axbxc | Ton/Year | 209,898 |
| Average dwelling time (D) | Days | 10 |
| Peak ratio (P) | | 1.3 |
| Average stacking weight (w) | Ton/m2 | 2.0 |
| Effective use ratio (r) | | 0.75 |
| Annual operating days (T) | Days/year | 250 |
| Required Area of CFS (WxDxP/(wxrxT)) | Square m. | 7,276 |

(3) Maintenance Shop

The size of the maintenance shop depends on such factors as the rate of container damage, the type and number of cargo -handling vehicles and machines to be used in the terminal. Considering other examples, following dimensions are assumed:

Area : 1,000 m2 (40 m x 25 m)/ berth
Height : 10 m
Width of the space in front of the maintenance shop
: more than 10 m

(4) Terminal Office Building

The area of the terminal office is decided from the number of persons working in the terminal. Based on past experience, it is assumed that around 150 persons work at one terminal. Required floor area for one person is usually set as 10 sq.m. Accordingly, required floor area is 1,500 sq.m. In case that half of the office is two stories, necessary area of terminal office is 1,000 sq.m for one terminal. It is located next to the terminal gate.

(5) Terminal Gate

Terminal gate is set up near access roads, and in the center of container yard. Gate facilities are generally made up of two truck scales and 4 gate lanes per berth.

(6) Stacking Yard

Stacking yard for the empty containers is kept in the vacant space of the terminal. However, this international container terminal may not be sufficient to house all empty container stacking. It is necessary to reserve sufficient area around the terminal in order to prepare stacking yards afterwards in accordance with the increase of demand.

Figure 4-17 to 19 show the basic layouts of container yard and marshalling yard.

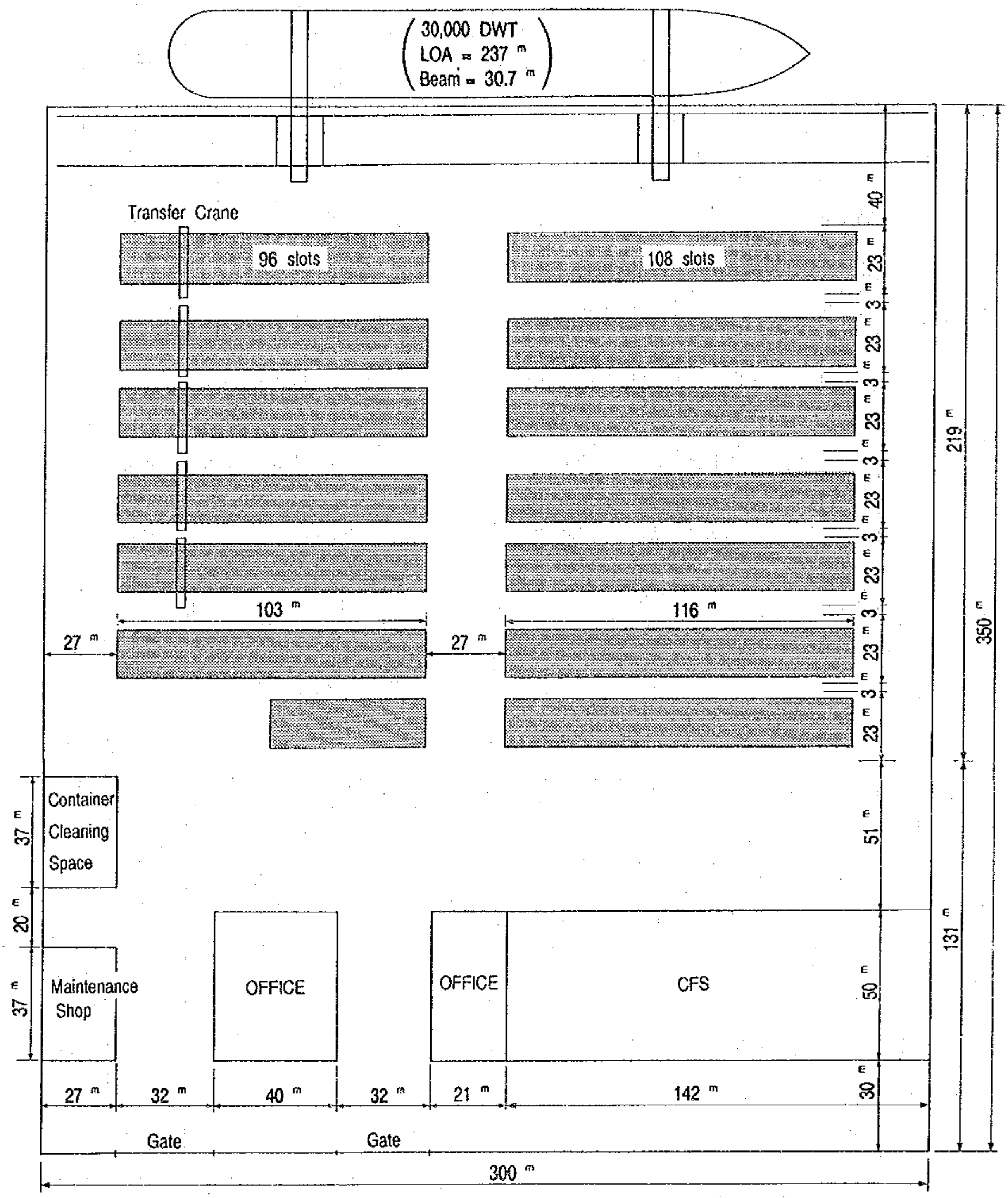



Figure 4-17 Basic Layout of Container Yard (International Container Terminal)

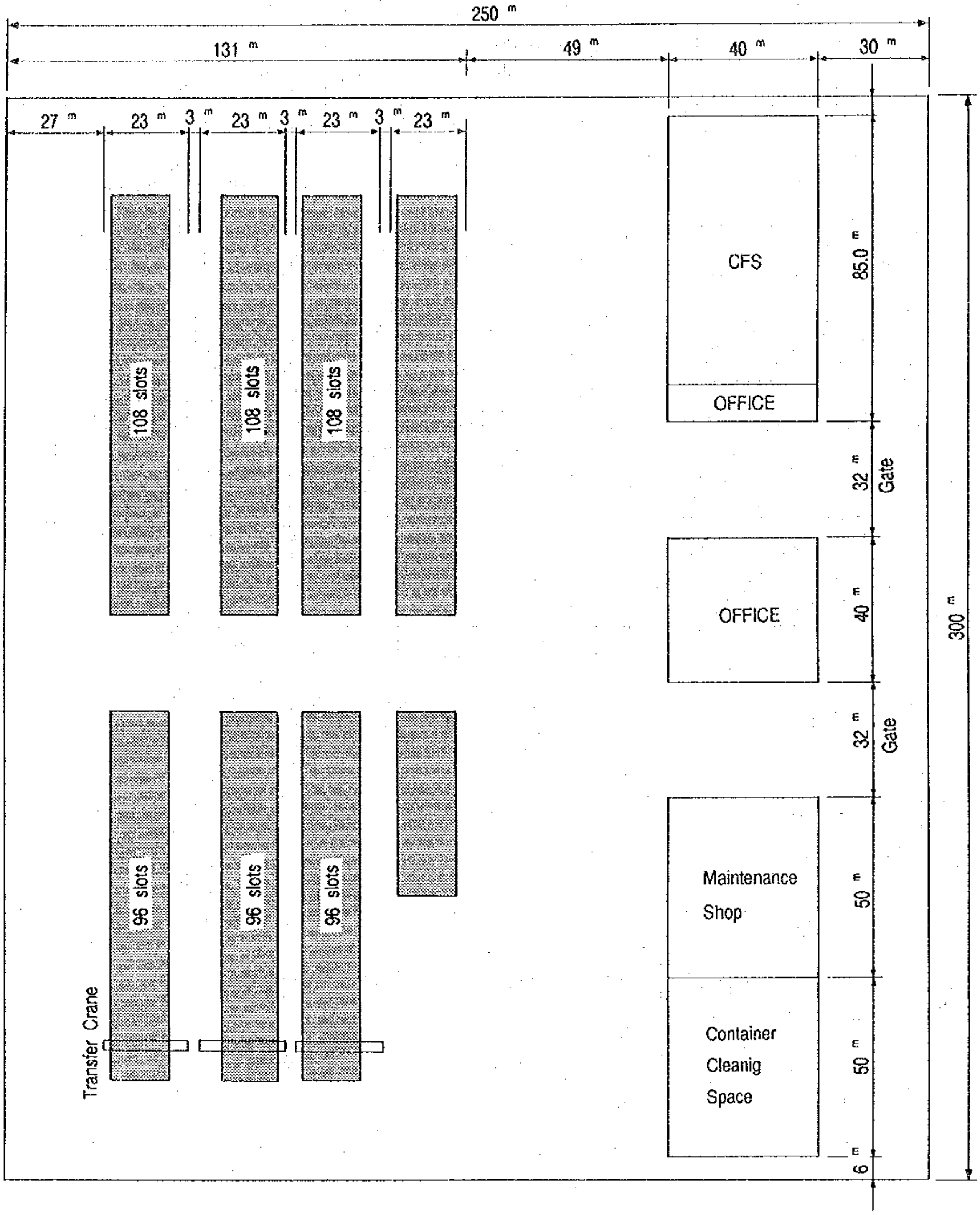



Figure 4-18 Basic Layout of Container Yard (at South Harbor)

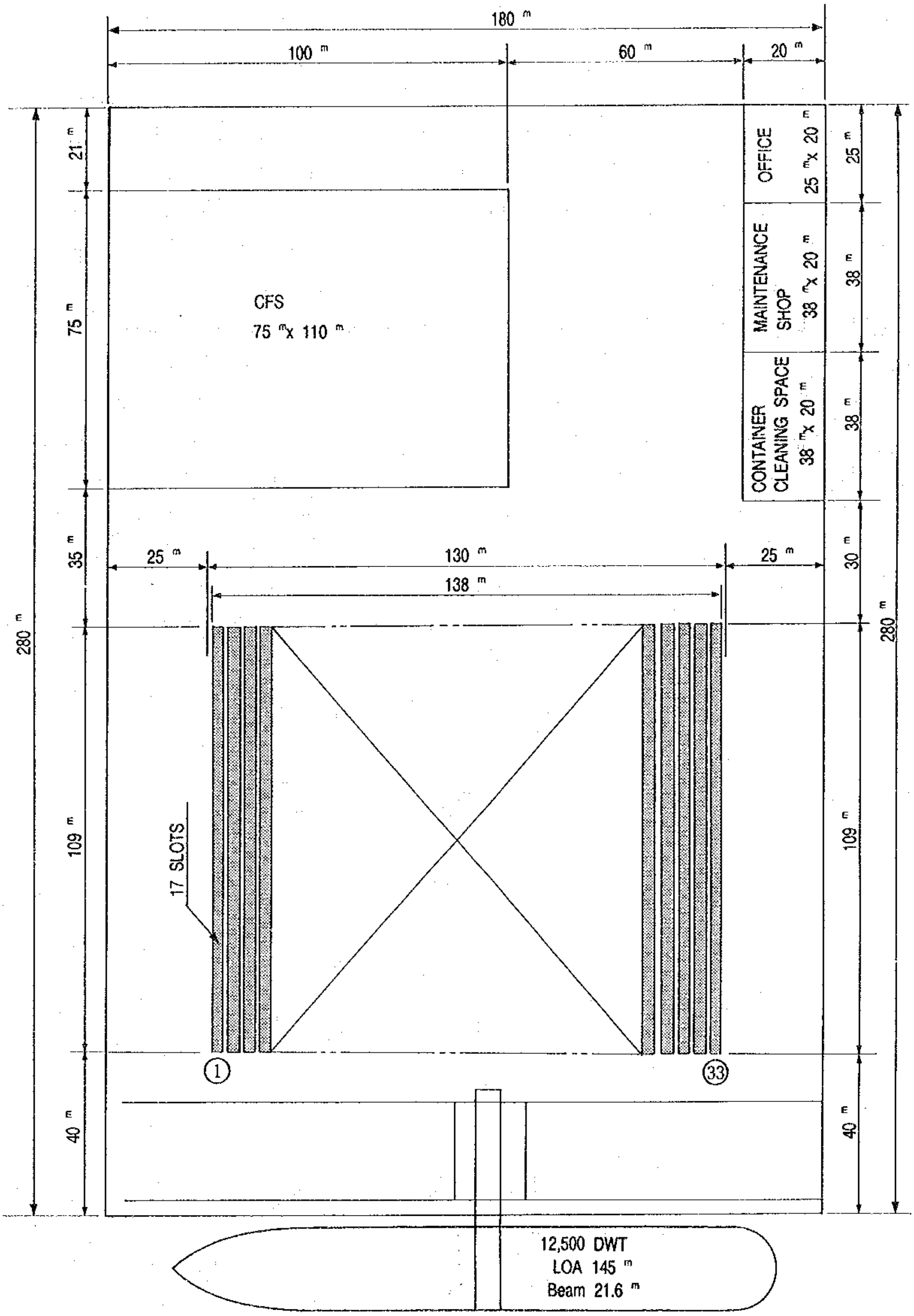



Figure 4-19 Basic Layout of Container Yard (Domestic Container Terminal)

4.4.5 Transfer Crane

The tire-mount transfer crane with a span of 23 m (for 6+1 row) and a height of three layers clearance are deployed in the international container marshling yard. This is the most general type recently used throughout the world. There are two major categories of cargo handling in marshaling yards. One is to or from quay side and the other is to or from the outside of the terminal through the gates. Transfer cranes are used for both types of cargo handling. These two handling operations may take place independently and simultaneously. Average handling capacity of a transfer crane is assumed at around 18 units/hour. To correspond with the handling capacity of two container cranes (50 units/hour), more than three transfer cranes are necessary for the former operation. For the latter operation, at least two transfer cranes are necessary. Since each container terminal can be operated independently, transfer cranes per one container terminal is five. The total number of transfer cranes in each international port master plan is summarised in Table 4-23, and the major specifications of a tire-mount transfer crane is shown in Fig. 4-20.

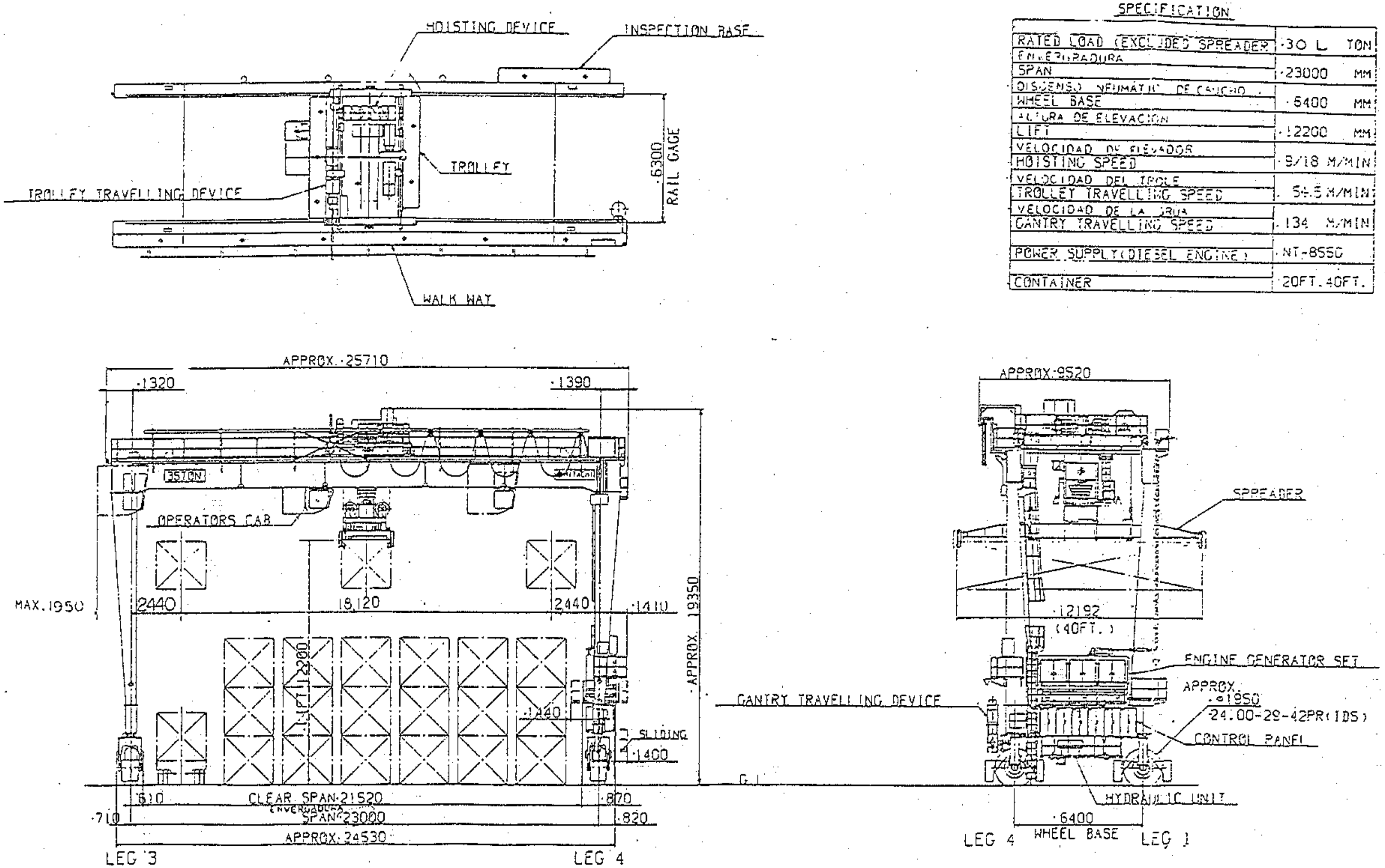
On the other hand, straddle carriers are deployed in the domestic container marshalling yard.

Table 4-23(1) Number of Transfer Cranes at Each International Port

| Port | Berth | | Number of Transfer Cranes | | |
|---|---|---|---|---|---|
| | | | Medium Case | High Case(I) | High Case(II),(III) |
| South Harbor | New Berth | 1(-13m) | - | 5 | |
| | " | 2 | - | 5 | |
| | " | 3 | - | 5 | |
| MICT | On Going Berth | 4(-13m) | 7 | 7 | 7 |
| | " | 5 | | | |
| | New Berth | 1 | 5 | 5 | 5 |
| | " | 2 | 5 | 5 | 5 |
| | " | 3 | 5 | 5 | 5 |
| | " | 4 | - | 5 | 5 |
| S.Point or Naic | New Berth | 1(-13m) | - | - | 5 |
| | " | 2 | - | - | 5 |
| | " | 3 | - | - | 5 |
| Total | | | 22 | 42 | 42 |

Table 4-23(2) Number of Straddel Carriers at Each Domestic Port

| Port | Berth | | Number of Straddel Carriers | | |
|---|---|---|---|---|---|
| | | | Medium Case | High Case(I) | High Case(II),(III) |
| North Harbor | New Berth | 1(-10m) | 3 | 3 | 3 |
| | " | 2 | 3 | 3 | 3 |
| | " | 3 | 3 | 3 | 3 |
| | " | 4 | 3 | 3 | 3 |
| | " | 5 | 3 | 3 | 3 |
| | " | 6 | 3 | 3 | 3 |
| | " | 7 | - | 3 | 3 |
| | " | 8 | - | 3 | 3 |
| | " | 9 | - | 3 | 3 |
| | " | 10 | - | 3 | 3 |
| | Extra | | 2 | 2 | 2 |
| Batangas | On Going Berth | 1(-10m) | 3 | 5 | 5 |
| | New Berth | 1(-10m) | 3 | 6 | 6 |
| | " | 2 | | | |
| | Extra | | 1 | 1 | 1 |
| Total | | | 27 | 44 | 44 |




SPECIFICATION

| | |
|---|---|
| RATED LOAD (EXCLUDED SPREADER) | 30 L TON |
| ENVERGADURA<br>SPAN | 23000 MM |
| DISCENSO NEUMATICO DE CAUCHO<br>WHEEL BASE | 6400 MM |
| ALTURA DE ELEVACION<br>LIFT | 12200 MM |
| VELOCIDAD DE ELEVADOR<br>HOISTING SPEED | 9/18 M/MIN |
| VELOCIDAD DEL TROLE<br>TROLLEY TRAVELLING SPEED | 54.5 M/MIN |
| VELOCIDAD DE LA GRUA<br>GANTRY TRAVELLING SPEED | 134 M/MIN |
| POWER SUPPLY (DIESEL ENGINE) | NT-855C |
| CONTAINER | 20FT. 40FT. |

Figure 4-20 Tire Mount Transfer Crane

### 4.4.6 Waterways and Basins

(1) Port of Manila

Waterways and basins with calmness, sufficient space and depth must be secured for smooth anchorage, smooth ship operation and loading/unloading of cargoes at berth. At the Port of manila, the existing access navigation routes should be used when the port is expanded in order to cope with gwowing containerization in the Philippines. But, the width and depth of the channel must be increased to accommodate larger container vessels expected in future. Taking into account the limited effect of waves and currents, relatively shorter waterways and frequent vessel passing each other, access waterways at the South Harbor and MICT should secure width of at least 200 m which is almost the same as the overall length of 30,000 DWT container vessel (210 m). On the other hand, the access waterway at the North Harbor should secure the width of 300 m which is 2 times as wide as the overall length of 6,000 GRT RO/RO vessel (140 m), taking into account the relatively long waterway and very frequent vessel passing each other.

In front of container terminals, a sufficient water area for turning of the bow should be secured. The area of turning basin should exceed the area of a circle with the radius of the overall length of the designed vessel, in case that tugboats are expected to be used for vessel maneuvering. Accordingly, an area with the radius of 210 m at the South Harbor and MICT, and 140 m at the North Harbor must be secured as a turning basin.

Water depth of these water area should be kept more than -13 m at the South Harbor and MICT, more than -6 to -10 m at the North Harbor. Although the entire water area of the Port of Manila is being kept more than -10 m at the South Harbor and MICT, and more than -6 m at the North Harbor, the Port of Manila will still need a considerable amount of dredging in order to accommodate larger vessels in future.

Waterways and basins for new container and non-container terminals at the Port of Manila proposed by the Study are shown in Fig. 4-21 and Fig. 4-22.

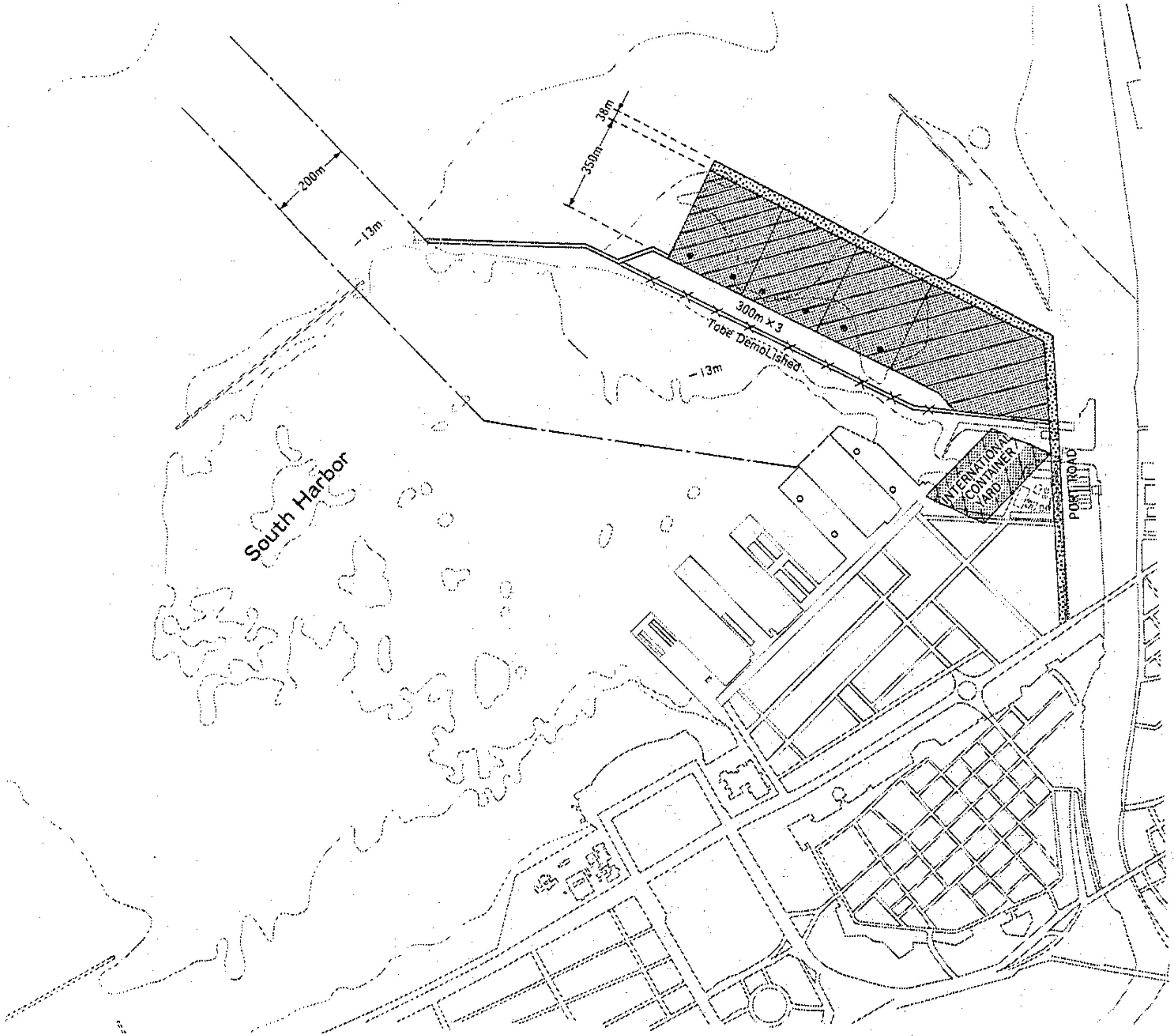



Figure 4-21 Waterways and Basins at South Harbor

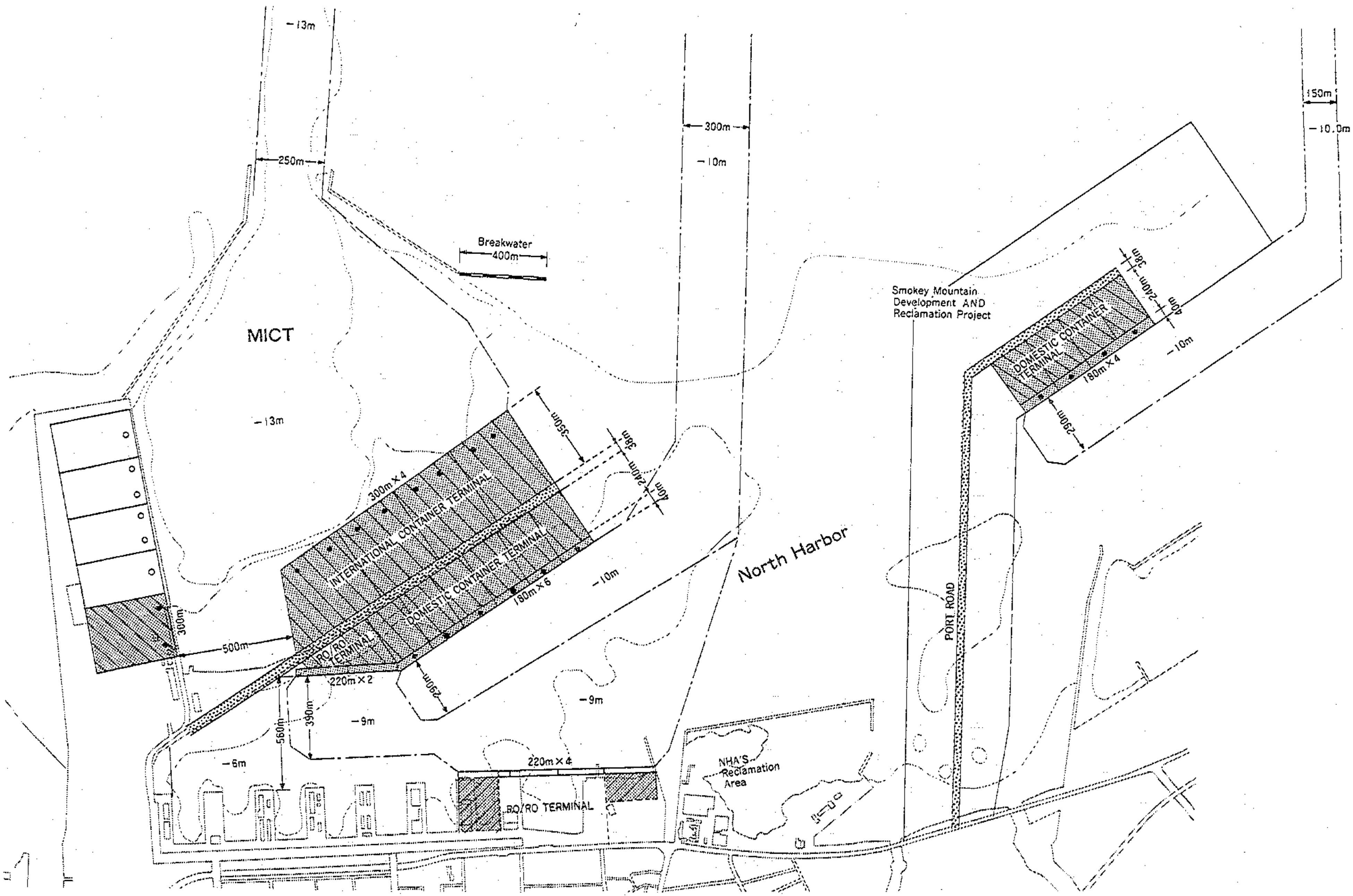



Figure 4-22 Waterways and Basins at MICT and North Harbor

(2) Sangley Point and Naic/Cavite New Port

Sangley Point or the Naic/Cavite New Port is one of the alternatives for developing an international container port within the Greater Capital Region to cope with growing containerization of the Philippines. According to vessel size forecast by the Study, calling ships at Sangley Point or the Naic/Cavite New Port in the target year 2010 is 30,000 DWT container carriers. Therefore, the depth of waterways and basins at each port should be -13 m, in accordance with the same argument at the Port of Manila. On the other hand, the width of an entrance channel should be 200 m which is almost the same as the overall length of 30,000 DWT container carrier, taking into account the relatively shorter waterways and infrequent vessel passing each other.

On the contrary, the area of turning basins at each port should exceed the area of a circle with the radius of the overall length of the designed vessel (210 m), in case that tugboats are compulsory. Waterways and basins for new container terminals at sangley Point or the Naic/Cavite New Port in case of the high case (II)/(III) scenario are shown in Fig. 4-23 and Fig. 4-24.

(3) Port of Batangas

Basically, the access waterways at the Port of Batangas is provided with enough depth and area for calling ships even in the long future. As a result, only depth and area of turning basins and/or mooring basins are focussed on as far as water area planning at this port is concerned. According to vessel size forecast by the Study, largest calling ships in the target year 2010 are 10,000 DWT genaral cargo carrier. Generally speaking, the area of turning basins is advisable to exceed the area of a circle with the radius of the overall length of the designed vessel (137 m). But, taking into account the strict calmness of the turning basin as well as compulsory usage of tugboats for vessel maneuvering at the Port of Batangas, the width of waterways between -10 m berth of the Phase I Project and a newly proposed -10 m berth at opposite side, should be 300 m which is 1.5 times as wide as the overall length of the designed vessel.
Fig. 4-25 shows the turning and mooring basin at the Port of Batangas in the target year 2010, in case of the high case (I) scenario.

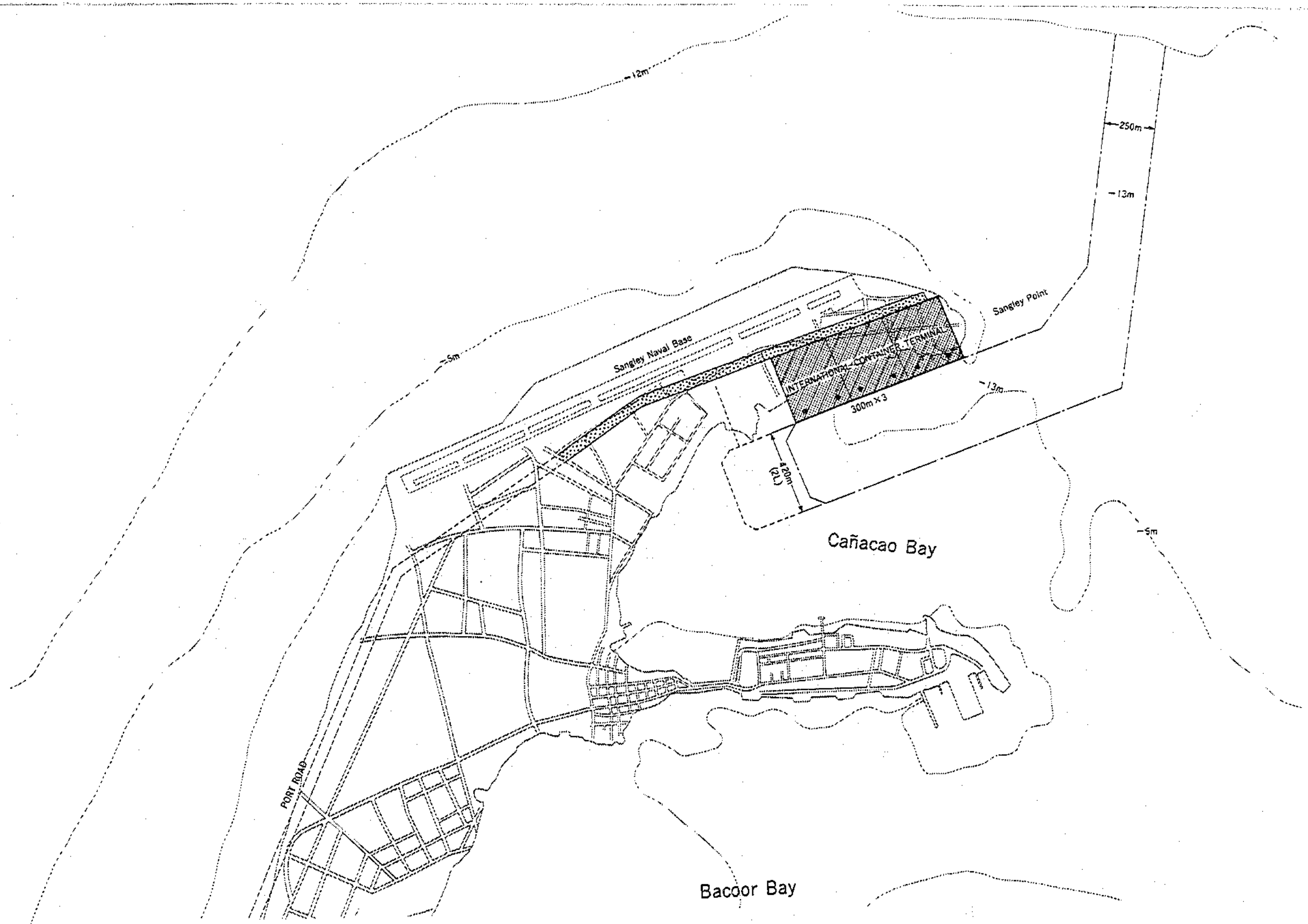



Figure 4-23 Waterway and Basin at Sangley Point

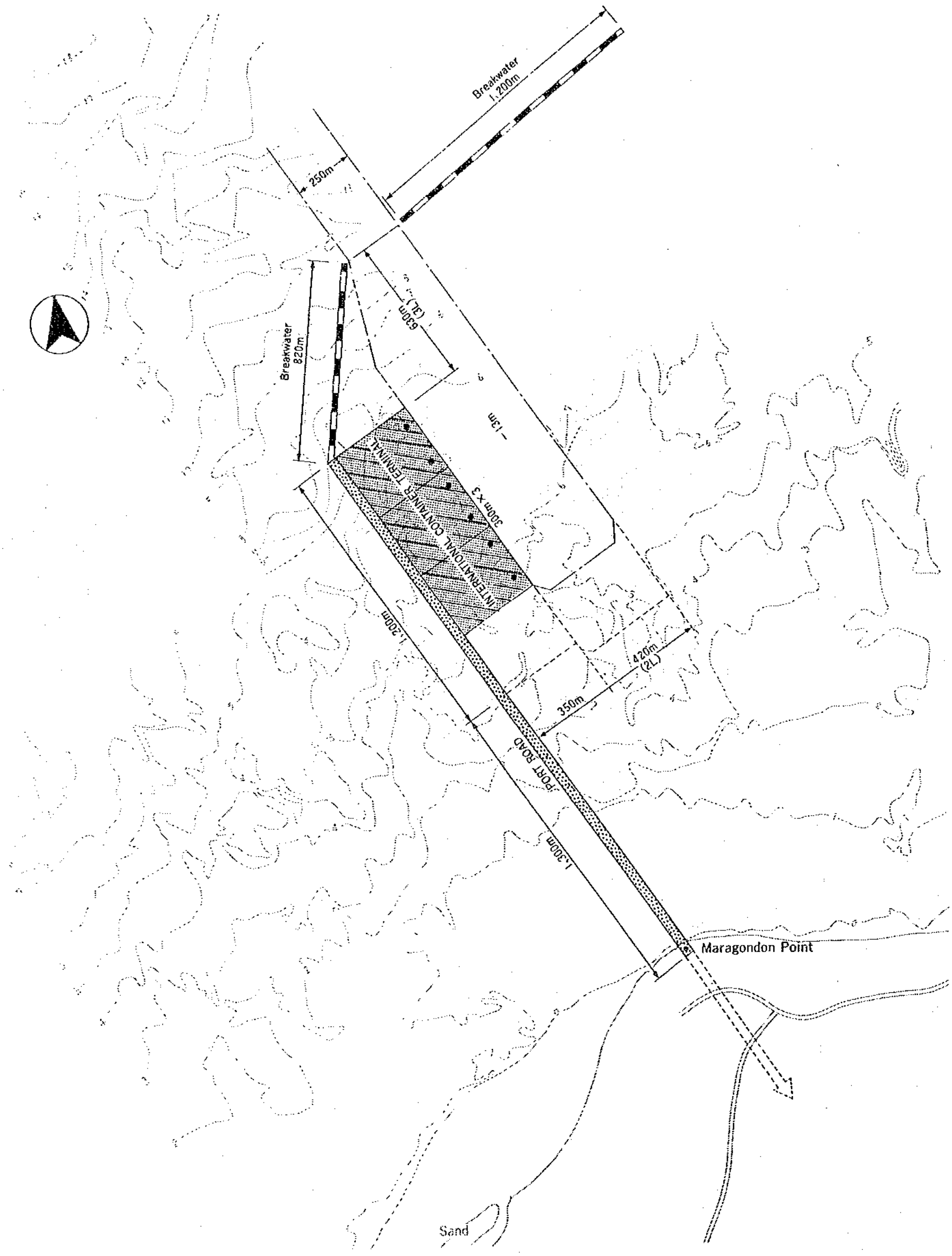



Figure 4-24 Waterway and Basin at Naic/Cavite New Port

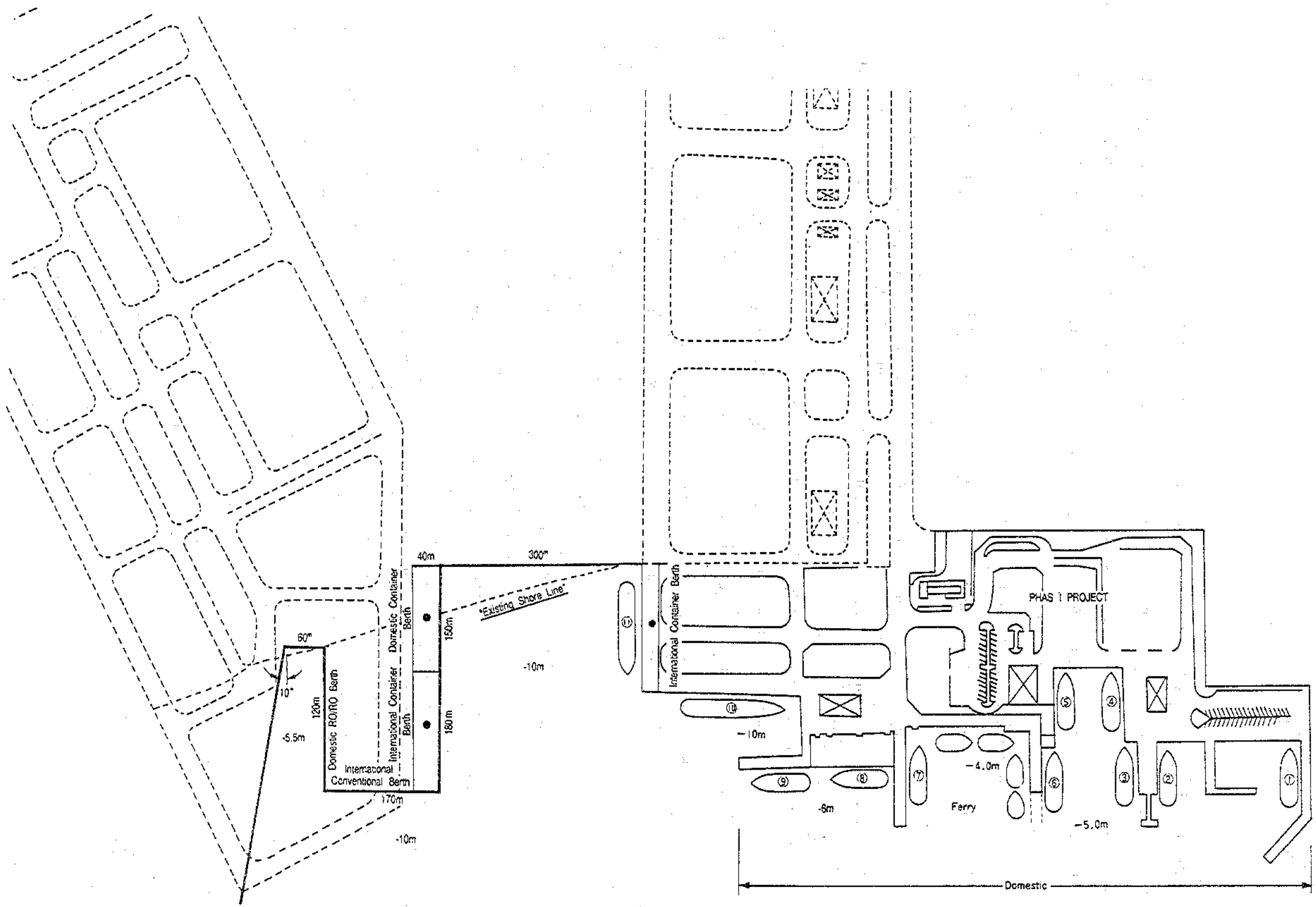



Figure 4-25 Waterway and Basin at Port of Batangas

4.4.7 Navigation Aids

Table 4-25 shows the necessary number of navigation aids. The layouts of navigation aids at each port are shown in Figure 4-26 to 4-29.

These navigation aids for assisting the safe traffic and berthing of vessels represent the minimum requirement, to cope with the incre of calling vessels in the target year.

Further-more, we recommend that special traffic rules for the developed port area be instituted concerning the following points to secure the safety of water-borne traffic.

* definition of the port area,
* definition of the North Harbor fairway, the preferred fairway and the secondary fairway,
* definition of large vessels, small vessels and miscellaneous vessels,
* priority of departing vessels in possible meetings at the entrance of the North Harbor fairway,
* principle of keeping to the right in the fairways,
* restriction on the maximum proceeding speed in each of the fairways,
* restriction on anchoring within the fairways,
* restriction on overtaking within the fairways,
* restriction on reciprocal meeting of special large vessels in the fairways,
* priority of vessels proceeding along the fairways to ones crossing the fairways,
* priority of vessels underway in the preferred fairway to ones underway in the secondary fairway in possible meeting in the proximity of the fairways' joint,
* priority of large vessels underway to other ones underway,
* reporting to the port captain on entrance, movement and departure with specific information,
* obtaining a berth assignment from the report captain,
* hoisting the destination flag of a vessel underway in the port.

Table 4-25 Navigational Aids for the developed Port Area

North Harbor

| Type of Mark | Description | Amount |
|---|---|---|
| Port hand Marks | Lighted Buoy | 7 |
| Starboard hand Marks | Buoy | 2 |
| Starboard hand Marks | Lighted Buoy | 6 |

Sangley Point

| | | |
|---|---|---|
| Port hand Mark | Lighted Buoy | 5 |
| Starboard hand Mark | Lighted Buoy | 4 |
| Starboard hand Mark | Lighted Beacon | 1 |

Naic/Cavite

| | | |
|---|---|---|
| Starboard hand Mark | Lighted Buoy | 1 |
| Starboard hand Mark | Buoy | 2 |
| Port hand Mark | Lighted Beacon | 1 |
| Port hand Mark | Lighted Buoy | 1 |
| Port hand Mark | Buoy | 1 |

South Harbor

| | | |
|---|---|---|
| Starboard hand Mark | Lighted Beacon | 1 |
| Starboard hand Mark | Lighted Buoy | 2 |
| Port hand Mark | Lighted Beacon | 1 |
| Port hand Mark | Lighted Buoy | 1 |

Remark: Desired arrangement plans of the above nav. aids are shown in sketches of the harbor charts.

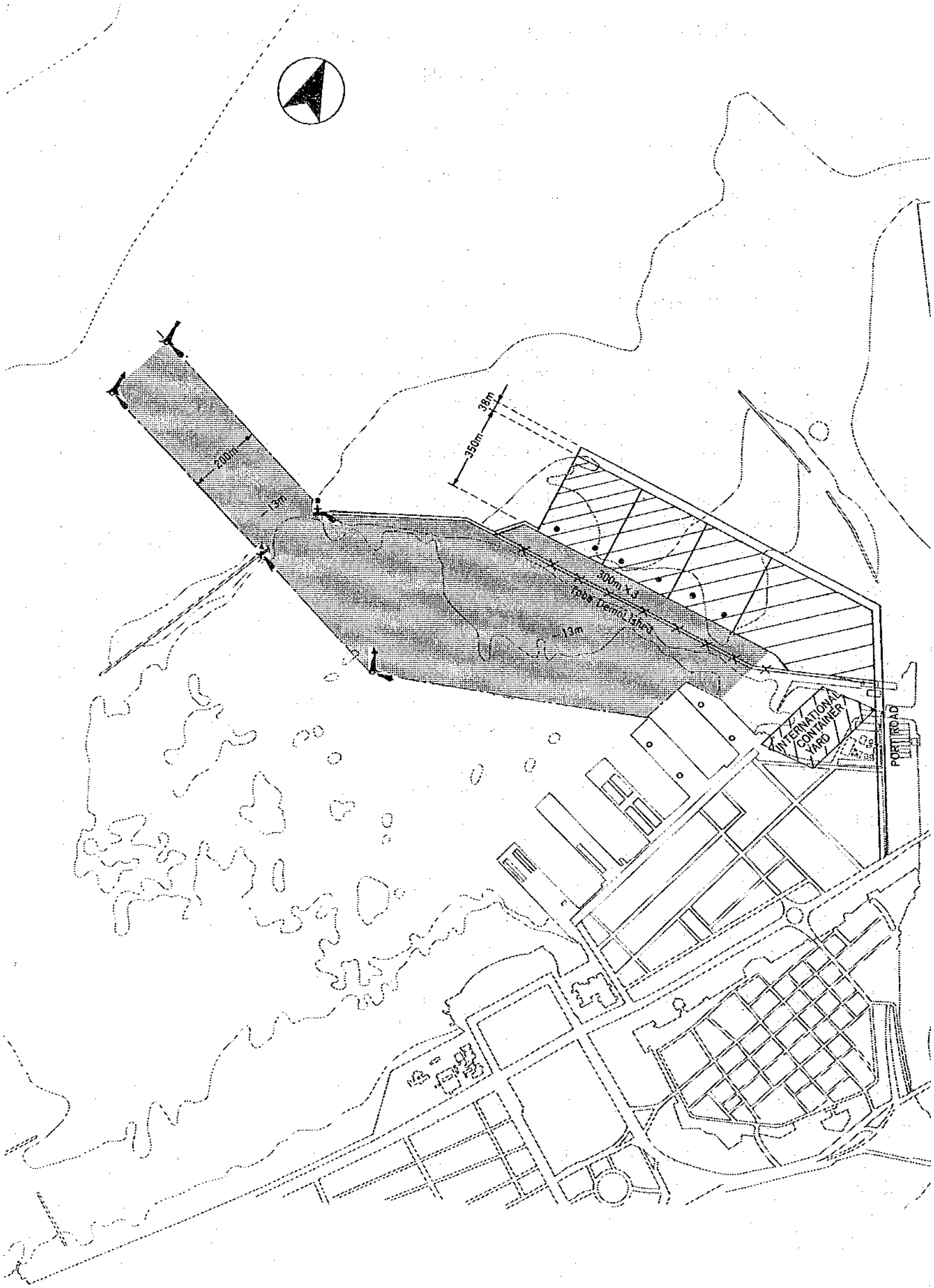



Figure 4-26 Navigation Aids at South Harbor

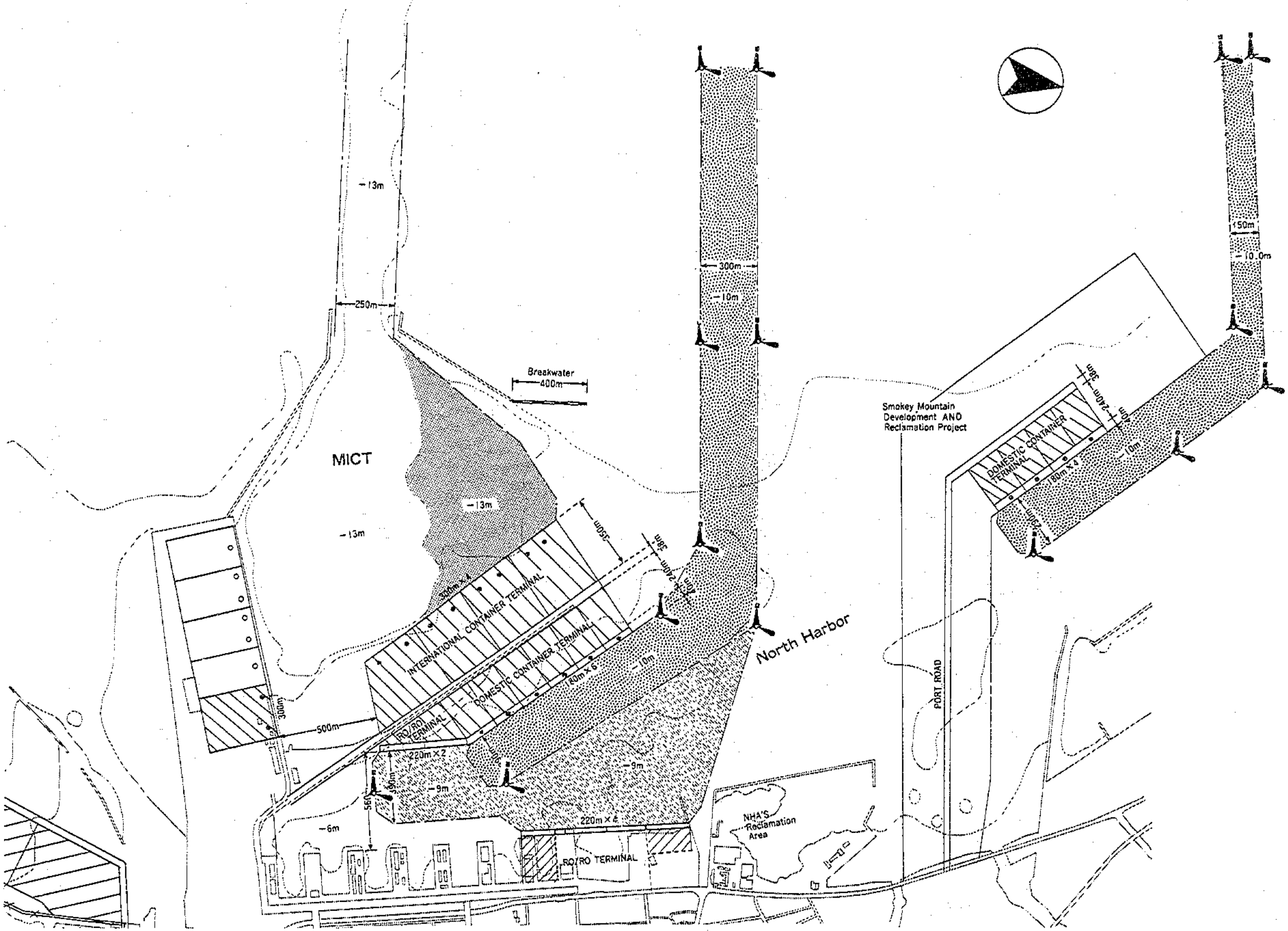



Figure 4-27 Navigation Aids at North Harbor

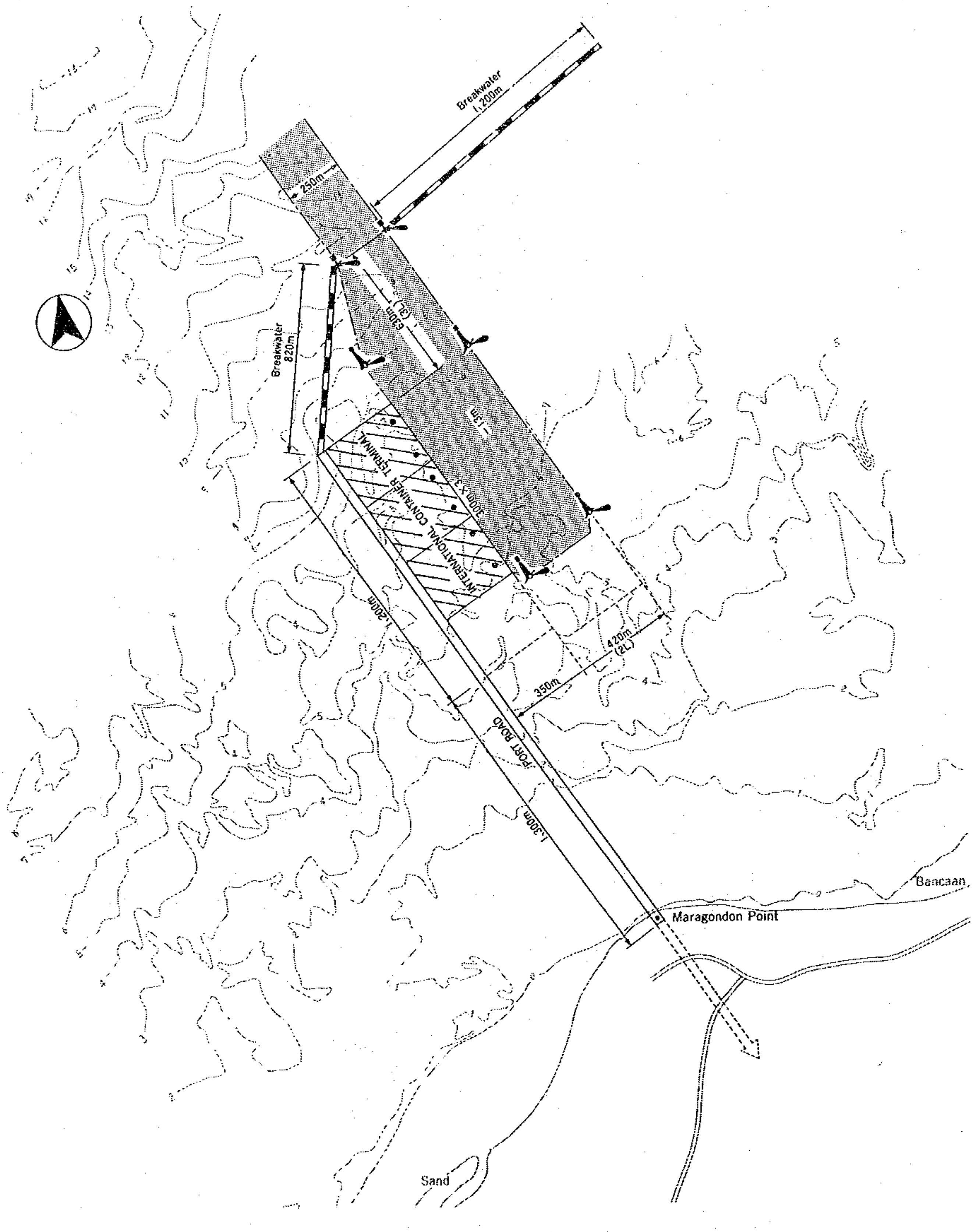



Figure 4-28 Navigation Aids at Naic/Cavite New Port

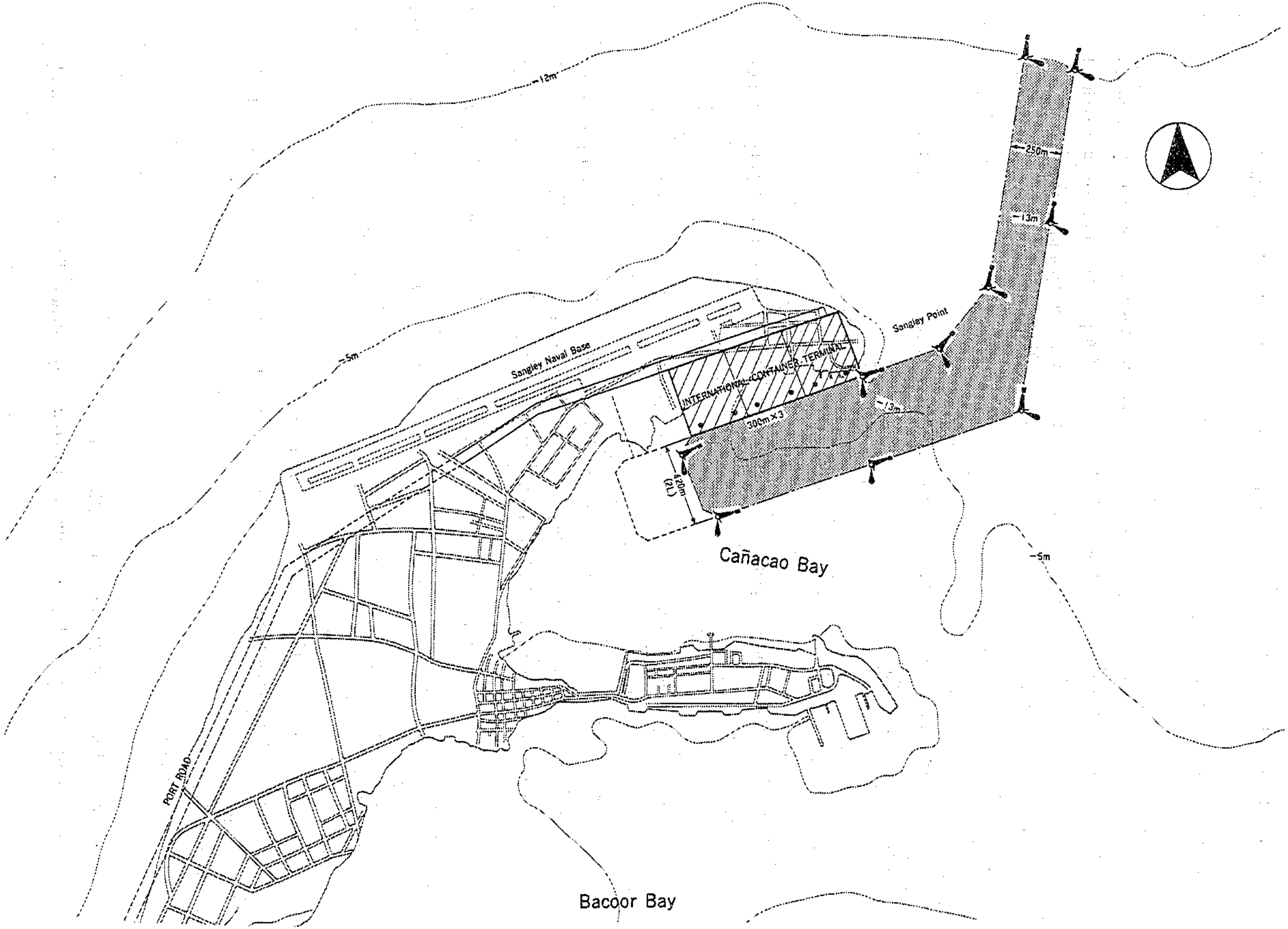


Figure 4-29 Navigation Aids at Sangley Point

# CHAPTER 5 DEVELOPMENT PLAN OF NON-CONTAINER TERMINALS

## 5.1 Evaluation of Existing Berth Capacity at Each Port

In this section, present capacity of non-container terminals at South Harbor, North Harbor and Port of Batangas is evaluated. Capacities of a port terminal are determined by several factors such as facilities, equipment and handling operations which can be represented by productivity of cargo handling equipment, berth occupancy ratio and so on.

Scope of evaluation of current port capacities covers pier only and excludes anchorage and Pasig River at each port.

### 5.1.1 Conditions for Evaluating Port Capacity

In evaluating the present port capacities, the following conditions of port facilities should be considered:

① on-going projects (rehabilitation at South and North Harbor, phase one project at Port of Batangas)
② prevalence of large size vessels in future (mentioned in Part I of Chapter 11.6)
③ renewal of actual port facilities (for example, the increased capacity of cargo handling equipment, additional number of gantry cranes at MICT and South Harbor etc.)

(1) Berth Conditions

1) South Harbor

Figure 5-1 shows plan view of South Harbor.
In the medium case scenario, there are 14 existing general cargo berths of ten(-10) meters in depth.

2) North Harbor

Figure 5-2 shows plan view of North Harbor.
New domestic RO/RO berth which is under construction between Pier 16 and

VETERAN SHIPYARD is mentioned in chapter 4.1. The existing berth shall accommodate vessels including RO/RO, Ferry and conventional vessels for general cargo and passenger at the same time. According to the Development Plan, a storage area, parking area and passenger terminal etc., which are located behind of marginal wharf, are planned.

These existing berths with six(-6) meters in depth shall be mainly used as general cargo handling berths by RO/RO or conventional vessels.

There are 41 existing berths excluding the under construction RO/RO berths.

3) Port of Batangas

Figure 5-3 shows plan view of Port of Batangas.

After Phase I Project, which commenced in 1993, is completed, Port of Batangas will have eight(8) domestic and two(2) foreign berths excluding small craft and ferry berth. One of the foreign berths shall be used as a multi-purpose berth, the other shall be used as a general cargo berth.

In future, the foreign general cargo berth shall accommodate conventional vessels. Domestic general cargo which shall be also handled at the these domestic berths shall be mainly transported by RO/RO vessel type.

(2) Productivity and Idle Time

According to the data from PPA, December 1992(see Appendix D-3), the staying times of conventional and combo vessel type are 108.7 and 40.3 hrs. respectively at South Harbor. Combo means the vessel for loading/unloading container and general cargo.

The productivity of forklift or ship's gear crane is assumed to be twenty(20) metric tons per hour according to the contract between terminal operator and stevedore. So, the Study Team adopted this productivity for domestic conventional vessel. On the other hand, productivity for foreign conventional vessel is assumed to be twenty five(25) metric tons per hour. And the idle time is assumed to be two(2) hours before and after the service time.

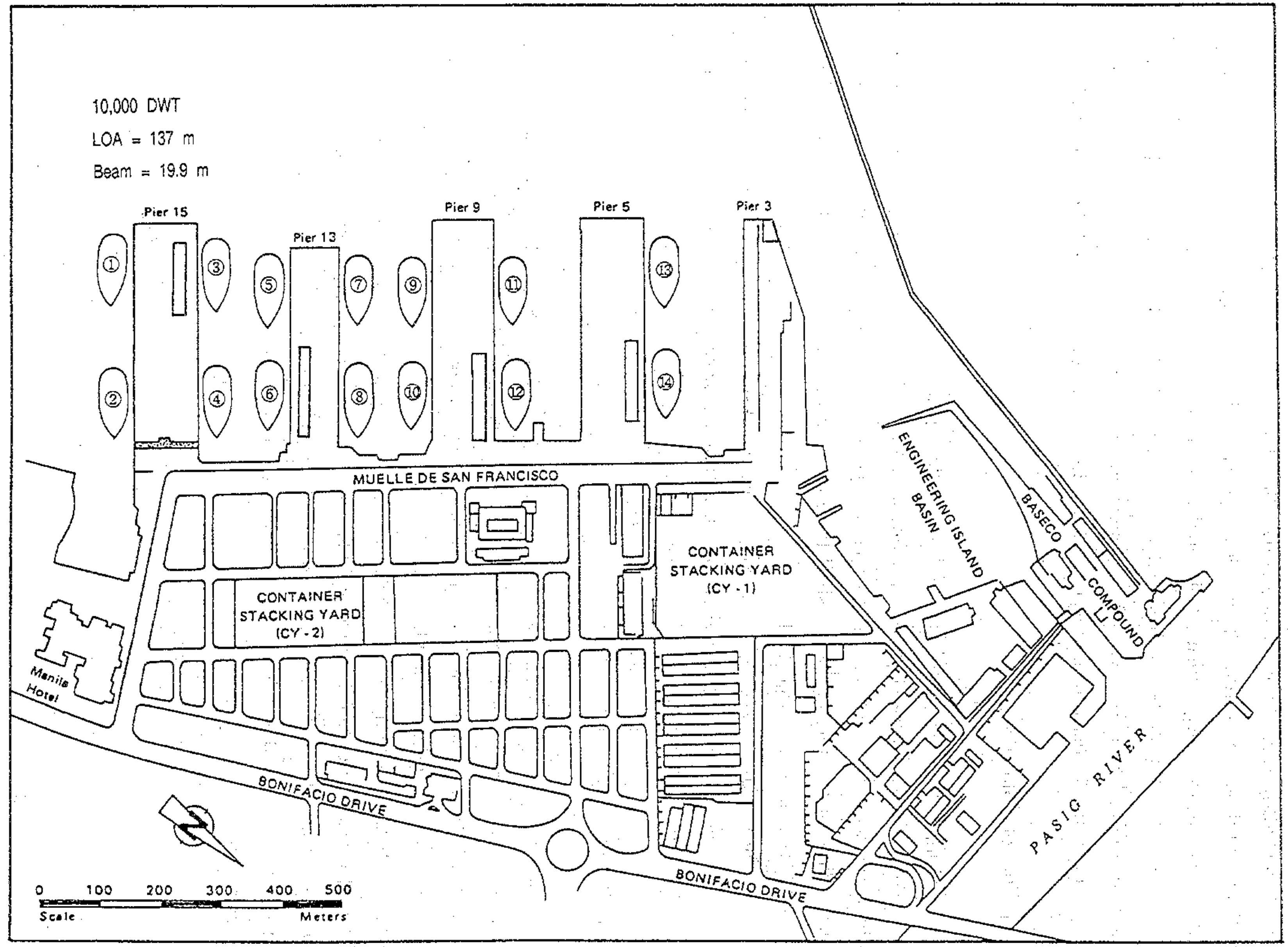



Figure 5-1 Plan View of South Harbor

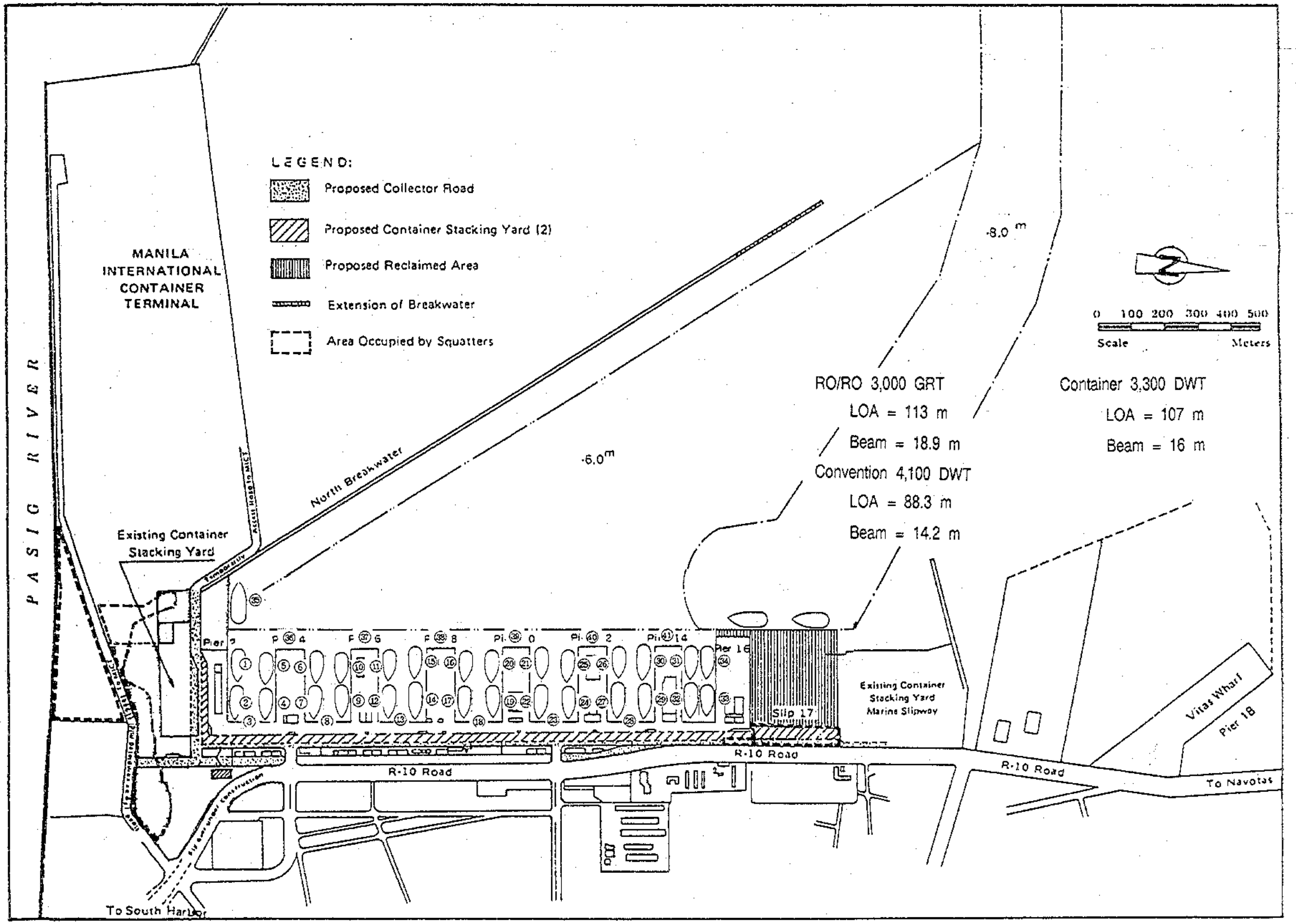



Figure 5-2 Plan View of North Harbor

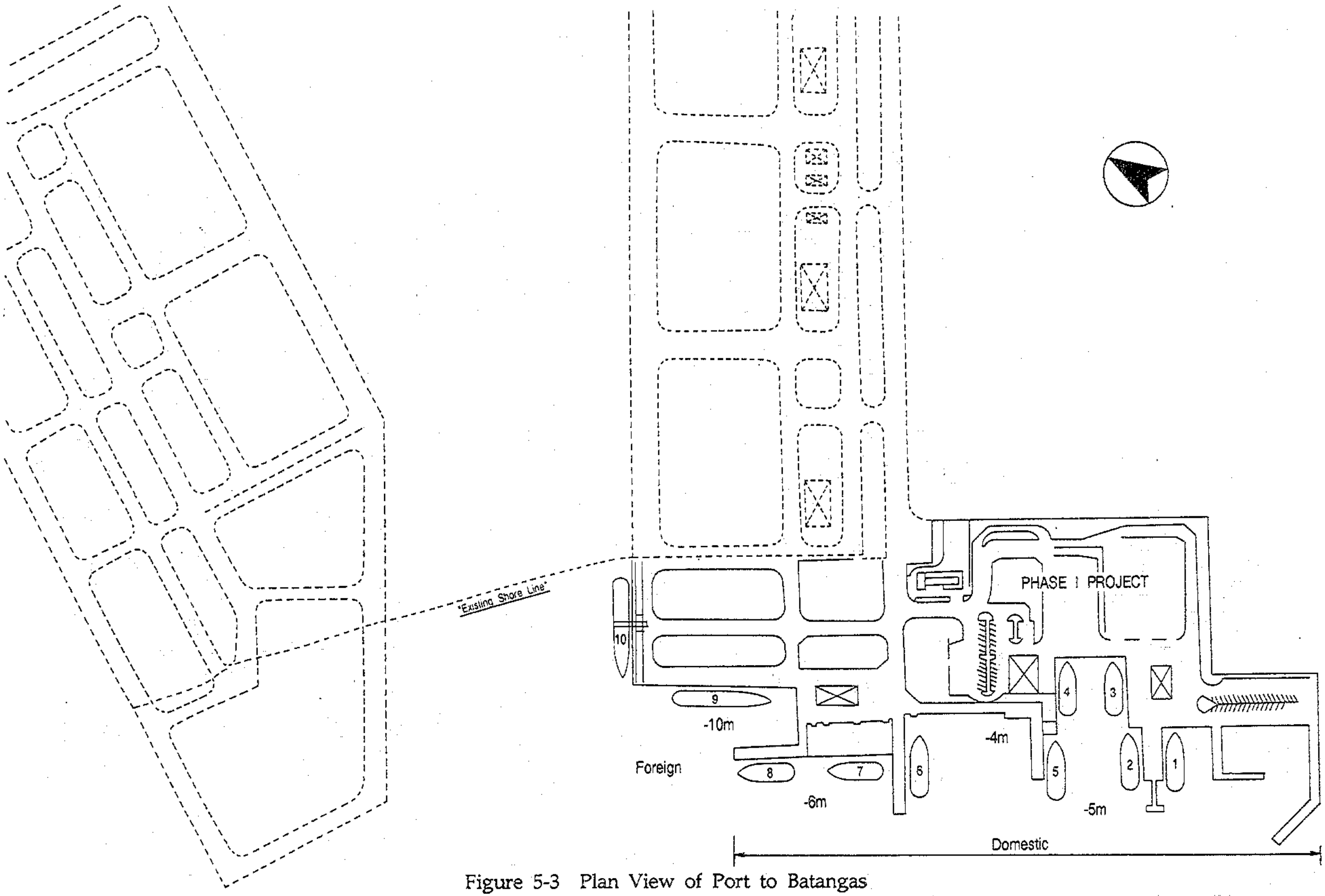



Figure 5-3 Plan View of Port to Batangas

(3) Berth Occupancy Rate

From Figure 4-6 mentioned in Part II of Chapter 4.1, it is noted that the occupancy rate for the port of North Harbor is over 70%. This implies that the port is operating at its full capacity. In addition, the field survey confirmed that the port is rather congested.

However, the berth occupancy rate for calculation at North Harbor is assumed to be 50%, according to the relation to the number of berths and recommended maximum berth occupancy (Table 4-1) because the Pier of North Harbor can accommodate two(2) standard vessels at the same time.

On the other hand, the berth occupancy rate for conventional vessel at South Harbor is assumed to be the same as the container berth occupancy rate (50%) at South Harbor.

(4) Operation Time and Days

The operation time is already mentioned in Part I of Chapter 8.2 Cargo handling is carried out in two shifts, 24 hours a day. Thus, considering the lunch time (1 hour) and the rest time(1 hour) of each gang, operation time a day is assumed as 20 hours at all ports.

The working time, however, is assumed as 13 hours for domestic cargo handling within the above operation time, that is, the operating time is 16 hours from 6 a.m. to 10 p.m. including the rest time. On the other hand, the working time for foreign cargo handling is assumed as 16 hours, an increase of 25% the domestic working time because an efficiency service for foreign vessel is expected.

The working days a year is assumed to be 360 at the Port of Manila excluding working holidays(3 days) and days in which no ships can berth due to inclement weather. But, the working days at the Port of Batangas is assumed to be reduced to 320 days considering the natural conditions based on the JICA report, the Development Project on the Port of Batangas in the Republic of the Philippines in December 1985, and the fact that there is no breakwater.

(5) Relation of Vessel Size and Loaded Cargo Volume per Vessel

Table 5-1 shows the relation between the forecasted vessel size mentioned in Part I of Chapter 11.6 and general cargo volume per vessel. The general cargo volume per conventional vessel is calculated as to be in proportion to the present average loaded cargo volume per conventional vessel at South Harbor and North Harbor. On the other hand, the general cargo volume at North Harbor by RO/RO vessel is assumed to be almost full capacity which is in accordance with the ship list from CONFERENCE OF INTERISLAND SHIPOWNERS AND OPERATORS(CISO)'s member.

Table 5-1 Relation of Vessel Size and Loaded Cargo Volume per Vessel

| | Vessel Type and Dimensions | | | | | | Cargo Volume per Vessel MT |
|---|---|---|---|---|---|---|---|
| | | | | LOA | Draft | Beam | |
| South Harbor | Convention | 10,000 | DWT | 137m | -8.5m | 19.9m | 2,700 |
| North Harbor | RO/RO | 3,000 | GRT | 113m | -4.9m | 18.9m | 1.300 |
| | Convention | 4,100 | DWT | 88m | -5.1m | 13.5m | 1.600 |
| Port of Batangas | Convention | 10,000 | DWT | 137m | -8.5m | 19.9m | 2,700 |
| | RO/RO | 2,000 | GRT | 96m | -4.4m | 17.1m | 45 |

Remarks: The MT in RO/RO type (2,000 GRT) means number of trucks.

The figure for calculation at Port of Batangas depends on the same data of South Harbor or North Harbor. And the other basic figures for calculation can be seen in Appendix D-3

### 5.1.2 Evaluation of Existing Berth Capacity at Each Port

The capacity of berth at each port is calculated by using formula 5.1 and 5.2.

Maximum Capacities
= Number of Vessels x Cargo Volume per Vessel ----------------(5.1)

(The number of vessels is determined by relevant factors such as service time, staying time and berth occupancy ratio etc. The service time is closely related to the productivity of cargo handling equipment.)

The number of vessels (v) is ascertained by using formula 5.2.

$$BOR=\frac{V\times M}{n\times m\times(H\times D-2V)} \quad \text{------------(5.2)}$$

| | | |
|---|---|---|
| BOR | : | Berth Occupancy Rate (50%) |
| V | : | Number of Vessel per year |
| M | : | Average Handling Cargo Volume per vessel |
| n | : | Number of Gantry Crane or Gang |
| m | : | Productivity |
| H | : | Operation hours per day |
| D | : | Operation days per year |
| 2V | : | Idle Time (2 hours per vessel) |

(1) South Harbor

The existing berth capacity (14 berths) at South Harbor is estimated as 3,900,000 MT per annum.

Berth's dimensions and figure for calculation are assumed to be as follows:

| | |
|---|---|
| Average vessel size | :10,000 DWT, L=137m, Draught 8.5m |
| Berth's Length and Depth | :170m, -10.0m |
| Number of Gang | :4 gangs |
| Productivity | :25 MT/hour |
| Cargo volume per vessel | :2,700 MT |
| Staying time per vessel | :27 hours / vessel |
| BOR | :50% |
| Working time | :16 hours / day |
| Working days | :360 days / year |
| Idle time | :2 hours / vessel |

* Number of Vessel = 103 Vessels per year
* Cargo volume = 278,100 MT / berth

(2) North Harbor

1) RO/RO Vessel

The capacity of existing berth (1 berth) at North Harbor for general cargo by RO/RO vessel type is estimated as 177,000 MT per annum.

Berth's dimensions and figure for calculation are assumed to be as follows:

| | |
|---|---|
| Average vessel size | :3,000 GRT, L=113m, Draught 4.9m |
| Berth's Length and Depth | :140m, -6.0m |
| Number of gang | :4 gangs |
| Productivity | :20 MT / hour |
| Cargo volume per vessel | :1,300 MT |
| Service time per vessel | :16.5 hour / vessel |
| BOR | :50% |
| Idle time | :2 hours |
| Working time | :13 hours / day |
| Working days | :360 days / year |

* Number of Vessel = 136 Vessels / year
* Cargo Volume = 176,800 MT/berth

2) Conventional Vessel

The capacity of general cargo berth (1 berth) at North Harbor is estimated as 136,000 MT per annum.

Berth dimensions and figure for calculation are assumed to be as follows:

| | |
|---|---|
| Average vessel size | :4,100 DWT, L=88.3, Draught 5.1m |
| Berth's Length and Depth | :105, -6.0m |
| Productivity | :20 MT / hour |
| Number of Gang | :3 Gangs |
| Cargo volume per vessel | :1,600 MT / vessel |
| Service time per vessel | :26.7 hour / vessel |
| BOR | :50% |
| Idle time | :2 hours |
| Working time | :13 hours / day |
| Working days | :360 days / year |

* Number of Vessel = 85 vessels / year
* Cargo Volume = 136,000 MT / berth

(3) Port of Batangas

1) Foreign Conventional Berth

The berth capacity (1 berth) at Port of Batangas for foreign general cargo is estimated as 248,000 MT per annum.

2) RO/RO Berth

Considering that the present cargo handling system for domestic cargo at Port of Batangas is almost exclusively Roll on Roll off system, the method of calculation of the berth capacity for the RO/RO vessel depends on the Standards of Ferry in Japan. According to this standards, the formula is as follows:

* $N = P/(T \times 365 \times a \times r \times n)$ ------------------------------------------(5.3)

here; N:Frequency a day

P:Cargo volume (using the large cargo volume of inward or outward)

T:Capacity of loaded cargo per truck (usually, 6ton/truck)

a:Ratio of sailing possibility a year (determined by natural conditions)

r:Ratio of using RO/RO vessel (usually, 0.6)

n:Loaded number of truck per vessel

* Limitation of frequency a day per berth:

Long distance ; 3 sailings / berth

Short and middle distance ; 6 sailings / berth

The capacity of existing berth (1 berth) at Port of Batangas for general cargo by RO/RO vessel type is estimated as 319,000 MT per annum.

Berth dimensions and figure for calculation are assumed to be as follows:

| | |
|---|---|
| Average vessel size | :2,000 GRT, L=96m, Draught 4.4m |
| Berth's Length and Depth | :117m, -5.0m |
| Ratio of sailing possibility a year | :assumed to be 0.9 |
| Loaded number of truck per vessel | :45 trucks / vessel |
| Limitation of frequency | :3 (short haul) |

## 5.2 Required Number of Conventional Berths

### 5.2.1 Foreign Conventional Berths

Table 5-2 shows the foreign general cargo assignment to each port based on forecasts in 2010. In accordance with this table and the existing berth capacity mentioned in Chapter 5.1, the necessary number of conventional berths for forecasted cargo volume can be calculated.

Table 5-2 Foreign General Cargo Assignment to Each Port in 2010

Low Case Unit: 1000(MT)

| | Present Cargo Vol. | Cargo Demand in 2010 | Required Nos. Berth | Edxisting Nos. Berth | Additional Nos. Berth |
|---|---|---|---|---|---|
| South Harbor | 1,646 | 2,100 | 7.6 | 14.0 | 0.0 |
| Port of Batangas | 54 | 150 | 0.6 | 1.0 | 0.0 |

Medium Case Unit: 1000(MT)

| | Present Cargo Vol. | Cargo Demand in 2010 | Required Nos. Berth | Edxisting Nos. Berth | Additional Nos. Berth |
|---|---|---|---|---|---|
| South Harbor | 1,646 | 2,820 | 10.1 | 14.0 | 0.0 |
| Port of Batangas | 54 | 240 | 1.0 | 1.0 | 0.0 |

High Case Unit: 1000(MT)

| | Present Cargo Vol. | Cargo Demand in 2010 | Required Nos. Berth | Existing Nos. Berth | Additional Nos. Berth |
|---|---|---|---|---|---|
| South Harbor | 1,646 | 4,000 | 14.4 | 14.0 | 0.0 |
| Port of Batangas | 54 | 400 | 1.6 | 1.0 | 1.0 |

(1) Medium Case

The medium case scenario requires ten(10) foreign conventional berths at South Harbor. The 14 existing berths to can sufficiently cope with foreign general cargo.

At the Port of Batangas, the existing berth can cope with the foreign general cargo as a conventional berth.

(2) High Case

The high case scenario requires 14 conventional berths at South Harbor. The 14 existing berths to can cope with foreign general cargo.

One(1) foreign conventional berths are required at the Port of Batangas. Therefore, it is necessary to construct one(1) additional foreign conventional berth.

5.2.2 Domestic Conventional Berths

Table 5-3 shows domestic general cargo assignment to North Harbor and Port of Batangas based on forecasts in 2010. And additional number of domestic conventional berths for forecasted cargo volume is also shown in the same Table.

Also, the ratio of these general cargo volumes transported by conventional and RO/RO type vessel shall be assumed to be 20% and 80% respectively in the target year because the present ratio of general cargo transported by conventional to RO/RO vessel type (72% to 28%: see Appendix D-4 ) shall change to produce effective cargo handling in domestic trade at North Harbor.

Table 5-3 Domestic General Cargo Assignment to Each Port in 2010

Low Case Unit: 1000(MT)

| North Harbor | Vessel Type | Present Cargo Vol. | Cargo Demand in 2010 | | Required Nos. Berth | Existing Nos. Berth | Additional Nos. Berth |
|---|---|---|---|---|---|---|---|
| | | 3,510 | 3,000 | | | | |
| | RO/RO | Small (28%) | | 2,400 (80%) | 13.6 | 36.0 | 0.0 |
| | Conventional | Small (72%) | | 600 (20%) | 4.4 | | 0.0 |
| Port of Batangas | | 944 | 900 | | | | |
| | RO/RO | Small (100%) | | 900 (100%) | 2.8 | 5.0 | 0.0 |

Medium Case Unit: 1000(MT)

| North Harbor | Vessel Type | Present Cargo Vol. | Cargo Demand in 2010 | | Required Nos. Berth | Existing Nos. Berth | Additional Nos. Berth |
|---|---|---|---|---|---|---|---|
| | | 3,510 | 4,050 | | | | |
| | RO/RO | Small (28%) | | 3,240 (80%) | 18.3 | 36.0 | 0.0 |
| | Conventional | Small (72%) | | 810 (20%) | 6.0 | | 0.0 |
| Port of Batangas | | 944 | 1,520 | | | | |
| | RO/RO | Small (100%) | | 1,520 (100%) | 4.8 | 5.0 | 0.0 |

High Case Unit: 1000(MT)

| North Harbor | Vessel Type | Present Cargo Vol. | Cargo Demand in 2010 | | Required Nos. Berth | Existing Nos. Berth | Additional Nos. Berth |
|---|---|---|---|---|---|---|---|
| | | 3,510 | 5,600 | | | | |
| | RO/RO | Small (28%) | | 4,480 (80%) | 25.3 | 36.0 | 0.0 |
| | Conventional | Small (72%) | | 1,120 (20%) | 8.2 | | 0.0 |
| Port of Batangas | | 944 | 2,400 | | | | |
| | RO/RO | Small (100%) | | 2,400 (100%) | 7.5 | 6.0 | 1.0 |

Remarks: Existing Berths at Port of Batangas includes the one Emergency berth.

(1) Port of Manila (North Harbor)

1) Medium Case

The medium case scenario requires 24 domestic conventional berths at North Harbor. The existing berths(36) can to cope with the domestic general cargo due to the required number of berths. At the same time, two(2) of the remaining twelve(12) berths at North Harbor will be used as domestic container berths by RO/RO vessel type in order to use the berths effectively.

2) High Case

The high case scenario requires 34 domestic conventional berths at North Harbor. At the same time, the remaining two(2) berths will be used as domestic container berths by small RO/RO vessel type. In this case, the maximum capacity of existing berths(36) at North Harbor to handle the forecasted domestic general cargo volume will almost be reached. Therefore, the domestic general cargo and the part of container cargo shall be handled at existing berths only. The other domestic container cargo will be handled at new berths.

(2) Port of Batangas

1) Medium Case

The medium case scenario requires 5 domestic conventional berths at Port of Batangas. The existing berths(8) can sufficiently cope with the domestic general cargo due to the required number of berths. At the same time, the remaining three(3) berths at Port of Batangas will be used as domestic container cargo berths by RO/RO vessel type in order to use berths effectively.

2) High Case

The high case scenario requires 7 domestic conventional berths at Port of Batangas. At the same time, the remaining two(2) berths will be used as domestic container berths by small RO/RO vessel type. The total required berths are 11 berths including domestic container berths. In this case, the existing domestic berths are assumed as an nine(9) including the one Emergency berth. The maximum capacity of existing berths(9) to handle the forecasted domestic general cargo volume will almost be reached. Therefore, the domestic general cargo shall be handled at existing berths and additional one(1) berth. The other domestic container cargo transported by container vessel shall be handled at new berths.

Table 5-4 shows the additional conventional berths at the Port of Manila and Batangas.

Table 5-4 Additional Non-Container Berth at Each Port in 2010

| | Classified Berth | Present Num. of Berth | Medium case | | High case | |
|---|---|---|---|---|---|---|
| | | | Num. of Berth | Length. Depth | Num. of Berth | Length. Depth |
| South Harbor | For. Conv. | 14 (170m, -10) | 0 | 0 | 0 | 0 |
| | Sub Total | 14 | 0 | 0 | 0 | 0 |
| MICT | For. Conv. | 0 | 0 | 0 | 0 | 0 |
| | Sub. Total | 0 | 0 | 0 | 0 | 0 |
| North Harbor | Dom. Conv. | Depth | 0 | 0 | 0 | 0 |
| | Dom. RO/RO | -6.0m | 0 | 0 | 0 | 0 |
| | Sub Total | 41 | 0 | 0 | 0 | 0 |
| Port of Btangas | For. Conv. | 1(230m, -10m) | 0 | 0 | 1 | 170m, -10.0m |
| | Dom. Conv. | 2(-5.5m) | 0 | 0 | 0 | 0 |
| | Dom. RO/RO | 8(-5.0m) | 0 | 0 | 1 | 120m, -5.5m |
| | Sub Total | 11 | 0 | 0 | 2 | 290m |
| Ground Total | | | 0 | 0 | 2 | 290m |

Remarks: 1) For. Cont. means Foreign Container berth.

2) For. Conv. means Foreign Container berth.

3) Dom. Conv. means Domestic Conventional berth.

4) The present number of berth is calculated by the Study Team, considering the average ship size will become large in luture.

5) The present number of berth of the Port of Btangas is based on the plan of Phase I.

5.2.3 Passenger Berths

Table 5-5 shows passenger traffic assignment to each port based on forecasts in 2010.

Table 5-6 shows the number of one-way passengers transported by RO/RO vessel type, 2,000 GRT and 3,000 GRT, in 2010 at the existing berth. The passenger capacity by vessel which depends on the RO/RO report and CISO'S list is assumed to be as follows:

RO/RO 2,000 GRT--------1,000 Person per Vessel
RO/RO 3,000 GRT--------2,000 Person per Vessel
RO/RO 13,700 GRT--------3,500 Person per Vessel

Comparing with these tables the required number of passenger berths is not necessary for forecasted passenger traffic can be confirmed.

Therefore, there is no additional berth for passenger traffic at North Harbor and

Port of Batangas is required.

Table 5-5 Passenger Assignment to Each Port in 2010

Unit; Thousand Person

| | 1991 | Medium Case | High Case |
|---|---|---|---|
| Port of Manila | -- | -- | -- |
| Disembarkation | 1,690 | 5,700 | 9,000 |
| Embarkation | 1,480 | 4,990 | 7,890 |
| Sub Total | 3,170 | 10,690 | 16,890 |
| Port of Batangas | -- | -- | -- |
| Disembarkation | 600 | 2,600 | 4,620 |
| Embarkation | 600 | 2,600 | 4,600 |
| Sub Total | 1,200 | 5,200 | 9,220 |
| Ground Total | 4,370 | 15,890 | 26,110 |

Table 5-6 Number of One way Passenger Transported by RO/RO Vessel in 2010

Unit; Thousand Person

| | Nos. of Vessel | Medium Case | High Case |
|---|---|---|---|
| Port of Manila<br>RO/RO 3,000 GRT | 3,560 (4,680) | 7,120 | 9,360 |
| Sob Total | 3,560 (4,680) | 7,120 | 9,360 |
| Port of Batangas<br>RO/RO 2,000 GRT | 8,000 (10,700) | 8,000 | 10,700 |
| Sub Total | 8,000 (10,700) | 8,000 | 10,700 |
| Ground Total | 11,560 (15,380) | 15,120 | 20,060 |

Remarks: ( ) High Case

## 5.3 Required Scale and Quantity of Port Facilities

### 5.3.1 Berth Dimensions

The vessel size which will call the Port of Manila and Port of Batangas in the target year is already mentioned in Part I of Chapter 11.6. Thus, in this section, the depth and length of berth for accommodating the average standard vessels are dealt with.

According to Technical Standards for Port and Harbors in Japan, the depth of the berth is 1.1 times the full load draft in order to facilitate a vessel's berthing. The length of berth is generally determined by the over all length of the vessel and the mooring method for a single berth.

The angle of mooring rope to the marginal wharf is normally 30 and 40 degrees. The following is used to compute the berth length

$$L = LOA + ( B \times 1.73 \sim 1.19)$$

(1) Foreign Conventional Berths

1) South Harbor

The size of conventional vessels calling South Harbor in the target year is 10,000 DWT with 137 meters LOA , 8.5 meters draft and 19.9 meters beam.

So, the depth and length of berth at South Harbor are approximately computed as 9.4 meters and 157 meters respectively. At the same time, according to the Technical Standards, the depth and length of berth are determined as 10.0 meters and 170 meters respectively due to the use of standard vessel size.

2) Port of Batangas

The depth and length of berth is the same as the above berth's dimensions due to the same vessel size of the North Harbor.

(2) Domestic Conventional Berths

The size of conventional RO/RO vessels calling South Harbor in the target year is

2,000 GRT with 96 meters LOA, 4.4 meters draft and 17.1 meters beam.

So, the depth and length of berth are approximately computed as 4.8 meters and 117 meters respectively. The depth and length of berth are determined as 5.5 meters and 120 meters respectively.

### 5.3.2 Storage Area

The necessary area of open storage and transit shed for general cargo handling is calculated by using the same formula below.

$A = N \times f / ( R \times r \times W )$

where; A : Necessary Area of Open Storage or Transit Shed (m2)

R : Turnover of Cargo ( 33 times / year )

r : Efficiency of Using the Space ( 0.7 )

W : Weight of Cargo per sq.m ( 0.8 or 1.0 MT/ m2 )

f : Peak Ratio (1.3)

N : Cargo Throughput per annum ( MT / year )

The cargo throughput per annum is determined by the ratio of using the open storage or transit shed. The ratio of using the open storage or transit shed for domestic general cargo at North Harbor is assumed as 10 % in both case according to the hearing. On the other hand, at the South Harbor, the ratio of using the open storage or transit shed is assumed as 75 % and 20 % respectively according to the hearing. In addition, at the Port of Batangas, the figure is assumed to be the same as the above.

Table 5-7 to 5-9 show the result of necessary area of the open storage and transit shed.

### 5.3.3 Passenger Terminal

The necessary area of passenger terminal is calculated by using the formula below.

$A = a \times n \times N \times r \times q$

where; A : Necessary Area of Passenger Terminal (m2)

a : Necessary Area per person ( 1.2 m2 / person )

n : Capacity per vessel

N : Number of Vessels departing at same time (1.5 vessels) r : Peak Ratio ( all day ; 1.0 )

q : Change Ratio of Season ( average per year 1.0)

The average number of disbarking/embarking passenger per vessel in the target year can be calculated by using the Table 5-5 (passenger assignment to each port in 2010) and in Part I of Chapter 11.6 (number of vessels in 2010). RO/RO vessel type which means 3,000 GRT and 2,000 GRT are used for passenger traffic at the Port of Manila and Port of Batangas, while the number of one way passenger, large figure, is used for calculation. By using the average number of passenger per vessel, the necessary area of the passenger terminal can be calculated.

Table 5-10 shows result of necessary area of the passenger terminal at Port of Manila and Port of Batangas.

Table 5-7 Required Storage Area in 2010 at North Harbor

Unit; Thousand MT,

| | Present (1991) | Medium Case | High Case |
|---|---|---|---|
| Cargo Volume | 5,600 | 4,100 | 5,600 |
| Transit Shed (sq.m.) | 20,300 | 32,000 | 44,000 |
| Open Storage (sq.m.) | 121,300 | 26,000 | 35,000 |
| Total (sq.m.) | 141,600 | 58,000 | 79,000 |

Source: Present date from PPA's Port Inventory

Table 5-8 Required Storage Area in 2010 at South Harbor

Unit; Thousand MT,

| | Present (1991) | Medium Case | High Case |
|---|---|---|---|
| Cargo Volume | 1,650 | 2,800 | 4,000 |
| Transit Shed (sq.m.) | 32,500 | 4,800 | 69,000 |
| Open Storage (sq.m.) | 24,300 | 112,000 | 159,000 |
| Total (sq.m.) | 56,800 | 116,800 | 228,000 |

Source: Present date from PPA's Port Inventory

Table 5-9 Required Storage Area in 2010 at Port of Batangas

Unit; Thousand MT;

| | Present (1991) | Medium Case | High Case |
|---|---|---|---|
| Cargo Volume | 1,000 | 1,800 | 2,800 |
| Transit Shed (sq.m) | 0 | 16,000 | 26,000 |
| Open Storage (sq.m) | 920 | 20,000 | 32,000 |
| Total (sq.m) | 920 | 36,000 | 58,000 |

Source: Present date from PPA's Port Inventory

Table 5-10 Required Passenger Terminal Area in 2010

Unit: Thousand Person

| | | Present (1991) | Medium Case | High Case |
|---|---|---|---|---|
| North Harbor | | | | |
| | Nos. of Passenger | 3,170 | 10,690 | 16,890 |
| | Terminal Area (sq.m) | 22,800 | 17,000 | 27,000 |
| Port of Batangas | | | | |
| | Nos. of Passenger | 1,200 | 5,200 | 9,220 |
| | Terminal Area (sq.m) | 360 | 3,200 | 5,500 |
| Total (sq.m) | | 23,160 | 20,200 | 32,500 |

Having closely examined the issues presents in Chapters 4 and 5, plan view of Master Plans at each port are shown in the following tables and figures.

(1) Berth Requirement

1) Medium Case

1) Port of Manila ------------------------------------------------------------ Table 5-11

2) Port of Batangas ---------------------------------------------------------- Table 5-12

2) High Case

1) Port of Manila (High Case I) ------------------------------------------ Table 5-13

2) Port of Batangas ---------------------------------------------------------- Table 5-14

(2) Plan View of Master Plans

1) Medium Case

1) Port of Manila ------------------------------------------------------------ Figure 5- 4

2) Port of Batangas ---------------------------------------------------------- Figure 5- 5

2) High Case

1) Port of Manila (High Case I) ------------------------------------------ Figure 5- 6

2) Port of Batangas ---------------------------------------------------------- Figure 5- 7

3) Alternative

① Naic/Cavite New Port (High Case II) ---------------------------- Figure 5- 9

② Sangley Point (High Case III) ------------------------------------- Figure 5-10

Table 5-11 Berth Requirement of Port of Manila (Medium Case)

| | Cargo Volume 1991 (*1,000MT) | Cargo Volume 2010 (*1,000MT) | Existing Capacity (*1,000MT) | Cargo Assignment to New Berth(A) (*1,000MT) | New Berth Capacity Per Berth(B) (*1,000MT) | Required Additional Berth(A)/(B) (Nos. of Berth) | Remarks |
|---|---|---|---|---|---|---|---|
| Container Cargo | 11,952 | 45,150 | 21,420 | 23,730 | - | 11 | |
| Foreign | 5,002 | 22,240 | 14,500 | 7,740 | 2,570 | 3 | -13m quaywall |
| Domestic | 6,950 | 22,910 | 6,920 | 15,990 | - | 8 | |
| Container Vessel | - | - | 6,920 | 13,750 | 2,170 | 6 | -10m quaywall |
| RO/RO Vessel | - | - | | 2,240 | 1,420 | 2 | -9m quaywall |
| General Cargo | 5,156 | 6,870 | 9,570 | 0 | 0 | - | |
| Foreign | 1,646 | 2,820 | 3,890 | 0 | - | - | |
| Domestic | 3,510 | 4,050 | 5,680 | 0 | - | - | |
| Total | 17,108 | 52,020 | 30,990 | - | - | 11 | |

Note: Existing Capacity includes On-going Project's facilities.

Table 5-12 Berth Requirement of Port of Batangas (Medium Case)

| | Cargo Volume 1991 (*1,000MT) | Cargo Volume 2010 (*1,000MT) | Existing Capacity (*1,000MT) | Cargo Assignment to New Berth(A) (*1,000MT) | New Berth Capacity Per Berth(B) (*1,000MT) | Required Additional Berth(A)/(B) (Nos. of Berth) | Remarks |
|---|---|---|---|---|---|---|---|
| Container Cargo | 0 | 2,940 | 2,010 | 1,210 | - | 1 | |
| Foreign | 0 | 770 | 1,050 | 0 | - | - | |
| Domestic | 0 | 2,170 | 960 | 1,210 | - | 1 | |
| Container Vessel | - | - | 960 | 1,210 | 2,100 | 1 | -10m quaywall |
| RO/RO Vessel | - | - | | 0 | - | 0 | |
| General Cargo | 998 | 1,760 | 2,200 | 0 | - | - | |
| Foreign | 54 | 240 | 280 | 0 | - | - | |
| Domestic | 944 | 1,520 | 1,920 | 0 | - | - | |
| Total | 998 | 4,700 | 4,210 | - | - | 1 | |

Note: Existing Capacity includes Phase I Projects's facilities.

Table 5-13 Berth Requirement of Port of Manila (High Case I)

| | |
|---|---|
| International Container Berth | 7 Berths (Depth: -13.0m) |
| Domestic Container Berth | 10 Berths (Depth: -10.0m) |
| Domestic RO/RO Berth | 3 Berths (Depth: - 9.0m) |

Table 5-14 Berth Requirement of Port of Batangas (High Case)

| | |
|---|---|
| International Container Berth | 1 Berth (Depth: -10.0m) |
| International General Cargo Berth | 1 Berth (Depth: -10.0m) |
| Domestic Container Berth | 1 Berth (Depth: -10.0m) |
| Domestic General Cargo Berth | 1 Berth (Depth: - 5.5m) |

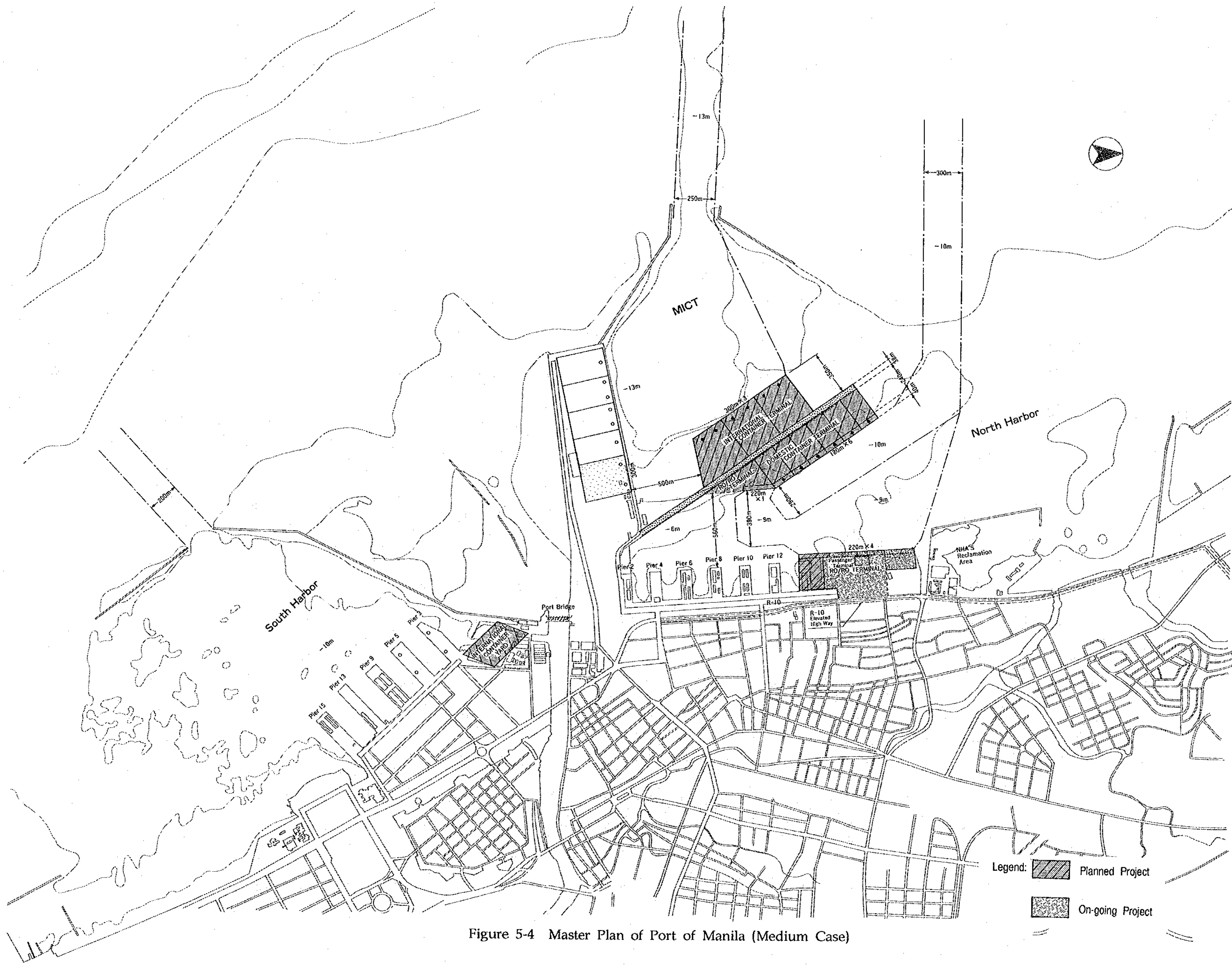



Figure 5-4 Master Plan of Port of Manila (Medium Case)

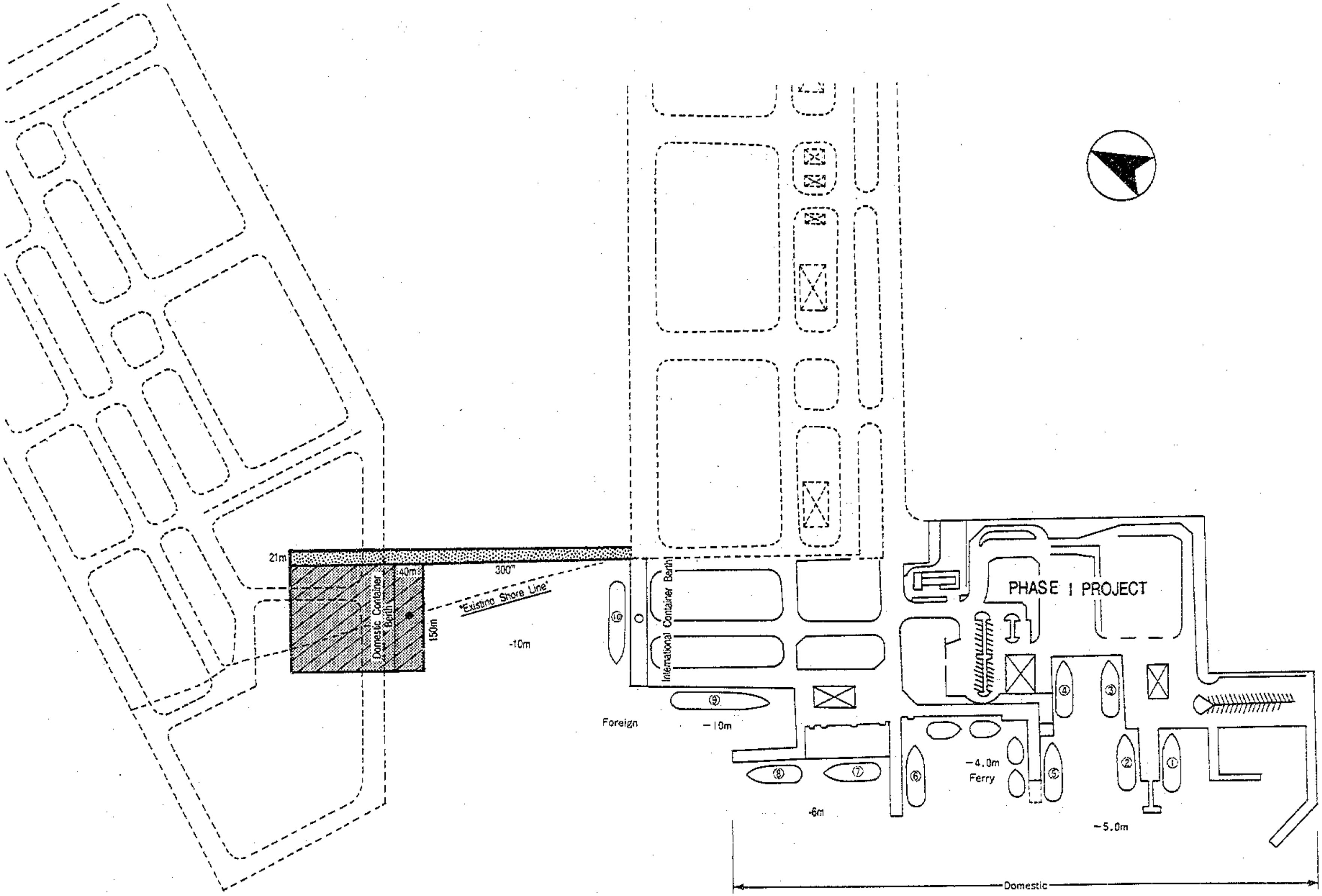



Figure 5-5 Master Plan of Port of Batangas (Medium Case)

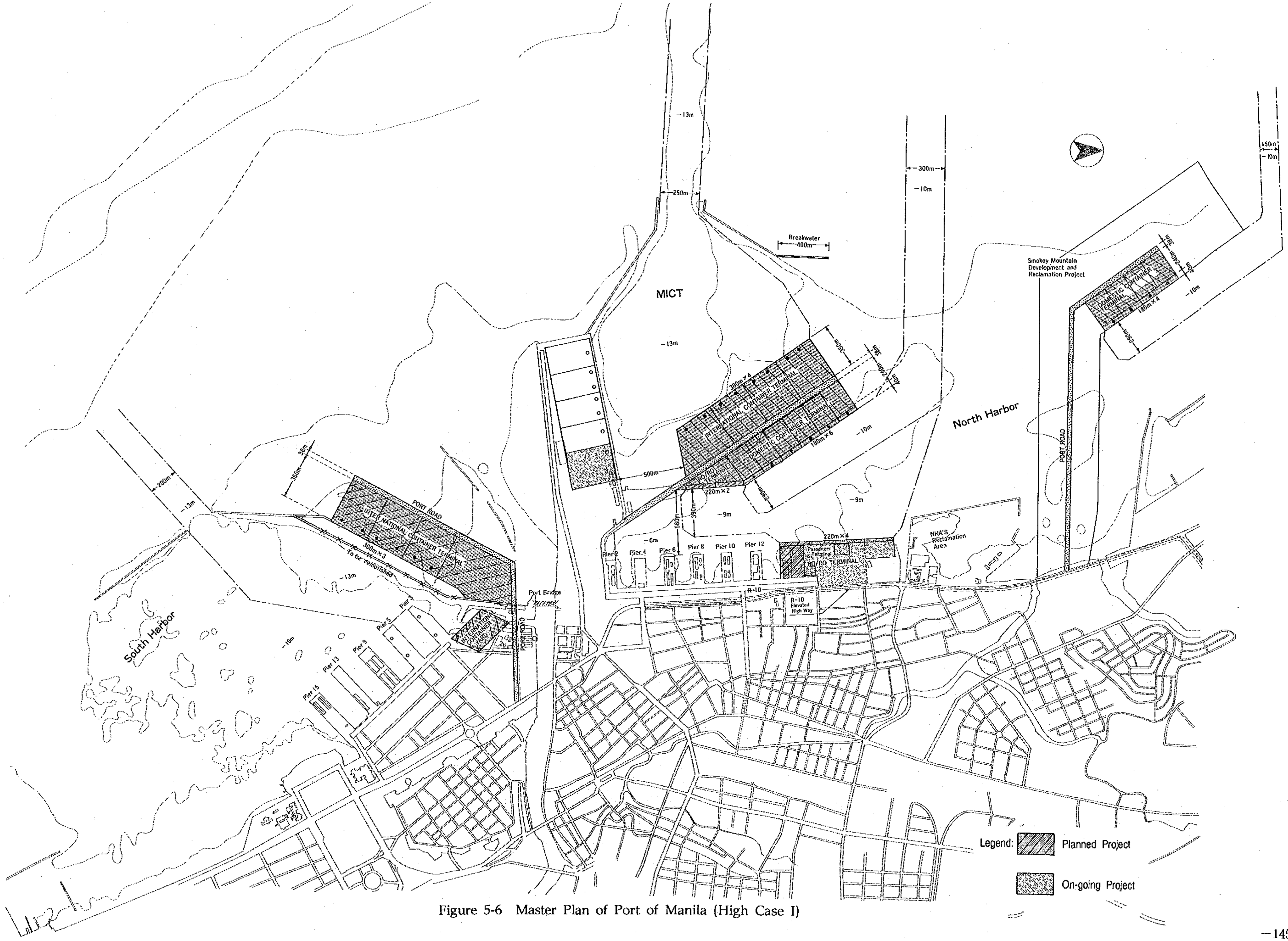



Figure 5-6 Master Plan of Port of Manila (High Case I)

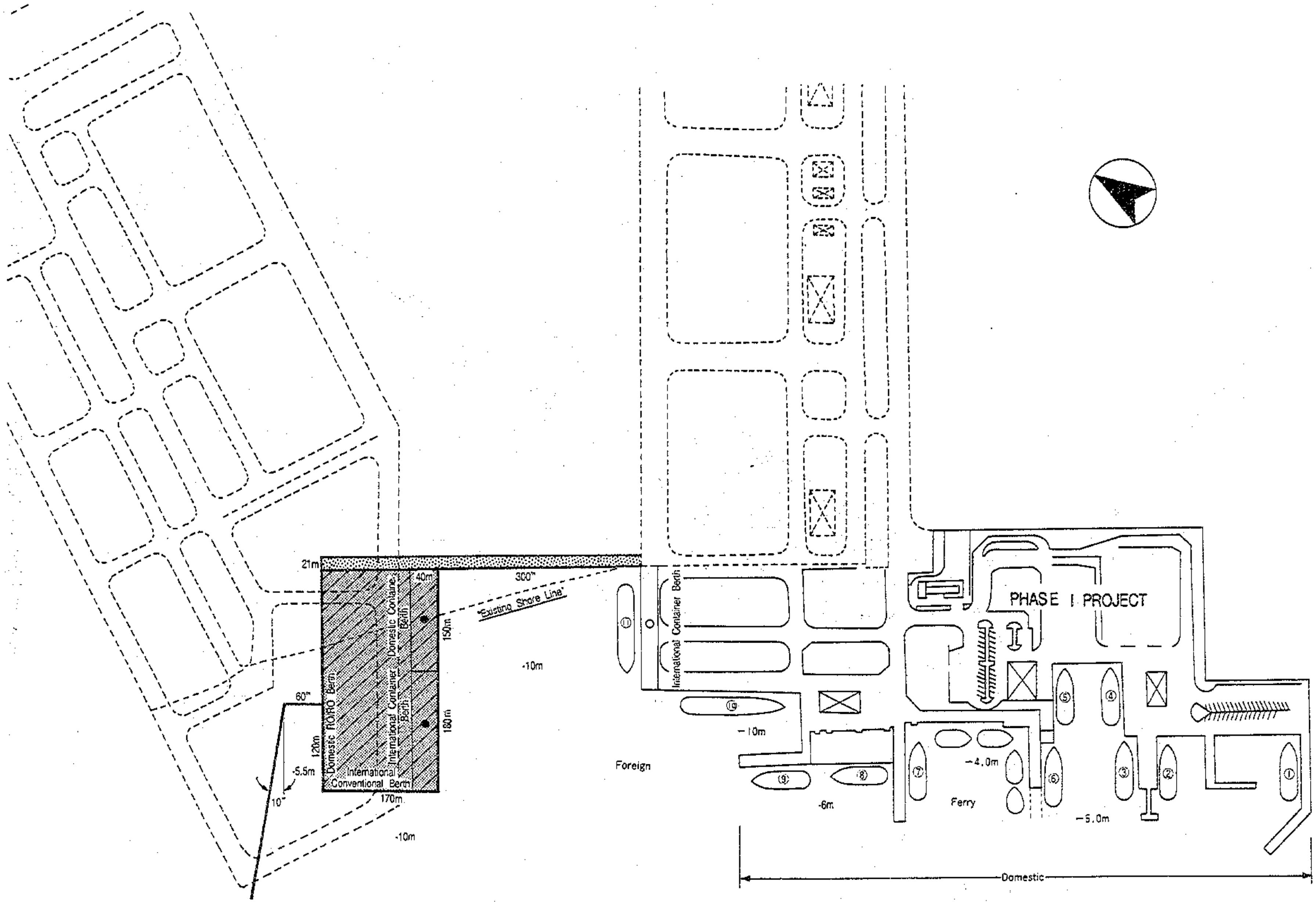



Figure 5-7 Master Plan of Port of Batangas (High Case)

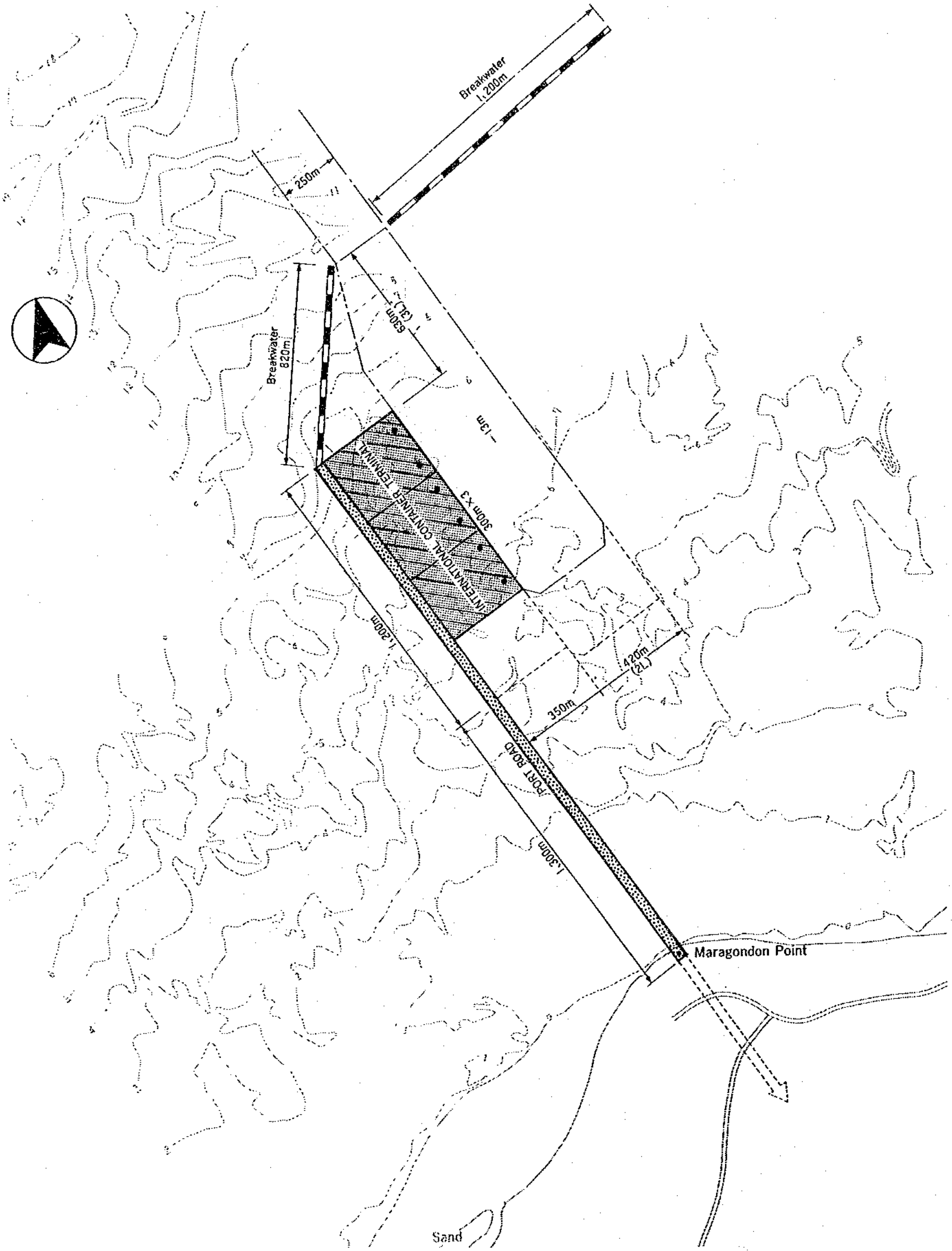



Figure 5-8 Master Plan of Naic/Cavite New Port (High Cose II)

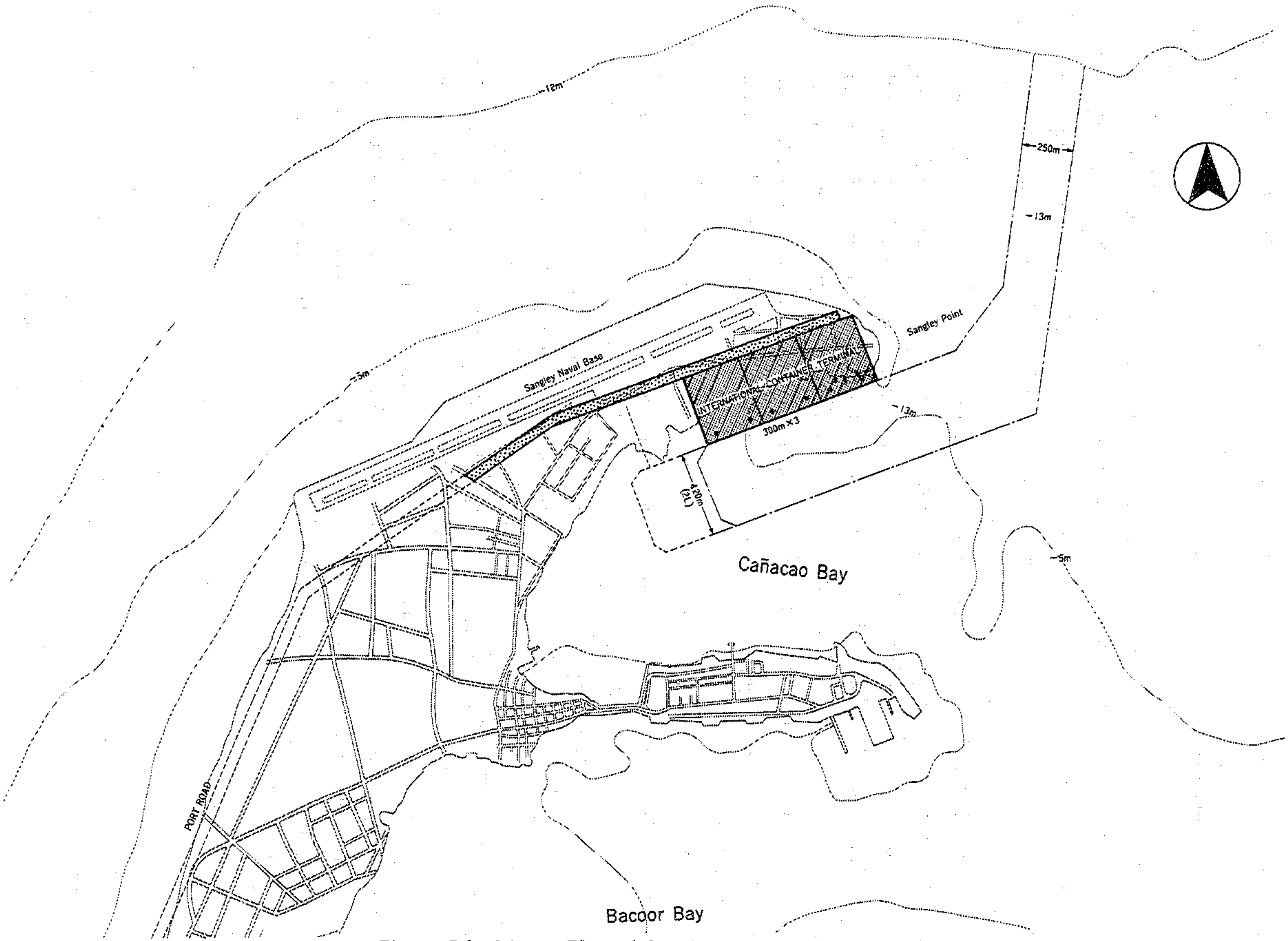



Figure 5-9 Master Plan of Sangley Point (High Case III)

# CHAPTER 6 DEVELOPMENT OF LAND TRANSPORTATION SYSTEM

## 6.1 Existing Urban Transport System

Basically, land transport to/from the Port of Manila is undertaken by road transport. There exists a railway system owned and operated by the Philippine National Railways (PNR), but this railway is now being operated mostly for passenger transport only. Cargo transport by railway will need large scale rehabilitation of facilities, rolling stock and operating system.

Metro Manila's road transport network is composed of a set of radial and circumferential major roads which also supplemented with secondary and tertiary roads, PNR, the Light Rail Transit (LRT) line and a limited waterway. Metro Manila has total public road length of about 3,100 km which comprises of [1] national road (910 km), [2] city road (1,280 km), [3] municipal road (590 km) and [4] barangay (village) road (320 km). In addition to public roads, there are about 1,850 km of private roads which are located inside housing subdivisions and several commercial complexes developed by a private sector.

As far as a road system is concerned, Metro Manila's road network is relatively well-structured in comparison with that of many other Asian cities. This structure is remarkably realized in the area within and around EDSA urban trunk roads, where most of them were completed during the first half of this century. Basic road network comprises of 10 radials and 6 circumferentials, although radial-circumferential configuration has not been completed yet. In particular, development of circumferential roads are still less than halfway to be completed. On the other hand, radial roads have been mostly developed. However, it is also pointed out that there is a great lack of road quantities in most areas outside EDSA where urban development has been in rapid progress and traffic demand has been increasing sharply. Accordingly, road traffic is not properly dispersed and also inclines to concentrate on limited major roads with congestion and environmental impact. The existing road network in Metro Manila is shown in Fig. 6-1.

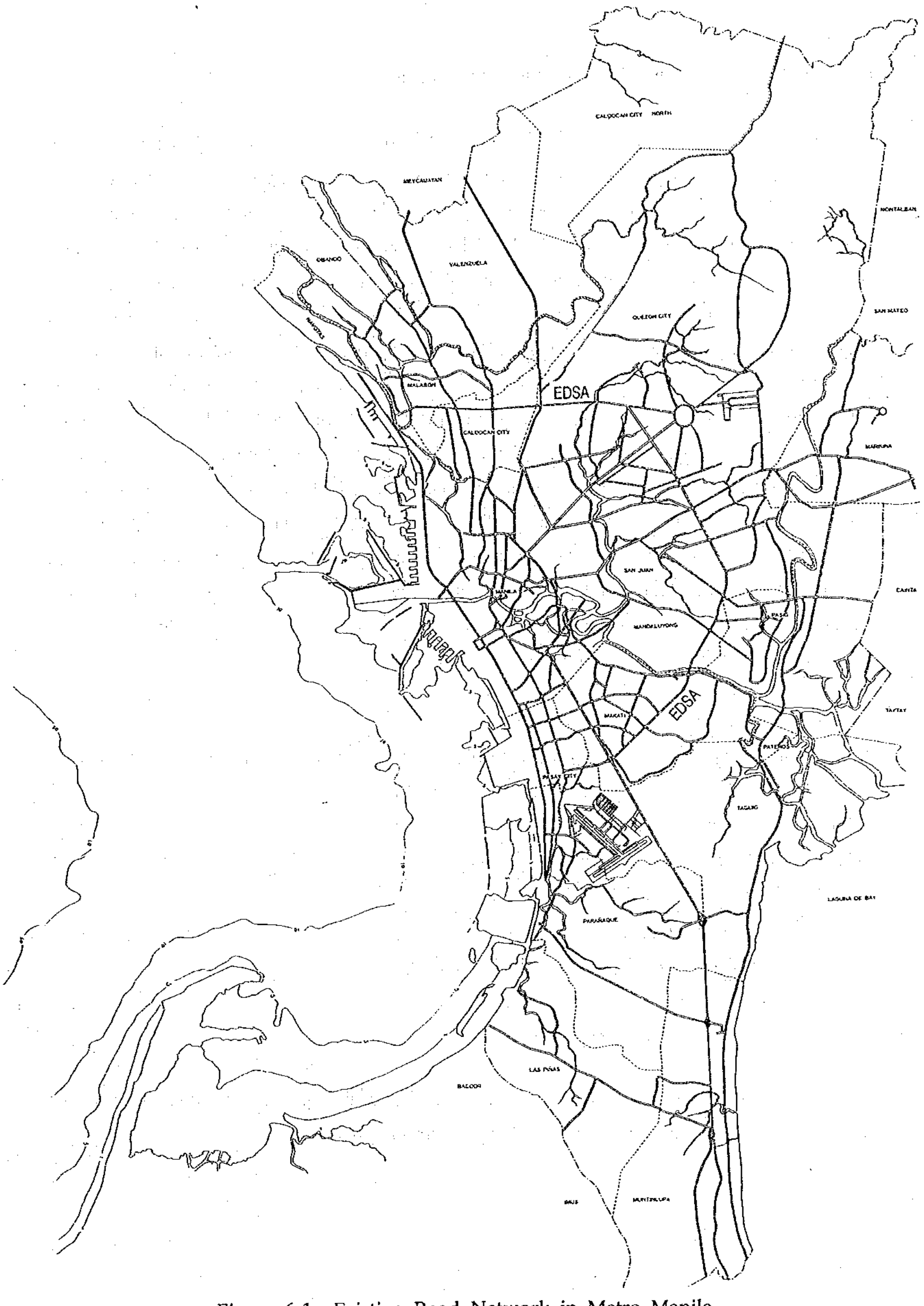



Figure 6-1 Existing Road Network in Metro Manila

## 6.2 Road Development Plan for the Target Year

There is no need to say that Metro Manila's traffic congestion will become critical or even chaotic unless any implementation of road development projects is carried out. The official road development program up to the year 1998 has been already made public by the government concerned. In order to establish a long-term road development program beyond the year 1998, the government concerned has been conducting a number of feasibility studies. One of the most successful studies is the "Feasibility Study on Metro Manila Urban Expressway System" in 1993 by JICA. In the course of the study, a long-term road development program for Metro Manila up to the year 2010 was established after being reviewed, examined and finally approved by DPWH. Fig. 6-2 shows that road program to be completed by the year 2010. Obviously, the long-term program contains all on-going, committed and planned road projects in and around Metro Manila. Some of on-going projects are being delayed due to right-of-way acquisition and unauthorized settler problems. Rail and LRT projects are also taken into account in this program. And as one of the key components of the long-term road development program, the existing nine expressway proposals must be paid attention. Each expressway proposal is defined below.

Existing nine expressway proposals :

(1) UTSMMA (Urban Transportation Study for Metro Manila Area in 1973) Proposal
(2) Elevated Expressway from Alabang to Quirino Ave.
(3) R-1 Extension (PEA)
(4) Manila-Cavite Expressway
(5) C-5 from R-1 to SLE (BOT)
(6) R-10 and C-5 (BOT)
(7) C-5 from NLE to Commonwealth Ave. (BOT)
(8) East Luzon Expressway
(9) Metro Manila Tollway (PNCC)

The above nine expressway proposals are shown in Fig. 6-3. Needless to say, the Study is based on this long-term road development program.

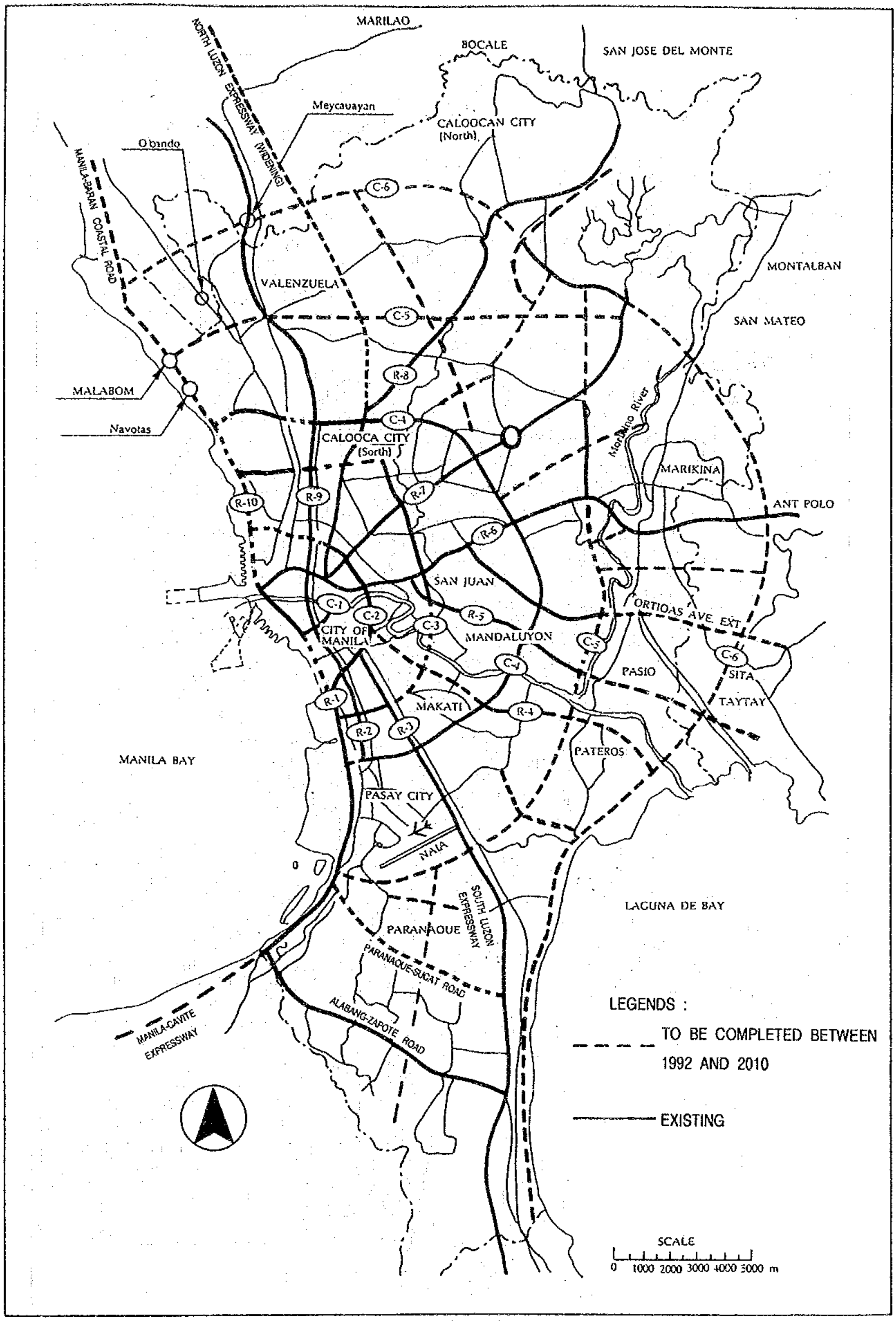



Figure 6-2 Long-term Road Development Program up to 2010

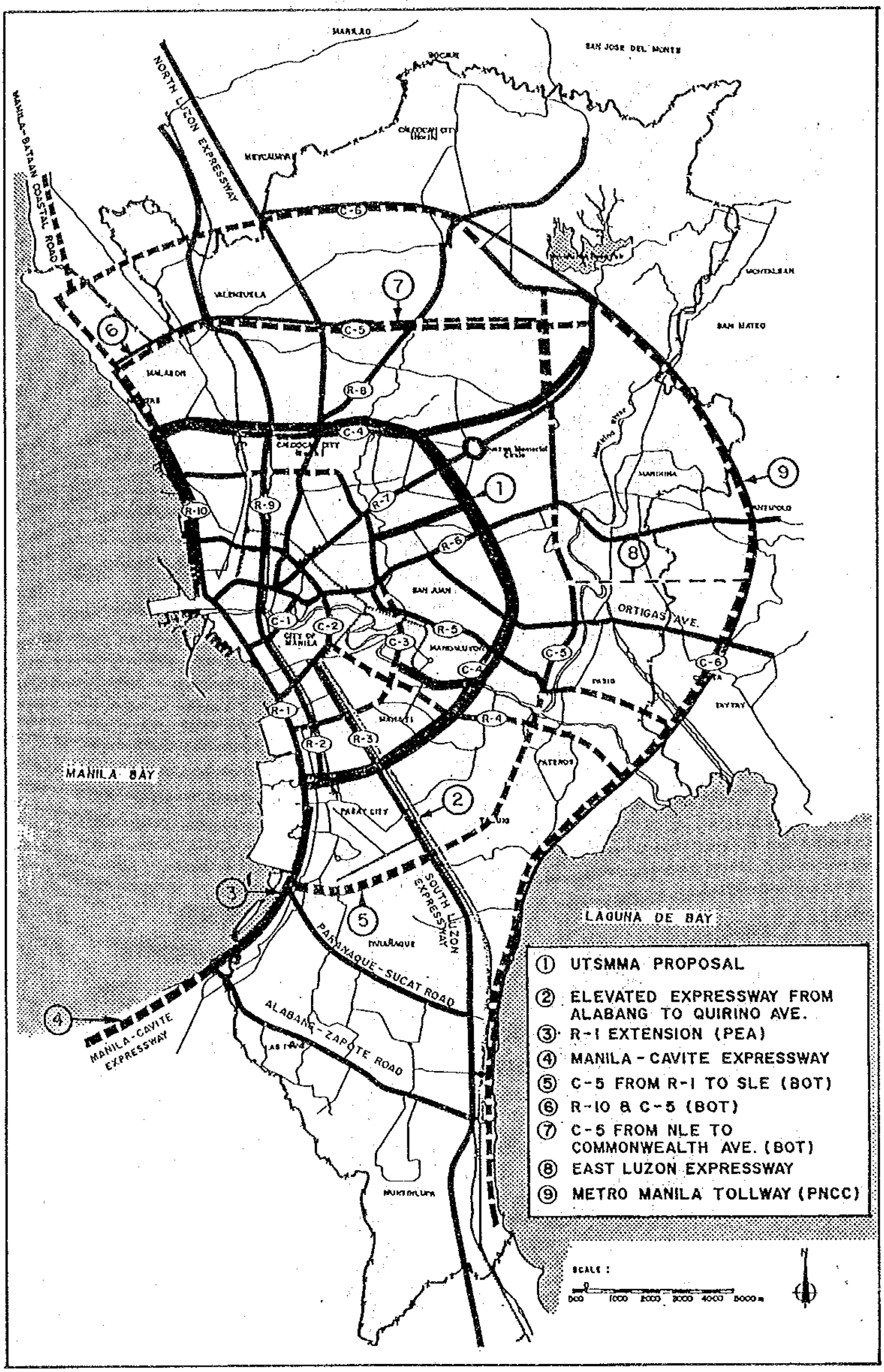



Figure 6-3 Nine Expressway Proposals

### 6.3 Development Plan of Port Road in Metro Manila

The most important thing is undoubtedly the access system to the Port of Manila, as shown in Fig. 6-4. In due course of master planning for the Port of Manila, the importance of a road master plan in advance in and around the port was found out. Shape of land reclamation and connecting expressway network are the most difficult and complicated matter of planning. Therefore, far in advance from actual needs, master plan work must be started. Difficulties come from soft clay of sea bottom and crowded dwellers and unauthorized settlers near the port and other related reasons. Overcoming the difficulties, several sites of foreign and domestic wharves and routes of access road connecting hinterland must be arranged consistently.

To confirm the port road proposal, there are lot of things to do, like soil boring and preparation of sufficient alternatives of master plans, saving duplication of fruitless investment.

Also, offshore access points of the proposed ring road are very important particularly at bridge and tunnel sites. The ring road route must be sufficiently consistent with whole trunk road system in Metro Manila.

### 6.4 Coastal Expressway to Naic-Ternate

The present Cavite Coastal Expressway is going to be extended to the City of Rosario near the EPZA site in the near future. This project is very helpful to the new port of Naic/Cavite near the cities of Naic and Ternate. With the present trunk line between Rosario and Ternate and the above extended expressway to Rosaio will be able to support the new port during the construction and earlier operation period of one or two berths.

But, at the later stage of opening three container berths in the new port, an expressway of six lanes must be directly extended to the new port. This direct connection by the expressway will be necessary probably by 2010. Three kilometers' access road to the new port should be exceptionally financed at the early construction period. For example, this access road of 3 km is desirable to be financed by PPA or DPWH, prior to the overseas loan. This will be fruitful to the direction of the port road project promotion.

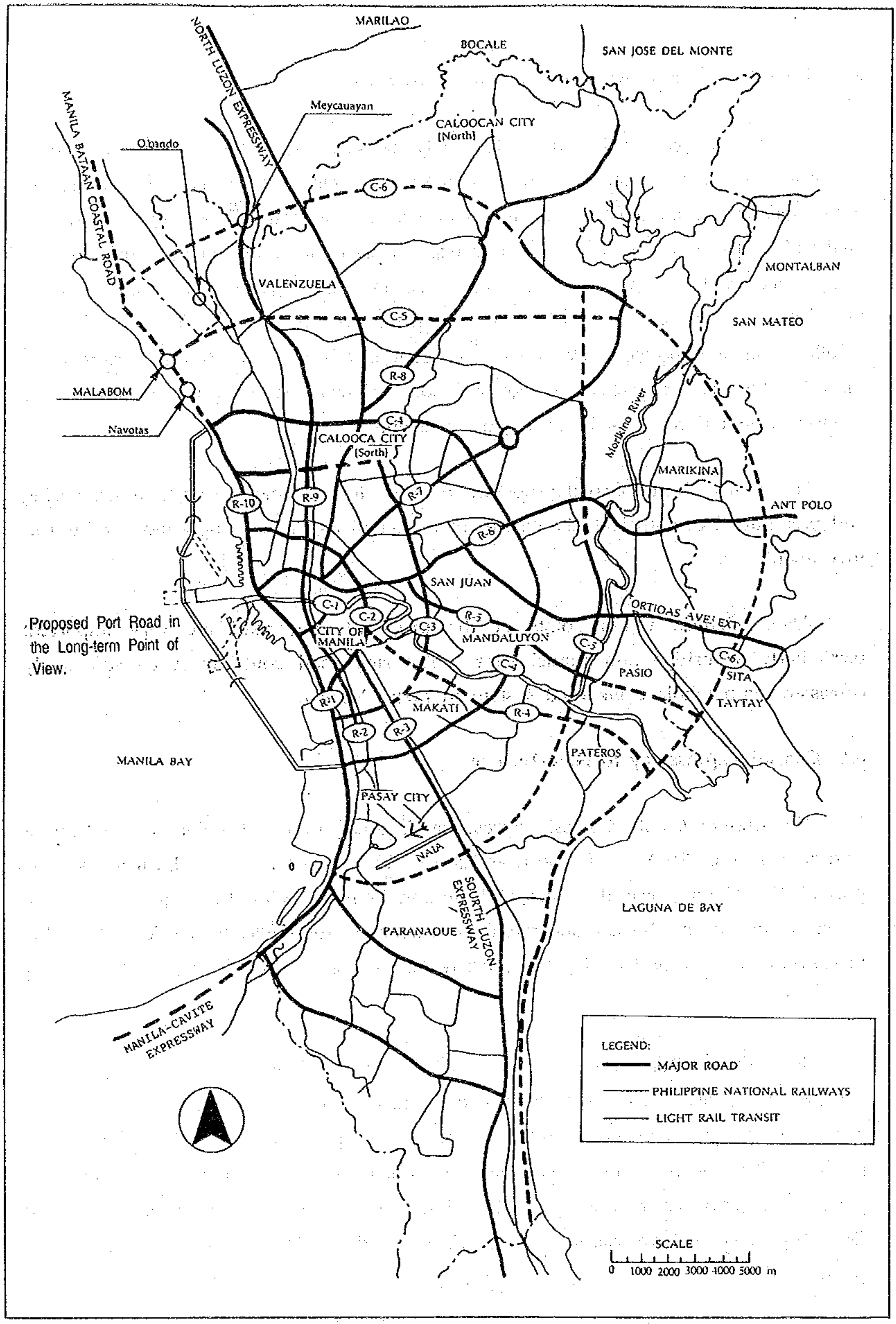



Figure 6-4 Metro Manila Urban Transport System

## 6.5 Plan of Railway Rehabilitation and Inland Container Depot Development

The Port of Manila is now connected to the hinterland by road only. Increasing container traffic at the Port of Manila is having a significant impact on the urban road system. In order to alleviate urban road congestion, there have been several ideas of railway rebirth and inland depot development. But, the Philippine National Railways (PNR) have not been involved in any project of rail-served container transport, accordingly none of those ideas have been realized yet. The Manila International Container Terminal (MICT) at the Port of Manila, one of the most successful transport corporations in the Philippines, publicized the project of introduction of the railway system into MICT's container terminal as well as development of inland container depot. That project has not been initiated yet, but according to the business world's observation, it can be safely said that MICT's intention is enough matured.

Recently, the Study on the Project of the Rail-served Inland Container Depot for the Manila Port, conducted by UN ESCAP, revealed the fact that the railway system with the inland container depot is economically and financially feasible on condition that total container traffic is limited to 175,600 TEU without making a large extra investment including restoration of rolling stocks and disruptive effect of railway crossing. The Study examined four alternative inland container depots (ICDs) and finally proposed the FTI (Food Terminal Inc.) ICD project as the "main project case". Fig. 6-5 shows the location of four alternative ICDs.

The possibility of ICD project in connection with the port master plan for the Port of Manila is still under consideration at this moment due to delay of basic data collection. However, it might be recommended that both railway rehabilitation and road development projects described in this chapter, are vital to a port extension on a large scale at the Port of Manila, otherwise the port will not be able to handle rapidly increasing seaborne cargo and passenger in future.

Concerning the relation of ICD and road development, ICD is deeply related to the delayed improvement of port access road and truck ban. First priority must be given to the abolition of truck ban in a nearby port area of MICT. Next is urgent road improvement, and as to the third alternative, the ICDs must be unavoidable.

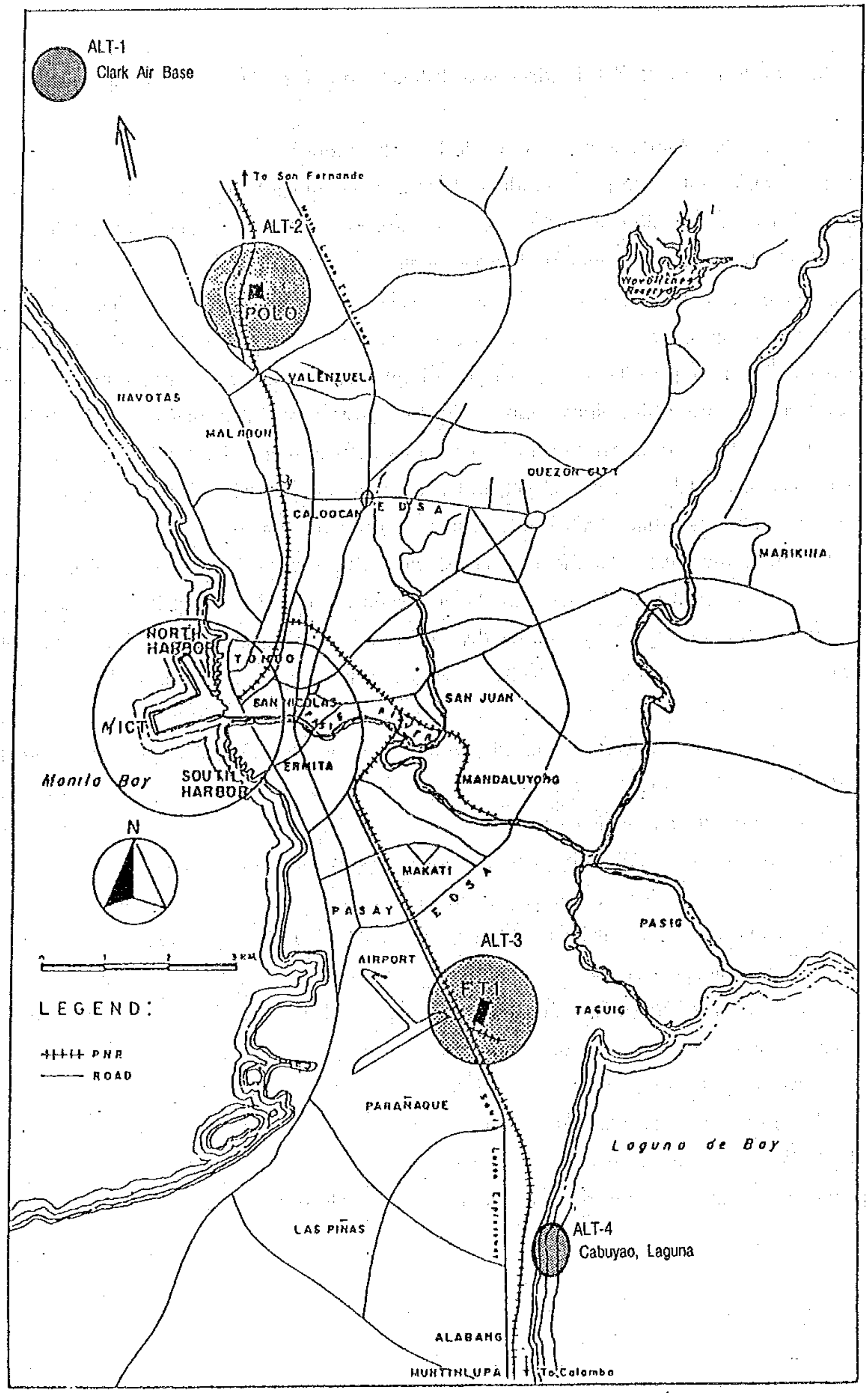



Figure 6-5 Four Alternatives of Inland Container Depot

## 6.6 Port Road Planning

### 6.6.1 Preconditions of Port Road Planning

Impacts on the urban traffic in Metro Manila from the Port related vehicles are described in Chapter 7.6. In this section, based on cargo volume projected in the Master Plan (target year 2010), necessary number of vehicle lanes along the existing breakwater at the North Harbor and the port bridge between MICT and the South Harbor (see Figure 6-6) are examined.

The preconditions for calculating the necessary number of vehicle lanes is as follows:

(1) Cargo volume transported by one truck (w)
 Container cargo : One box per truck
 General cargo : Domestic cargo 5.67 metric tons per truck
 Foreign cargo 9.03 metric tons per truck

(2) Annual working days (D)
 300 days

(3) Monthly variation ($\beta$)
 1.2

(4) Daily variation ($\gamma$)
 1.4

(5) Real load rate ($\epsilon$)
 0.75

(6) Related vehicle rate ($\delta$)
 0.4

(7) Hourly variation ($\sigma$)
 Domestic cargo 0.09
 Foreign cargo 0.11

### 6.6.2 Port Road Planning

Based on the forecasted cargo volume handled at port in the target year 2010, and using each factor above, design traffic volume (vehicles/hour) is obtained by using the following formula.

Annual handled cargo volume and traffic volume per year/day at each place can be seen in appendix B-36.

Design Traffic Volume (vehicles/hour)

$$\frac{\textit{Annual handled cargo volume}}{W} \times \frac{(b \times \gamma)}{D} \times \frac{(1+\delta)}{\epsilon} \times \sigma$$

After the calculation, in case of the medium and high economic growth scenario, the necessary number of vehicle lanes of the port road which is planned along the existing breakwater at the North Harbor and the port bridge between MICT and the South Harbor is shown in Table 6-1. Further, the design standard traffic volume is adopted as 600 vehicles hour/lane which is based on technical standards in Japan.

The design traffic volume at the port bridge between MICT and the South Harbor is set by using the ratio used in a simulation for the urban traffic impact in Metro Manila described in the Chapter 7 of Part II. All of the port-related vehicles allocated to the port bridge are assumed to use this port bridge.

Table 6-1 Design Traffic Volume and Necessary Vehicle Lanes

| Item / Project | Design Traffic Volume (vehicles/hour) | | Number of Lanes | |
|---|---|---|---|---|
| | Medium Economic Growth Case | High Economic Growth Case | Medium Economic Growth Case | High Economic Growth Case |
| Existing Breakwater (Foreign/Domestic Container Terminal) | 1,670 | 2,360 | 4 (6) | 4 (6) |
| Port Bridge (Connected between MICT and South Harbor) | 2,050 | 2,960 | 4 (6) | 6 (6) |

Remarks: Design traffic volume includes passenger related vehicles.

: The planned vehicle lanes are given in parentheses.

The width of the port bridge should be determined, taking future expansion of road lanes into account.

In addition, the width of the port road which is planned along the existing breakwater should be also determined, taking into account the parking/waiting space of trucks and other port-related vehicles. This is because there is no room for expansion on both sides of the port road.

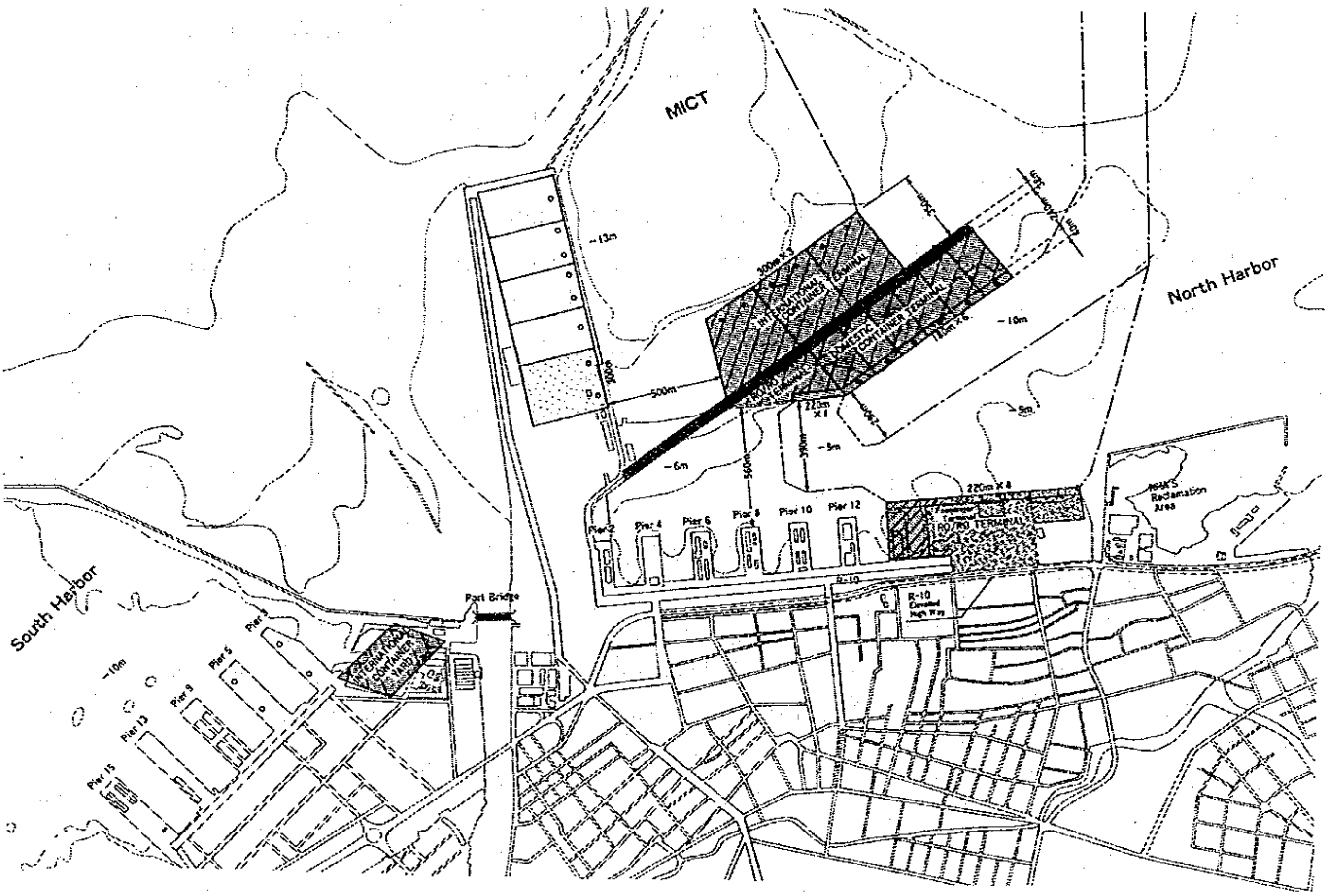



Figure 6-6 Location of Port Road