2.5 Master Plans of Cebu Baseport / the New Cebu Port

2.5.1 Conceptual Zoning of Cebu Baseport

(1) Ongoing /planned project

In this master plan, the following ongoing / planned projects are assumed to be implemented on their schedule.

1) Expansion (30m offshore) of the backyard and deepening the berths of B8-B17 with construction of RORO ramps (PMO 2)
2) Rehabilitation of pier 2 and demolition of the shed (PMO 3, 4)
3) Rehabilitation of fender system and working apron of the berths of B28-30 (PMO 5)
4) Close of the berths of B31-33 due to the Cebu South Coastal Road Project (PMO 5)
5) Relocation of the fast craft terminal

(2) Future Utilization Plan

Based on the characteristics of each port area and ongoing/planned projects mentioned above, the basic future utilization plan for each area is as follows;

1) Area of PMO 1
This area has a 693m strait quay equipped with 2 gantry cranes and marshaling yard. This area can accommodate large vessels and will be used for deep draft vessels, such as large RORO ferries and domestic container vessels.

2) Area of PMO 2
This area will be used for large RORO ferries, conventional cargo vessels, and middle RORO ferries (stern ramp type). Main port function of PMO 2 is middle RORO ferry terminal. The required RORO ramp facilities for stern ramp vessels will be developed.

3) Area of PMO3 and PMO4
This area has conventional berths with three piers and will be used for middle/small class conventional cargo vessels, passenger/cargo vessels, and fast crafts. Conventional cargo vessels should be allocated at PMO 4 area for the separation of passengers and cargoes.

4) Area of PMO5
Berths 31-33 are to be closed. Therefore, only berths 28-30 will be used in future. This area should be used for conventional cargo vessels.

2.5.2 Required Facilities

Required berth facilities are obtained by using the forecast of vessel size and cargo handling productivity. The required berth size is basically decided by the following formula:

Berth length (Parallel mooring system) = Vessel length + Ship breadth
(Right angle mooring system) = Vessel breadth × 3
Berth depth = Vessel draft × 1.1

(1) The New Cebu Port

1) Foreign Container Terminal

In order to establish an efficient international container network, the New Cebu port should handle domestic feeder containers as well as foreign containers. Therefore, it is assumed that the New Cebu port will handle 1,319 thousand TEUs in 2020 (502 thousand TEUs in 2010), including 10% of the total domestic container cargos.

a) Berth Length and Depth
The maximum vessel size is assumed to be 40,000DW (LOA270m, B32m, D12m). The berth is 300m long and 13m deep.

b) Handling Productivity
The New Cebu port should aim at ensuring high productivity and efficient management to be able to compete with neighboring ports. The productivity of the existing gantry crane at CIP is 22 boxes / hour. The target productivity of gantry crane in 2020 is 33boxes / hour (28box / hour in 2010). The handling productivity / berth is calculated as follows:

Handling productivity / berth
= Sum of (Handling productivity / gantry crane × Efficiency of each gantry crane)
33 box/h × (1+0.7+0.5) = 72.6box/h in 2020
(28 box/h × (1+0.7+0.5) = 61.6box/h in 2010)

c) Required Number of Berths
Assumptions for obtaining the required number of foreign container berths in 2020 are as follows
Working time per day = 22 hours
Actual Working days per year = 361 day
Standard container vessel size: 17,000DW(1,600DW in 2010)
Average number of loading / unloading containers: 600 boxes in 2020 (450 boxes in 2010)
TEU / box =1.5
Berth occupancy rate = 60%

Idle time at ship berthing = 15%

The required number of berths for foreign container vessels is four (4) in 2020 and two (2) in 2010. (See Table 7.5.2-1)

Table 2.5.2-1 Required Number of Foreign Container Berths

	Cargo Vol. (thousand TEU)	Cargo Vol. (thousand box)	Handling Productivity (boxes/day)	Work Time (day/vessel)	Total Berth Time (day-berth)	No.of required berth
2020	1,319	879	1,597	0.45	1,223	3.4
2010	502	335	1,355	0.45	549	1.5

d) Required Land Depth of the Container Terminal
Required land depth of the container terminal is 500m. (See Table7.5.2-2)

Table 2.5.2-2 Required Land Depth of Container Terminal

Facility Item	Depth of Terminal Area	Formula
Apron and Back Reach Area	65 meters	Apron Width 40m (Quay side Gantry Crane Span 30 m) Back Reach Maneuvering Space 30 m
Container Stacking Area	208 meters	1 Lane width 26 meters for RTGs Operation 26m Span x 8 Lane=208m
Container Yard Main Passage	60meters	2 Way Passage (C.Y Length-way)
Terminal Facilities Building Area	100 meters	Office Building, C.F.S, Gate Booth, Maintenance Shop, and Power Station etc
Total	433 meters	
Access Road etc.	67 meters	
Ground Total	500 meters	

e) Required Number of Container Stacking Ground Slots
The required number of container stacking ground slots is calculated as follows.

Number of container handling per week by TEUs
(1,318,894 TEUs ÷ 52 Weeks) = 25,363 TEUs/Week

Export and out-bound container stacking by TEU

(25,363 TEUs ÷2)	= 12,682 TEUs/Week
- Average Stacking High	= 3.8 Tiers/Ground Slot
- Yard Stacking Efficiency	= 1.2 /Ground Slot
- Container Receiving Efficiency	= 0.6 /Week

Estimation of ground slots for export and outbound container stacking
(12,682 TEUs ÷ 3.8) x 1.2 x 0.6 ≒2,403 TEUs

Import and In-bound container handling by TEU

(25,363 TEUs ÷2)	= 12,682 TEUs/Week
- Average Stacking High	= 3.2 Tiers/Ground Slot
- Yard Stacking Efficiency	= 1.0 /Ground Slot
- Container Delivery Efficiency	= 1.1 /week

Estimation of ground slots for import and inbound container stacking
(12,682 TEUs ÷3.2) x 1.0 x 1.1 ≒4,360 TEUs

Empty container storage ratio of total container annual throughput is assumed to be 30%.

(1,318,894 TEUs x 0.3) ÷ 52 Week	= 7,609 TEUs/Week
- Average Stacking High	= 4.0 Tier/Ground Slot
- Yard Stacking Efficiency	= 1.1 /Ground Slot

Estimation of ground slots for empty container stacking
(7,609 TEUs ÷4.0) x 1.1 = 2,093 TEUs/Ground Slots

As a result of the calculation, total required ground slots is obtained as follows.

Table 2.5.2-3 Total Required Ground Slot

Container Status	Required Capacity (TEU)
Export / Out-bound Container Stacking Slots	2,403 Ground Slots
Import / In-bound Container Stacking Slots	4.360 Ground Slots
Empty Container Stacking Slots	2.093 Ground Slots
Total Required Container Ground Slots	8,856 Ground Slots

Based on the above calculation and standard container yard layout, the planned container yard capacity is assumed to be as follows.

Dry freight container stacking area
(20 Bay x 6 Row x 4) x 17 Block = 8,160 TEUs/Ground Slots
Reefer container stacking area

(19 Bay x 6 Row x 2) x 2 Block = 456 TEUs/Ground Slots

Dangerous container (cargo) stacking area

(268 m ÷ 7m) x 12 Row = 460 TEUs/Ground Slots

Table 2.5.2-4 Container Yard Capacity

Planning of Yard Stacking Ground Slots	Capacity (TEU)
Dry Freight Container Stacking Ground Slot	8,160 Ground Slots
Reefer Container Stacking Ground Slot	456 Ground Slots
Dangerous Container (Cargo) Stacking Area	460 Ground Slots
Total Container Stacking Ground Slot	9.076 Ground Slots

f) Container Freight Station (CFS)

Since LCL (Less than container) cargo tends to decrease recently, required CFS scale at the New Cebu Port is estimated approximately 3,200 m2 (80meters in length and 40meters in wide).

g) Electric Substation

The container terminal needs electric substation, which will supply the necessary electricity to the gantry cranes, reefer containers, yard lighting facilities, administration building, gate booth, and maintenance shop (repair shop). It is also recommended that diesel-generator units of appropriate capacity should be provided to cope with any unexpected power failure that may happen.

2) Foreign Multi Purpose Terminal

a) Berth Length and Depth

The maximum vessel size is assumed to be 18,000DW (LOA165m, B22m, D9m). The berth dimension is 190m long and 10m deep.

b) Required Number of Berths

Assumptions for obtaining the required number of foreign conventional berths in 2020 are as follows:

Working time per day = 22 hours

Actual working days per year = 361 day

Average loading / unloading cargo volumes = 8,400MT/vessel

Handling productivity = 35MT/h × 3gangs = 105MT/h

Idle time at ship berth = 2hours

Berth occupancy rate = 70%

Number of calling vessels in 2020 =90 vessels

Berthing time / vessel = 8,400MT ÷105MT/h +2h = 82h

82h x 90vessel ÷22h ÷361day ÷0.7 (berth occupancy rate) =1.3

The required number of berths for foreign conventional vessels is two (2) in 2020

3) Required Yard Area

The necessary area for open storage and transit shed for general cargoes is obtained by using the formula below:

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

Where;

A	:	Necessary area of open storage or transit shed (m2)
R	:	Turn of cargo (40 times / year)
r	:	Efficiency of using the space (0.7)
W	:	Weight of cargo per m2(1.0)
f	:	Peak ratio (1.3)
N	:	Cargo throughput per annum (MT / year)

The cargo throughput per annum is determined by the ratio of the open storage or transit shed use. The ratio of the open storage or transit shed use of foreign general cargo is assumed to be at 50%.

Necessary area for open storage or transit shed (m2)

= 756 thousand MT × 0.5 × 1.3 / (40 × 0.7 × 1.0) =1.8ha

The total length of quay side is 380m and the necessary depth of the backyard is about 50m. Including the apron area and road space, total depth of land area is assumed to be 100m.

(2) Cebu Baseport

1) Large RORO Ferry

a) Berth Length and Depth

The maximum vessel size is assumed to be 18,000GRT(LOA195m, B25m, D7m). The berth dimension is 225m long and 8m deep.

b) Required Number of Berths

Assumptions for obtaining the required number of foreign conventional berths in 2020 are as follows:

Actual working days per year = 365 day

Average loading / unloading containers = 214boxes / vessel

Handling productivity = (10boxes/h/head × 5head) =50boxes / h
Idle time at ship berth = 2*hours*
Number of calling vessels in 2020 = 2,090 vessels

Berthing time / vessel = 214boxes ÷ 50boxes/h +2h = 6.3h
Number of calling vessels / day = 5.7 vessels

Considering the schedule of large RORO ferry services, two (2) cycles at one berth per day is assumed. So the required number of berths for large RORO ferries is three (3) in 2020.

c) Passenger Terminal
Required space for large RORO ferry passenger terminal in 2020 is obtained as follows;

3,000(person/vessel) × 0.6 (load factor) × 0.7 (utilization ratio) × 1.2(m2/person)
× 1.5(space factor) × 3 (vessels) ≒ 7,000m2

2) Middle RORO Ferry (stern ramp)

a) Berth Length and Depth
The standard vessel size is assumed to be at 4,000GRT(LOA120m, B20m, D5m). The berth is 60m long and 6m deep (Right angle mooring system).

b) Required Number of Berths
Assumptions for calculating the required number of middle RORO berths in 2020 are as follows:

Actual working days per year = 365 day
Average loading / unloading cargo volumes = 490MT / vessel
Handling productivity = 200MT/h
Idle time at ship berth = 2hours
Number of calling vessels in 2020 = 12,800 vessels / year =35.1 vessels / day

Berthing time / vessel = 490 MT ÷ 200 MT/h +2h = 4.5h

Considering the schedule of middle RORO ferry services, three (3) cycles at one berth per day are assumed. So the required number of berths for middle RORO ferries is twelve (12) in 2020.

c) Passenger Terminal
Considering the number of berths (12), three (3) passenger terminals are planned. Required space for each passenger terminal in 2020 is obtained as follows;

1,200(person/vessel) × 0.6 (load factor) × 0.7 (utilization ratio) × 1.2(m2/person)

$\times$1.5(space factor)$\times$3 (vessels) ≒ 2,800m2

3) Domestic Container Vessel

a) Berth Length and Depth

The maximum vessel size is assumed to be 7,000DW (LOA150m, B25m, D7m). The berth is 175m long and 8m deep.

b) Required Number of Berths

Assumptions for obtaining the required number of berths for domestic container vessels in 2020 are as follows;

Working time per day = 22 hours
Actual Working days per year = 361 day
Number of calling vessels in 2020 = 429 vessels
Average number of loading / unloading containers: = 208 boxes in 2020
Handling productivity = 22boxes/h$\times$2 gantry crane = 44 boxes / h
Berth occupancy rate = 70%
Idle time at ship berthing = 2hours

Berthing time / vessel = 208 boxes$\div$44boxes/h +2h = 6.7h
6.7h x 429vessels $\div$22h/day$\div$361day$\div$0.7(berth occupancy rate) = 0.5berth

The required number of berths for domestic container vessels is one (1) in 2020.

4) Domestic Conventional Cargo Vessel

a) Berth Length and Depth

The standard vessel size is assumed to be 2,000DW(LOA83m, B13m, D5m). The berth is 100m long and 6m deep.

2) Required Number of the Berths

Assumptions for obtaining the required number of berths for domestic conventional cargo vessels in 2020 are as follows:

Working time per day = 20 hours
Actual working days per year = 361 day
Average loading / unloading cargo volumes = 960 MT / vessel
Handling productivity = 25MT /h/gang$\times$3 gang =75 MT / h
Berth occupancy rate = 70 %
Idle time at ship berth = 2 hours
Number of calling vessels in 2020 = 3,600vessels

Berthing time / vessel = 960MT / vessel ÷ 75 MT / h +2h = 14.8h
14.8h × 3,600vessels ÷ 20h/day ÷ 361day ÷ 0.7(berth occupancy)=10.5 berth

The required number of berths for domestic conventional cargo vessels is eleven (11) in 2020.

5) Passenger/Cargo Vessel

a) Berth Length and Depth
The standard vessel size is assumed to be 500GRT (LOA50m, B10m, D3m). The berth is 60m long and 4m deep.

b) Required Number of Berths
Assumptions for obtaining the required number of berths for passenger/cargo vessels in 2020 are as follows:

Number of cycles /day/berth = 3
Number of calling vessels in 2020 = 31.1 vessels / day

The number of required berths for passenger/cargo vessels is eleven (11) in 2020

6) Fast Craft

a) Berth Length and Depth
The standard vessel size is assumed to be 500GRT (LOA40m, B15m, D2m). Pontoon system is assumed to be used for berthing. One pontoon can accommodate two vessels by using both sides. The required quay length for one pontoon is obtained as follows;

10m (width of pontoon) + 15m (breadth of the vessel) × 2vessel
+ 15m (maneuvering space) = 55m

The required berth depth is 3.0m.

b) Required Number of Berths
Assumptions for obtaining the required number of berths for fast crafts in 2020 are as follows:

Number of cycles /day/berth = 5
Number of calling vessels in 2020 = 24.7 vessels / day

The number of required berths for the fast crafts is five (5) in 2020

7) Metro Bus Ferry

This service is operated by small boats. Assumptions for calculating the required number of metro bus ferry berths (pontoons) in 2020 are as follows.

Number of cycles /day/berth = 24 (30minutes /vessel/berth)
Number of calling vessels in 2020 = 46.9 vessels / day

The number of required berths (pontoons) for metro bus ferry is two (2) in 2020

8) Required Land Space for Domestic Container Vessels and RORO Ferries

a)Domestic Container Handling Area
Domestic containers handled at PMO 1 and 2 have two storage methods –the stacking system and the married system (containers are transported with trailer).

Total domestic container throughput is forecasted to be 1,203 thousand TEUs in 2020. 90% of the total cargoes will be handled at Cebu Baseport, while 10% of the total cargoes will be handled at the New Cebu port.

By large RORO ferry and container vessel	722 thousand TEUs (60% of the total)
By middle RO/RO ferry	361 thousand TEUs (30% of the total)

Container total throughput	1,083 thousand TEUs
- Annual working days	361 Days
- Handling TEUs/day	3,000 TEUs/day
- Ratio of stacking and married operation method	50% / 50%
- Stacking containers	1,500 TEUs
-Married containers (with trailer)	1,500 TEUs
- Yard usage revolution ratio	2times / day

Stacking container area of CIP
-Existing capacity of ground slots (CIP yard B and C block)
{(30 bay + 16 bay) x 2 block} x 5 row = 460 ground slots
- Average stacking height by RTGs 2.5 tiers
- Capacity of stacking containers handled at CIP
460 ground slots x 2.5 tiers x 2 times/day = 2,300 TEUs

The result of the calculation shows that CIP capacity for stacking containers (2,300TEUs / day) is sufficient for the handling volume in 2020 (1,500 TEUs /day).

Married container occupation space
- 8 m(Length) x 5m(Width) = 40 m2 / vehicle

- Maneuvering space (with passage) of a vehicle

40m2 x 3 = 120m2 / vehicle

Married container vehicles parking area

- Existing Capacity (CIP yard D and E Block)

487 m x 60m = 2.9 ha

- Number of handling married container per day = 1,500 TEUs
- Parking lot usage revolution = 2.5 times / day
- 1,500 Vehicles ÷ 2.5 times = 601 vehicle
- Required space of vehicles for married containers

120m2 x 601 Vehicles = 7.2 ha

The result of the calculation shows that the required land space for vehicles of married containers (7.2ha) is beyond the available space in CIP (2.9ha). 4.3ha of vehicle parking space for married containers should be developed near CIP area.

2) Parking space of vehicles for break bulk cargoes

Middle RORO ferries shall handle 40% of the total break bulk cargoes together with domestic containers. It is necessary to prepare parking areas of vehicles for break bulk cargoes. According to the demand forecast and the number of calling vessels, required space is obtained as follows:

- Average break bulk cargo volumes per vessel 216 MT
- Required number of vehicles

  216MT ÷ (8MT/vehicle x 0.7(load factor)) = 39vehicles
- Required parking space for 8-ton vehicle 45m2
- Total required parking space

  45m2 x 39vehicle x 12berth x 0.7(simultaneous berth occupancy ratio) = 1.5 ha

The result of the calculation shows that required land space of the vehicles for break bulk cargoes is 1.5ha.

3)Required Open Space

As a result of the above calculation, additional open space of 6 hectares is required near CIP area to accommodate cargo demand in2020.

(3) Summary of Required Facilities

Required port facilities in 2020 are summarized below.

Table 2.5.2-3 Required Port Facilities for the New Cebu Port in 2020

	Berth length (m) (No. of berths)	Berth depth (m)	Others
Foreign Container Terminal	1200 (4)	13	Back yard area: 60ha
Foreign Multi Purpose Terminal	380 (2)	10	Back yard area: 4ha

Table 2.5.2-4 Required Port Facilities for Cebu Baseport in 2020

	Berth length (m) (No. of berths)	Berth depth (m)	Others
Large RORO Ferry Terminal	675 (3)	8	Passenger Terminal (7,000m2) Additional Open Space (6ha*)
Middle RORO Ferry Terminal	720 (12)	6	RORO ramps Passenger Terminals (2,800m2 x 3)
Domestic Container Terminal	175 (1)	8	
Domestic Conventional Cargo Terminal	1,100 (11)	6	
Passenger/Cargo Terminal	660 (11)	4	
Fast Craft Terminal	165 (5)	3.0	
Metro Bus Ferry	(2 pontoons)	-	

* This area includes parking space for vehicles of middle RORO ferry

2.5.3 Required Equipment

Required number of container handling units, such as container handling quay-side gantry cranes, rubber tire mounted gantry cranes and prime movers for marshalling yard, are estimated as bellow.

An important factor for the operation of the container port is introduction of a fully efficient container (cargo) handling system for discharging, loading and transporting in the container terminal and port area.

The efficient and appropriate container operating system and capacity of the equipment is decided through total system planning based on the assumed number of containers to be handled and seasonal variations. Cost of each equipment to offer required performance is one of the essential factors for the selection of the cargo handling system.

The container (cargo) handling system is divided into the following three categories

-Movement of containers between vessel and quay-side apron.

-Movement of containers between quay-side apron and C.Y area.

-Stuffing cargo into or un-stuffing cargo from containers at CFS.

(1) Quantity of Container Handling Equipment

1) Quay side Gantry Crane (Articulated Boom Type)
The available number of quay-side gantry cranes for handling containers at a port is a governing factor in determining the turnaround time of container vessels. Hence, it is necessary to provide the optimum number of container handling equipment to ensure the completion of the container handling within the short port stay time of container vessels.

The required number of quay-side gantry cranes for handling containers can be estimated by following formula.

Table: 2.5.3-1 Forecasted Annual Container Throughput by TEUs

Container Transporting Method	Project Year 2020
Foreign Container Throughput	1,198,547 TEUs
Domestic Container Throughput 10% at New Port Handling	1,203,475 x 10% 120,347 TEUs
Total Container Throughput by TEUs and Boxes	1,318,894 TEUs (879,263 Boxes)

Nqc = A ÷(T x μ1 x P x Pqc x μ2 x E)

Where Nqc : Required number of quay side gantry cranes
A : Annual throughput in TEUs
T : Maximum annual available working hours
available working day per year = 361 days
actual working hours = 22 hours per day = 7,942 hours per year
P : Berth occupancy ratio (0.60).
Pqc : Productivity of quay-side gantry crane
33 Boxes/hour/unit in 2020.
μ1 : Percentage of availability (applied for ratio in 2000) = 0.7
μ2 : Container operation efficiency ratio = 0.8
E : Conversion rate of 20'/40' (applied for ratio in 2000) by TEU
50%/50% = 1.50

μ2 at the existing CIP is obtained at 0.8 and annual throughput of foreign containers at the CIP berths is 103,944 TEUs.

Nqc (2020) = 1,318,894÷(7,942 x 0.7x 0.6 x 33 x 0.8 x 1.5) = 9.98 Units ≒ 10 Units

Table: 2.5.3 -2 Required Number of Quay Side Gantry Crane

Kind of Equipment	Project Year 2020
Quay Side Gantry Crane	10 Units

2) Rubber Tire Mounted Gantry Crane (RTGs)

The RTGs installed at the marshalling yard just behind the quay side must be operated in good combination with quayside gantry cranes. Their work is to handle the containers, carried by tractor / trailer between quay side and marshalling yard, in the marshalling yard including for re-handling and/or pre-marshalling, transfer to CFS and container repair shop and cargo inspection of Bureau of Customs at the container stacking yard.

For quayside operation, one or two units of RTGs will be adequate to work in combination with one quayside gantry crane.

In general the operation efficiency of RTGs in receiving/delivery containers is approximately 23 boxes per hour due to re-handling of containers stacked in three or four tiers stow and hoisting or lowing operations across stacks which blocks the movement, and so on.

The required number of RTGs used at the marshalling yard is estimated by the following formula on the assumption that containers loading / discharging will be stacked once in the marshalling yard.

Nrc = Nrc1 + Nrc2 + Nrc3

Where Nrc : Required number of RTGs

Nrc1: RTGs mainly used for quay side gantry crane operation

(Basically: one unit RTG x one unit quay side gantry crane)

Nrc2: RTGs mainly used for container receiving/delivery operation

Nrc2 = Number of annual handling containers $\div$ Amy $\div$ T

Amy = $\mu 1$ x Prc x E

$\mu 1$: Percentage of available ratio = 0.7

Prc : Productivity of RTG on the basis of gross

(23 boxes/hour/unit)

E: Conversion rate of 20' / 40' (1.50 TEUs / box)

Amy = 0.7 x 23 boxes x 1.50 = 24.15

T: Maximum available working hours per year

(361days x 22 hour = 7,942 hours/year)

Nrc3 : Stand-by RTGs for immobilization due to repairmen, periodical inspection or other unforeseen circumstances

Nrc3 = (Nrc1 + Nrc2) x 10%

Nrc 1 = 10 Units

Nrc 2 = (1,318,894 x 2.7times) ÷24.15 ÷7,942 = 18.56
Nrc 3 = (10 Units + 18.56 Units) x 0.1 = 2.86

Nrc = 10Units + 18.56 Units + 2.86 Units=31.4 ≒ 32 Units

Table: 2.5.3-3 Required Number of RTGs

Kind of C.Y Operation	Project Year 2020
For Container Loading/Discharging Operation	10 Units
For C.Y Container Movement Operation Including CFS/Maintenance Operation by Prime Mover	22 Units
Total Units	32 Units

3) Prime Mover (Tractor / Trailer)

Terminal yard prime mover with trailer transports containers for loading or discharging to/from container vessels between the quay side apron and marshalling yard. They are used in order to speed up container movements in terminal yard. A cycle time of tractors depends on the distance between quay side gantry crane and marshalling yard. Therefore, an estimation of required number of tractors and trailers for proposed option were carried out on the following conditions.

Travel speed of tractor and trailer (Average)	15km/hour
Handling cycle time under the gantry crane	1.5 minute/container
Handling cycle time under the RTGs	2.0 minute/container
Handling productivity of gantry crane	33 boxes/hour
Container berth length and width	1200m/500m

Table: 2.5.3-4 Required Number of Prime Mover in 2020

Kind of C.Y Operation		Project Year 2020
For Container Loading/Discharging Operation @QSGC 1 Unit x 5 Units		50 Units
For Container Yard Movement Operation Including For CFS Operation Trailer		Tractor 15 Units Trailer 28 Units
Total Prime Mover	Tractor Head	65 Units
	Trailer	78 Units

4) Summary of Container Handling Equipment of the New Cebu Port

Required container handling equipment in long term plan is shown in Table 2.5.3-5

Table: 2.5.3-5 Summary of Number of Container Handling Equipment of the New Cebu Port Container Terminal,

Kind of Equipment		Project Year 2020
Quay Side Gantry Crane (QSGC)		10 Units
Rubber Tier Mounted Gantry Crane (RTGs)		32 Units
Prime Mover	Tractor Head	65 Units
	Trailer (Chassis)	78 Units

(2) Required Cargo Handling Equipment for the Multipurpose Terminal

As foreign conventional cargoes handled at the multi-purpose berth of the New Cebu Port are mainly steel products, lumbers and bagged goods, sheds should be constructed in order to prevent these cargoes from getting wet by rain. The main purpose of the sheds is not storage of these cargoes, but distribution of the cargoes. Dimensions of required cargo handling equipment are as follows. These heavy-duty and small forklift trucks should be provided by private stevedoring company.

Table: 2.5.3-6 Foreign Conventional Cargo Handling Volume per Year

Cargo Status	Break Bulk Cargo 2020
Foreign Export Conventional Cargo	70,833 tons
Foreign Import Conventional Cargo	685,536 tons
Total Volume	756,369 tons

Table: 2.5.3-7 Required Foreign Conventional Cargo Handling Equipment of Multipurpose Berth

Capacity of Equipment	Project Year 2020
3.5 tons Forklift Truck	8 Units
5.0 tons Forklift Truck	5 Units
10.0 tons Forklift Truck	1 Unit
15.0 tons Forklift Truck	1 Unit

(3) Cargo Handling Capacity and Required Equipment of Container Freight Station (CFS)

Since LCL (Less than container load) cargo has decreased at Cebu Baseport, CFS with 3,200m2 (80 meters in length and 40 meters in width) is assumed to be required. Fork lift trucks also should be prepared and managed by private companies.

1) Cargo Handling Capacity of CFS

Table: 2.5.3-8 LCL Cargo Handling Volume in 2000

	Export LCL Container			Import LCL Container		
	20'	40'	45'	20'	40'	45'
2000	394	279	41	274	174	6
Ratio By FCL	5.5%	1.7%	10.6%	2.3%	1.6%	20.0%
TEU	1,044.25 TEUs			635.50 TEUs		

Source: CPA Statistics in 2000 from Jan to Dec

Average cargo stuffing volume of LCL container is as follows.
Export Cargo : about 10 tons / TEU by Out ward Manifest
Import Cargo : about 8 tons / TEU by Inward Manifest

Annual LCL cargo handling volume in 2000 is as follows.
Export LCL : 1,044.25 TEUs x 10 tons = 10,442.5 t/Year
Import LCL : 635.50 TEUs x 8 tons = 5,084.0 t/Year
Total Handling Cargo Volume/Year = 15,526.5 t/Year

Actual cargo storage area is assumed to be 65% of floor space, while maneuvering area is 35%. Each space in 2020 is as follows.
Cargo storage space: 3,200 m2 x 65% = 2,080 m2
Maneuvering space : 3,200 m2 x 35% = 1,120 m2

Available LCL cargo handling and storage capacity at the New Cebu Port is as follows.
Storage capacity : 2,080 m2 x 2.0t/m2 = 4,160 tons/m2/moment
LCL cargo handling capacity (Cargo turn over period is assumed to be one week)
: 4,160 tons x 52 weeks = 216,320 tons/year

Considering the current situation of LCL cargoes, planned CFS is assumed to have sufficient capacity.

2) Required LCL Cargo Handling Equipment (Forklift Truck)

The LCL cargo volume ratio in long term plan is assumed to be the same as in 2000, which is shown bellow.
Export LCL cargoes (10,442 t ÷239,452t) x 100 = 4.36%
Import LCL cargoes (5,084 t ÷445,684t) x 100 = 1.14%

LCL cargo handling volume in 2020 is shown in Table 2.5.3-9 and 10.

Table: 2.5.3-9 LCL Cargo Handling Volume in 2020

	Ratio of LCL	Handling Cargo Volume
Export LCL	1,451,212tons x 4.36 %	63,272 tons/year
Import LCL	5,806,958tons x 1.14%	66,199 tons/year

Table: 2.5.3-10 Summary of LCL Cargoes

Cargo Category	Cargo Stuffing/Un-stuffing and Receiving/Releasing Work volume	Total Handling Per Year	Handling Per Week (52 W)
Export LCL	63,272 tons x 2 times	126,544 tons	2,434 tons
Import LCL	66,199 tons x 2 times	132,398 tons	2,546 tons

Required LCL cargo handling equipment in long term plan is shown in Table 2.5.3-11.

Table: 2.5.3-11 Required Number of LCL Cargo Handling Equipment

Capacity of Forklift	Required numbers (2020)	
2.5 Tons Low Mast Type	Container-Side	3 Units
	Truck-Side	3 Units
3.0 Tons Low Mast Type	Container-Side	2 Units
	Truck-Side	2 Units
5.0 Tons Normal Type	Both Side	2 Units
10.0 Tons Normal Type	Both Side	1 Unit

2.5.4 The Basic Development Plans

(1) The New Cebu Port

The site for the new Cebu port development (Consolacion) has a broad shallow shore area. Off the shallow area, the sea bottom drops with a steep slope. Considering the characteristics of this area, quay line should be settled along the necessary sea depth contour line in order to reduce the dredging volume and quay structure construction cost. Behind the quay line, the new container terminal can obtain large land space with small reclamation work in the shallow area. Based on the required facilities and the above consideration, two alternatives were planned. (See Fig. 2.5.4-1 and Fig. 2.5.4-2)

In alternative-1, the foreign multi purpose berths are planned to be at the side of the foreign container terminal in order to reduce the length of revetment. In alternative-2, container berths and foreign multi purpose berths are planned to be in a straight line.

Alternative-1 can reduce the length of revetment, but large volume of dredging is needed. As a result, total cost of Altenative-1 is estimated to be 18.2 billion pesos, which is higher than that of

Alternative-2, 17.9 billion pesos. Moreover, due to the siltation, maintenance dredging for the foreign multi purpose berths is considered to be necessary. Alternative-2 has advantage in terms of vessel navigation with smooth berthing at foreign multi purpose berths.

Alternative-2 is superior to Alternative-1

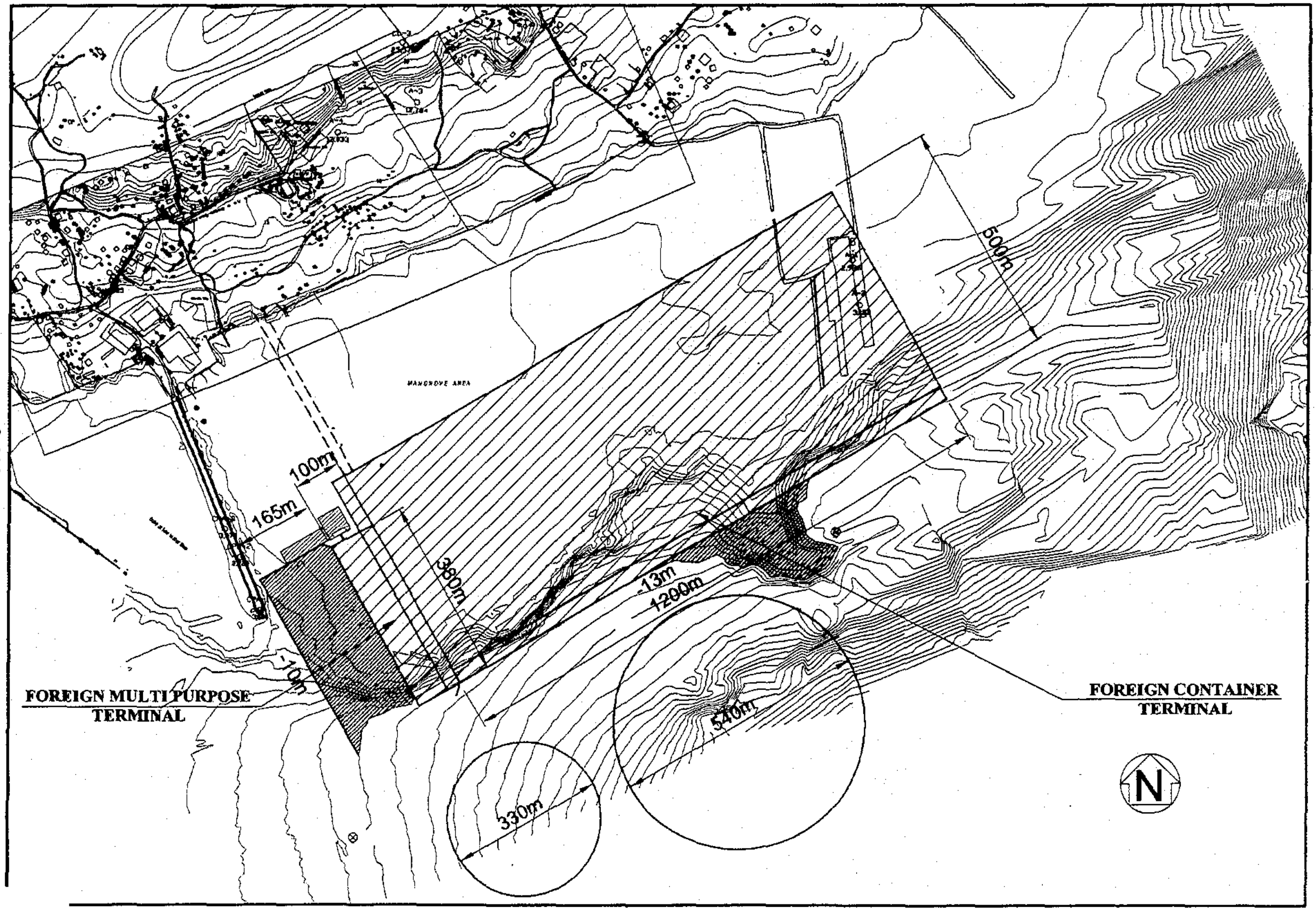


Fig. 2.5.4-1 New Cebu Port Layout Plan (alternative 1)

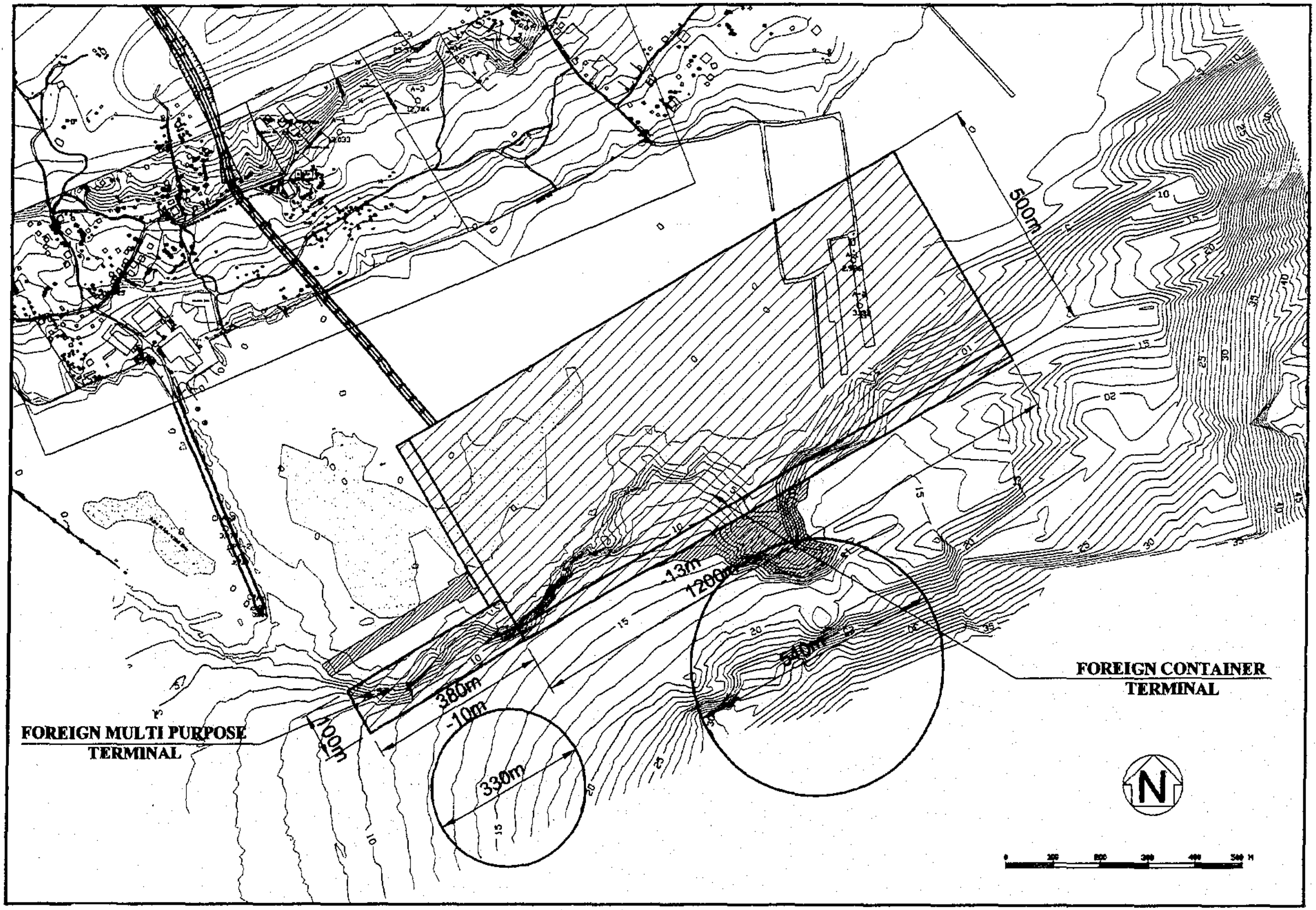


Fig. 2.5.4-2 New Cebu Port Layout Plan (alternative 2)

(2) Cebu Baseport

1) Berth Layout in 2020

Based on the conceptual zoning (See chapter 2.5.1) and required facilities (See chapter 2.5.2), berth allocation is planned as follows.

a) Large RORO Ferry Berth
Large RORO ferry berths are allocated at CIP terminal. But available quay length (B3-7) can accommodate only two berths. Therefore another berth is allocated at the northern end of PMO2 area (B-8, 9).

b) Middle RORO Ferry Berth
Middle RORO ferry berths (RORO ramps) are allocated at the southern part of PMO2 area (B11-17).

c) Domestic Container Vessel Berth
Domestic container berth is allocated at the northern end of CIP terminal (B2-3).

d) Conventional Cargo Vessel Berth
Domestic cargo vessel berths requires a total of 1,100m (11 berths). Two berths are allocated at PMO2 area (B9-11) for large conventional cargo vessels. Large vessels also can use northern part of PMO 1 area (B2-3) together with domestic container vessels. Other berths are allocated at PMO 4 and 5 areas (B22S-30).

e)Passenger/Cargo Vessel Berth
Passenger/cargo vessel berths are allocated at PMO 3 area (B20-23N)

f) Fast Craft Berth
Fast craft berths are allocated B18-19 areas in PMO 3 because this area is shallow but very calm in wave condition.

g) Metro Bus Ferry berths
Metro bus ferry berths are allocated at pier 3.

2) Development Plan

a) Ongoing/planned Project

*Expansion (30m off-shore) of backyards and deepening the berths of B8-B17 with construction of RORO ramps.

This project is being conducted by CPA in order to expand the backyard and increase

RORO ramp berths, which are necessary for efficient cargo handling for stern ramp RORO vessels. In addition to these purposes, the berth depth will be increased after the completion of the project. Phase 1 area, which is under construction, is B8-B10 (development quay length: 354m). Phase 2 area is B10-B12 (development quay length: 301m) and development work is to start in 2002. CPA plans to allocate B8 to B11 (berth length:434m) for conventional type vessels including large RORO ferries and remaining areas, from B11 to B17, for RORO vessels with stern ramp. Therefore the quays in this area (B11-B17) will be developed as RORO ramps (slops).

The quay length of RORO ramps area will be required 720m in length (12berths) according to the demand forecast. One berth has 60m quay length and 80m depth of backyard including apron, cargo handling are, and traffic lane. This project makes RORO style cargo handling possible for stern ramp RORO ferries and raises the productivity due to the introduction of RORO style cargo handling.

*Rehabilitation of pier 2 and demolition of the shed.
CPA is conducting rehabilitation of pier 2 and the old shed has already been demolished. CPA has no concrete plan to rehabilitate other piers. However, all pier structures are suffering from serious deterioration. Therefore, rehabilitation of other piers also should be conducted in due course.

*Rehabilitation of fender system and working apron of the berths of B28-B30
CPA is promoting rehabilitation of the berths B28-30, as heavy cargoes cannot be handled in this area because of the damaged berths. CPA is conducting rehabilitation of fender system and after the completion of this work, rehabilitation of working apron is to be conducted.

*Close of the berths of B31-B33 due to the Cebu South Coastal Road Project
This area will be used for the Cebu South Coastal Road Project and close of the berths of B31-B33 is scheduled in 2002.

*Relocation of the fast craft terminal
B13-14, where fast craft terminal is located at present, is included in the development area for RORO berths. Therefore this terminal should be relocated to a proper area. B18-B19 is proposed for the new site due to its water calmness and shallow condition.

b)Proposed Projects

*Expansion (30m off-shore) of backyard of conventional cargo berth (B21, 22, 24, 25, 28-30)
The width of back yard at this area is only from 30 to 50m, including traffic lane. For efficient cargo handling and smooth traffic flow, the widening of the back yard area is

essential. Considering the apron area (15m), traffic lane (15m), cargo stacking area, and future quay lengths of the piers, 30m off-shore expansion of back yard area should be conducted.

*Renovation of pier1. 2 and 3, including expansion of width of pier1 and 2 for large vessels
Pier 1 and 3 are suffering from deterioration and need to be renovated. Since the pier1 is planned to be allocated for conventional cargo vessels, the renovation work includes the reenforcement of the structure and expansion of the width of the pier to accommodate large conventional cargo vessels. The width of 40m is required to obtain a 15m wide apron area at both quay sides and 10m wide traffic lane at the center, while the old shed should be demolished because few cargoes require a shed. Pier 3 also should be renovated but the existing width of the pier is sufficient, because this pier is allocated for passenger/cargo vessels, whose size and loading volume are small. Pier 2 is under rehabilitation. However from the long-term viewpoint, the renovation and widening of the piers is required in order to accommodate large vessels and to improve cargo handling productivity and passenger safety.

*Construction of passenger terminal buildings with boarding bridge and elevated catwalk for RORO ferries
The separation of passenger movement and cargo handling is required for efficient cargo handling and passenger safety. Passenger terminal buildings are also required for convenience. Therefore, the passenger terminal building with a boarding bridge for large RORO ferries should be constructed in PMO1 area. In PMO2 area, RORO berths are planned to have continuous RORO ramps (slopes) at all quay sides in order to secure flexible berthing and to accommodate various sizes of RORO ferries in operation. Three passenger terminal buildings should be constructed for middle RORO ferries in PMO2 area, equipped with elevated catwalks for not only the separation of passenger and vehicle movement but also flexible operation in the back yard area. In PMO2 area, traffic lane should be established at the land side to separate the traffic area from the cargo/passenger handling area. In order to set the traffic lane in strait line, the building overlapping this line at B13 area should be relocated.

*Expansion of back-up area for RORO ferries
Expansion of back-up area for domestic container cargo handling and parking area for cargo vehicles of RORO ferries (about 6ha) is required. Considering efficient cargo handling, the private land behind the B8-9 in Port Zone, which is vacant or hardly utilized at present, is recommended.

The layout plan in 2020 is shown in Fig 2.5.4-3

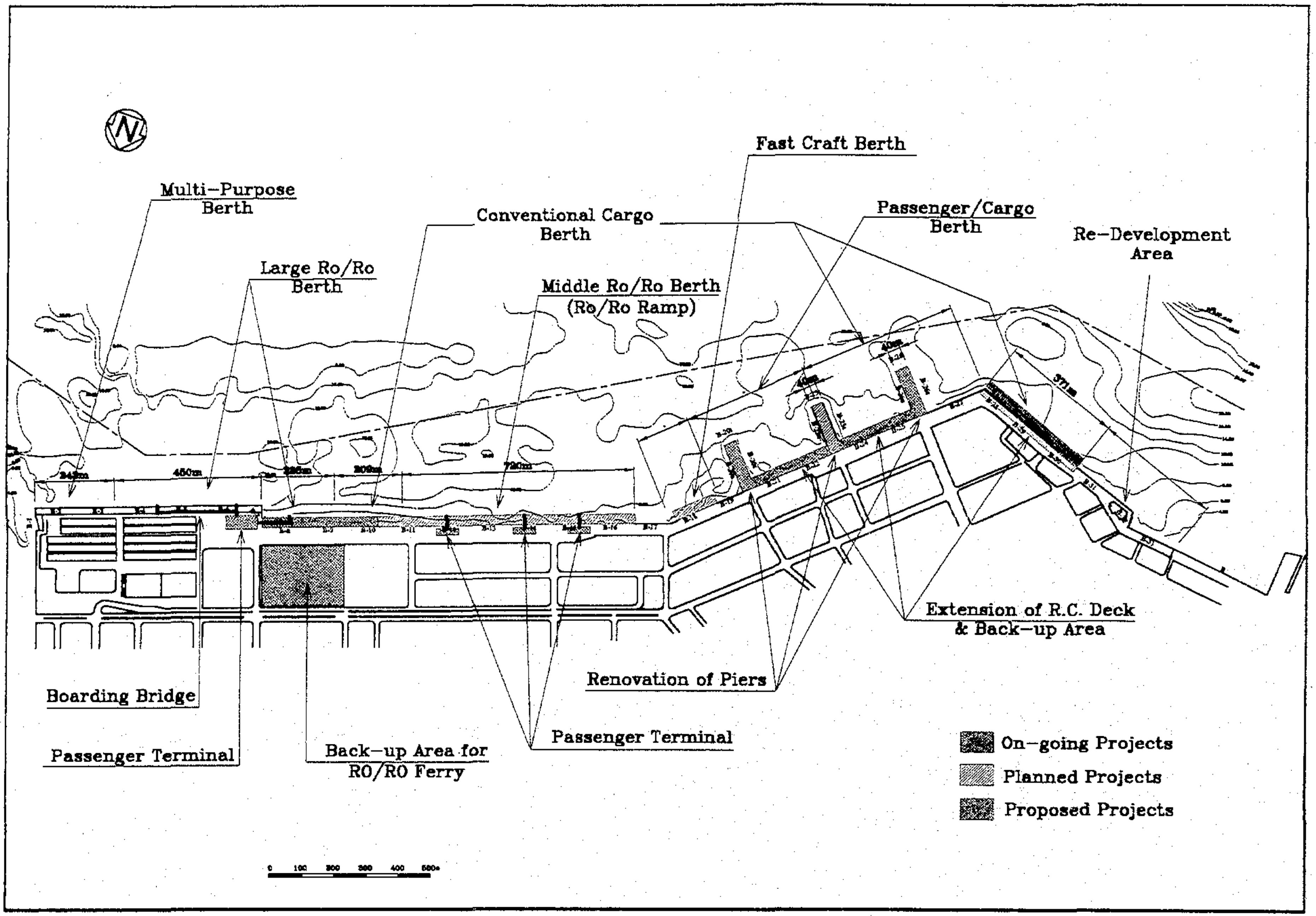


Fig. 2.5.4-3 Cebu Baseport Development Plan (2020)

(3) Timing of Expansion of Foreign Container Yard

At Cebu Baseport all foreign containers are handled at CIP. The total front quay length is 693 m, while the yard area is approximately 10has. Therefore the cargo handling capacity of CIP is determined by its marshalling yard capacity. The present marshalling yard capacity is obtained as below:

1) CIP Marshalling Yard Capacity

a. Total yard capacity of flat spots by TEU — 714 TEUs/Flat Spot

b. Ratios of export and import container

Export	40%	286 Flat Spots
Import	60%	428 Flat Spots

c. Average container stay in marshalling yard

Export Container	Average	2 Days
Import Container	Average	3 Days

d. Maximum efficiency of marshalling yard

Export Container = (b x Average stowing tiers)
= 286 TEUs x 3.0 Tiers = 858 TEUs/Day

Import Container = (b x Average stowing tiers)
= 428 TEUs x 3.0 Tiers =1,284 TEUs/Day

e. Annual Available Through-Put Efficiency of Marshalling Yard Usage Rate.

Export and Import Containers 70%

Total handling container per annual.

Export Container = (d x Annual Days x 0.7) ÷ Staying days
= (858 x 361 x 0.7) ÷ 2 days = 108,408 TEUs/Year

Import Container = (d x Annual Days x 0.7) ÷ Stayng days
= (1,284 x 361 x 0.7) ÷ 3 days = 108,156 TEUs/Year

Total Marshalling Yard Capacity 216,564 TEU/Year

According to the demand forecast, foreign container cargo throughput will reach almost 200 thousand TEUs in 2005.

Before the completion of the New Cebu port, the foreign container volume is assumed to be beyond the capacity of CIP. Therefore, temporary additional container yard area should be developed near PMO 1 area before 2005. The proposed candidate site is the vacant or hardly utilized private land behind B-8 and 9.

(4) Master Plan in 2020

1)The New Cebu Port

a) Foreign Container Terminal

Quay length	1,200m (4 berths)
Depth of back yard	500m
Water depth	13m
Gantry crane (Panamax)	10
RTG	37

b) Foreign Multi Purpose Terminal

Quay length	380m (2 berths)
Depth of back yard	100m
Water depth	10m

c) Service Boat Mooring Facility

2)Cebu Baseport

a) PMO1(-8.5m)

Multi purpose berth	243m (B2-3)
Large RORO ferry berth	450m (B3-7)
CIP area	10ha
Passenger terminal	7,000m2
Boarding bridge	400m

b)PMO2(-8.5m～-6.0m)

Large RORO ferry berth	225m (B8-9)
Conventional cargo berth	209m (B9-11)
Middle RORO ferry berth	720m (B11-17)
Additional back-up area	6ha
Passenger terminal	2,800m2 × 3

c) PMO3 (-6m)

Fast craft berth	165m (B18-19)
Passenger/cargo berth	694m (B20N-23N)

d)PMO4 (-7m～-5m)

Conventional cargo berth	807m (B23T-27)

5)PMO5(-7m～-5m)

Conventional cargo berth	371m (B28-30)

2.5.5 Navigation Aids

(1) Implementation of Secure order of Vessel Navigation

Generally, vessels arrive-in and leave-out Cebu Baseport through the South entrance channel because of the low mast clearance under the bridge at the North entrance channel. While both ways navigation is possible from off shore pilot station up to the Shell Oil Tank area, one way navigation from this point to CIP container berth for large vessels is recommended. This vessel navigation should be controlled by Harbor Master Office with VHF or signal flag.

(2) Existing Navigation Aids

Existing navigation aids (light house and light buoy) are listed in the following table.

Table: 2.5.5-1 Existing Navigation Aids

Place of Light House	Lighting Characteristic
South Entrance	
1. Prov, Capitol Dome	FIR 5s 61m 6M
2. Cuit Island	FL 5s 10m
3. Shell Tank Island	V.O (2) 4s 10m
4. Lauis Ledge off	FL 10s 16m 12M
North Entrance (Consolacion off Shore)	
1. Bagacay Pt	FL 5s 44m 20m
2. Bantollnao Pt	FL (3) G 15s 9m 10m
3. Mactan Bridge	ALT FL G (1) & (2) 5s

Source) Harbor Master Office and Chart No. INT-5733

(3) New Light Buoys and Beacons for Navigation Aids

The south entrance for Cebu Baseport and new north entrance for the New Cebu Port should be equipped with light buoys, light beacons and other navigation aids prescribed by the International Maritime Organization (IMO) regulations. The recommended implementation plan of the navigation aids are shown in Table 2.5.5-2, Fig. 2.5.5-1 (South Entrance for Cebu Baseport) and Fig. 2.5.5-2 (North Entrance for the New Cebu Port).

Table 2.5.5-2 Planned Light House and Light Buoy for Navigation Aids

No	New/Renewal	Description	Characteristic	Remark
1.	Renewal	Lauis Lege Light	FL.10s 16m 12M	According to UK Pilot the light structure was damaged, in 1967, and a temporary light is reported to be mounted on a metal pole. Caution must be taken not to mistake this temporary one for Mactan Air port Beacon. This error has caused the grounding of several vessels.
2.	Renewal	Light buoy exhibiting east patch of Lipta Bank	FL. G	Pilot side light buoy of Southern entrance channel
3.	New	Light buoy exhibiting West shoal of Mactan	FL. R	Starboard side light buoy of southern entrance channel
4.	New	Light Beacon	FL. R	Heading mark for approaching berth
5.	New	Panguian Light-House	FL.10s 20M	Substitute of Pangacay Light-House, which stands on the point. However, a large tank and a group of buildings stand on the North side of Bagacay Point and the light is obscured by these buildings when approaching from NE.
6.	New	Exhibiting South end of shoal	FL. R	
7.	New	Exhibiting North end of shoal	FL. G	
8.	New	Exhibiting East end of shoal	FL. W	

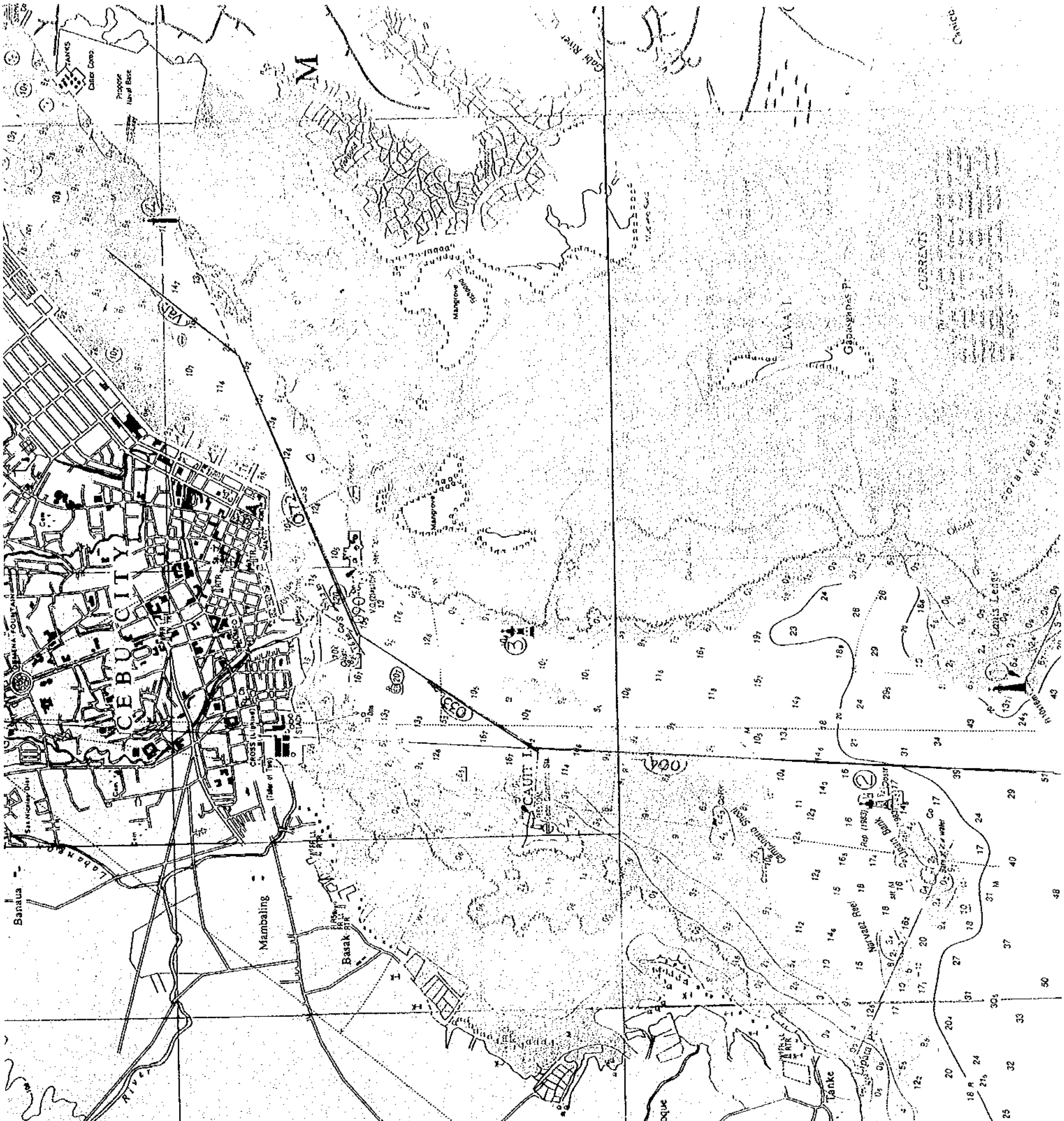


Fig. 2.5.5-1 South Passage

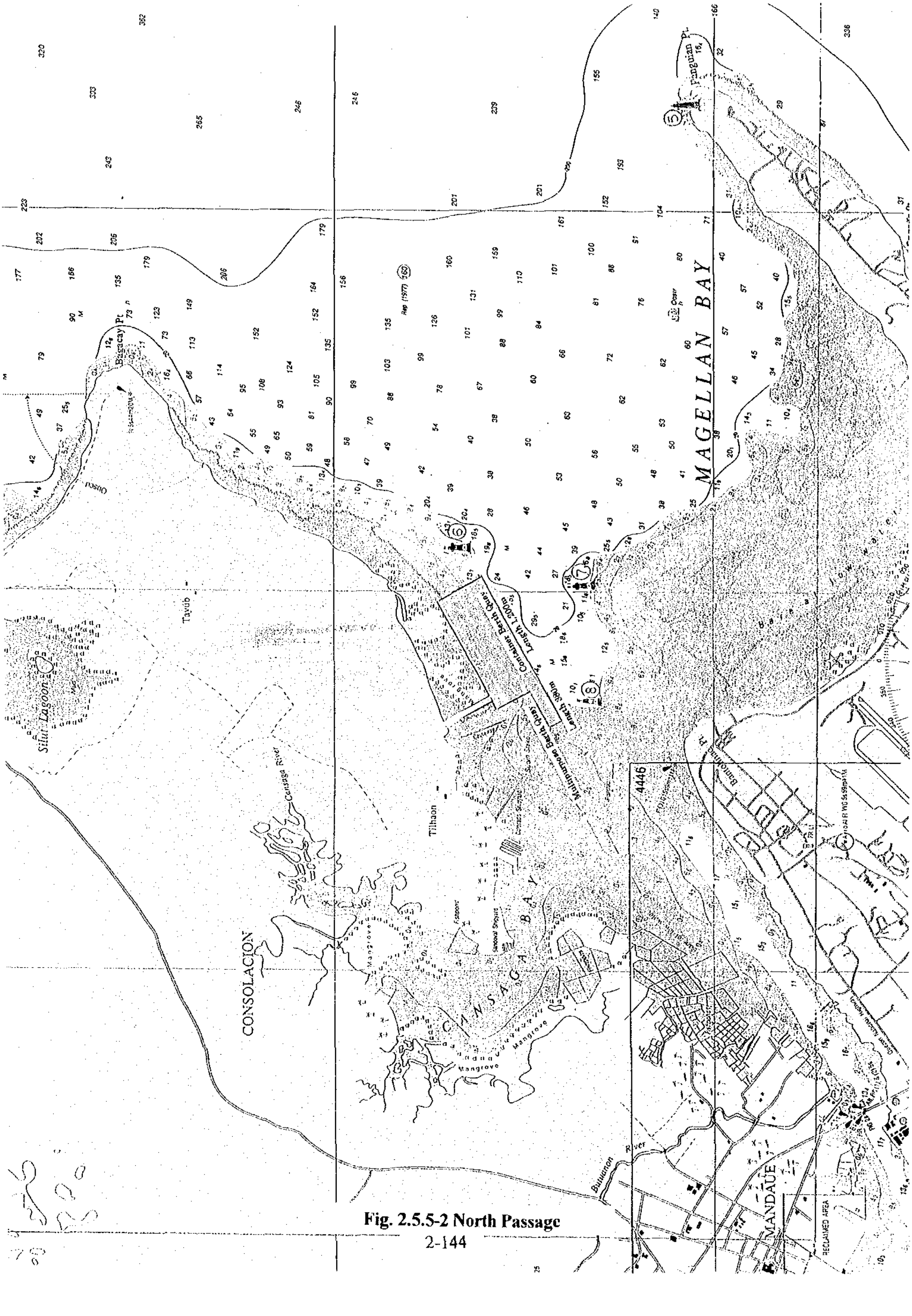


Fig. 2.5.5-2 North Passage

(4) Vessel Traffic Management System (VTMS)

1) General

Under the International Maritime Organization (IMO) regulations, it is mandatory for every port to have Vessel Traffic Management Service for the harbor. Vessels entering any port must follow "General Principles of Vessel Reporting System" contained in IMO guidelines.

These vessels carry the hydrographic chart of the harbor, which shows the details of the topography of the area. The master of the visiting vessel makes contact with Harbor Control through wireless communication, when the vessel is in the calling range. The Harbor Control then guides the vessel to come on its own up-to the port limits. The navigation of the vessel within the port limits is generally done by the local Pilots who have the necessary experience. The position of the vessel is then marked on the chart in the Harbor Control room, and its movement is monitored according to the sailing plan.

The traditional Vessel Traffic service described above just meets the minimum requirement of safety for navigation of vessel in the harbor. It, however, does not meet the requirements of navigation in any modern ports. The modern Vessel Traffic Management System (VTMS) should be equipped at modern ports to fulfill these requirements.

2) Benefits of VTMS

The modern Vessel Traffic Management System has two main purposes – safety and efficiency. It, therefore, results in:

- An increase in safety of vessels, crew and the port installations.
- An increase in efficiency due to better prediction and co-ordination of vessel movement resulting in fewer delays.

The safety aspect is addressed by taking necessary marine safety measures at the appropriate time. This requires acquiring advanced up-to-date information about navigational conditions such as available depth of water, current, winds, etc., and the position and status of all stationary and moving vessels in the harbor. This results in minimizing possible collisions, contact with side hulls and grounding.

The efficiency aspect is addressed through co-ordination of the port's marine operation resources e.g. fairways, tugs, berths, pilots, communication means, etc. The optimum use of these resources results in minimum transit time of vessel in the port. This improves the planning quality of the entire transport chain and increases the confidence of shipping companies in a particular port.

The basic benefits which the VTMS provides are;

- Acquisition and tracking of vessel in the harbor and its approach for effective monitoring of navigation in all weather and daylight conditions.
- Realistic, map-like presentation of vessel positions, on courses, speeds and absolute

movements within fairway environment.

- Obtaining and recording of pre-arrival and pre-departure information on all vessels calling at the port.
- Acquisition of all this information without vessel co-operation (i.e. without the help of on board equipment or interaction of vessel crew)
- Survey of absolute position of floating objects, such as buoys, beacons, and dredge, etc.

3) Configuration of VTMS in Cebu Port

The navigational channels of the South entrance (finger pier, marginal berths and Mactan Island exclusive berths) and North Entrance (New Cuba Port) are shown in Fig. 2.5.5-1 and Fig. 2.5.5-2. The VTMS area for Cube Harbor is proposed to be covered by three RADAR stations located at ①Lipta Pt ②Middle of Three ③Panguian Pt. The VTMS control and display systems will be provided at Port Traffic Control Center of Cebu Harbor Master office.

4) The main components of VTMS

Radar sensor system is comprised of 3 elements.

- One antenna and pedestal
- Dual transmitter / receivers
- One control and maintenance display

A radar is a line of sight device. An electric-magnetic pulse generated at the transmitter is radiated from the antenna via the Wave-Guide. The radiated pulse gets reflected after hitting the target such as vessels. This reflected Radar echo is received by antenna and sent to Control System. The radar range, therefore, is a function of the height at which the antenna is located. For example, a radar antenna mounted at 8 meters above sea level will have a radar horizon of only about 6.5 N/miles (12 K/meters) due to curvature of the earth.

5) Radar Data Processing System

At each radar sites, along with Radar Sensor Systems, a Radar Data Processing System will be provided whose main functions are target extraction and target tracking. Target extraction consists of eliminating noises, interference signals from other radar, rain/sea clutters and other unwanted signal and identifying real targets for further data processing.

Target tracking consists of evaluating and building tracks of the targets that will be tracked by each radar site. All the data from the remote radar site will be transmitted to the Control Center at Cebu Port by 3 separate communication links.

6) Communication Links

It is proposed to provide digital microwave links between the radar sites and Control Center at Cebu Port. This will enable transmission of raw radar data or extracted data to the Control Center for further processing. It will also facilitate remote control and operation of radar sensor and processing systems from the Control Center.

In addition to the above 3 microwave links, one more link will be provided between Cebu South and North Control Center. This will enable exchange of processed radar data between the two Control Centers and connect the two computers for data sharing.

7) Radio Direction Finder

VHF / DF Radio Direction Finding equipment is supplementary equipment proposed in the VTMS set-up. It determines the bearing of vessel, when it makes VHF contact with the Control Center. This information is fed to the VTMS computer for determining the vessels position accurately.

8) Differential Global Positioning System

Global Positioning System (GPS) is a space-based radio position and navigation system designed to provide three-dimensional position data worldwide. It consists of 21 satellites commissioned by the U.S. Department of Defense (DOD). This system is newly available to other civil users all over the world. A mobile GPS receiver indicates the position of the location in terms of latitude, longitude and altitude. Because of the deliberately introduced errors in the satellite message, GPS currently provides civil users with a horizontal position accuracy of 100 meters. To improve the position accuracy, it is necessary to establish a shore reference station, which can transmit the error correction in a given area. A mobile GPS receiver can then give a position accuracy of 2 meters to 10 meters. Such a system involving a shore reference station is called Differential Global Positioning System (DGPS).

It is proposed to have GPS for accurate positioning of survey vessels, dredgers and other important vessels using the port. Input from GPS will supplement the information obtained from radar sensors to give accurate position of vessels. The GPS will also be used for automatic recording of position of marine survey vessels to generate hydrographic maps.

9) Control Center Computer and Display Processing Systems

The two Control Centers at Cebu Baseport and New Port will have the computer systems for multi tracking and display processing following sub-systems.

2.5.6 Hinterland Road Development for the New Cebu Port

(1) Importance of Road Development

The site of the New Cebu Port has only narrow local roads. Development of an access road and hinterland road network is essential for the new port development. In particular, the New Cebu Port can play its role under the well linkage with the Cebu Baseport through an efficient road network. The access road to the main road is necessary for the New Cebu Port. Moreover, the Cebu North Coastal Road Project (Mandaue-Consolacion-Liloan), which includes a new bridge crossing Cansaga Bay, is essential for the development of the New Cebu port. The implementation schedule of Cebu North Coastal Road Project is from 2003 to 2006 and this project should be promoted on the schedule.

According to the foreign container traffic survey by manifests of October 2000, about 80% of export containers came from Mandaue city, Cebu city, and Mactan island. About 90% of imported containers went to the same areas. In this sense, the development of the Cebu North Coastal Road Projet is crucial for the new port development. (See Table 4.1.5-2 & -4)

(2) Access Road of the New Cebu Port

Required number of lanes of access road is obtained as follows.

1) Foreign Container Terminal

The planned traffic volume is obtained from the cargo handling volume as shown below.

Planned traffic volume (cars/hour)
= Annual cargo handling volume $\times$ a / W $\times$ b / 12 $\times$ c / 30 $\times$ (1+d) /e $\times$ f

where:

a	: Share by vehicles	= Car transportation / all transportation (1.0)
b	: Monthly variation	= Cargo volume in the peak month / average monthly cargo volume (1.2)
c	: Daily variation	= Cargo volume in the peak day / average daily cargo volume (1.5)
d	: Rate of related vehicles	= Number of related vehicles / number of total trucks (0.1)
e	: Loaded truck ration	= Number of loaded trucks / total number of trucks (0.5)
f	: Hourly variation	= Traffic generation per peak hour / daily traffic generation volume (0.1)
W	: Loading ratio of trucks	= Cargo transportation volume per loaded truck (one box)

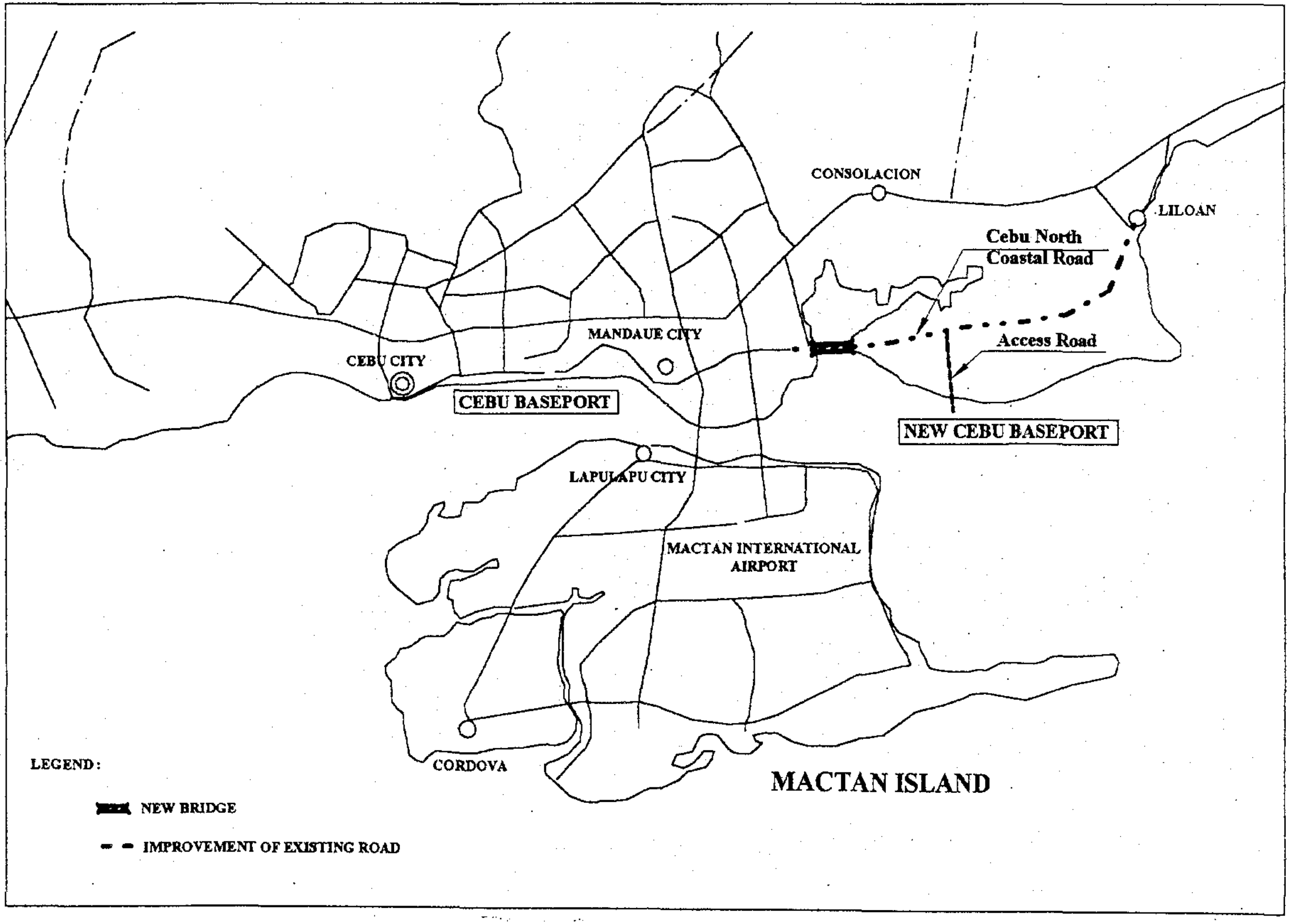


Fig. 2.5.6-1 Access Road and Cebu North Coastal Road

In 2020 the New Cebu container terminal will handle foreign containers of 1,319 thousand TEUs. 120 thousand TEUs out of 1,319 thousand TEUs will be transported by domestic container vessels. Therefore the planned traffic volume is obtained as shown below.

Planned traffic volume (cars/hour)
= 1,199 thousand TEUs / 1.5(box/TEU) × 1.0 / 1 × 1.2 / 12 × 1.5 / 3 0 × (1+0.1) /0.5 × 0.1
=879

2) Foreign Multi Purpose Terminal

The planned traffic volume is obtained from the cargo handling volume as below.

Planned traffic volume (cars/hour)
= Annual cargo handling volume × a / W × b / 12 × c / 30 × (1+d) /e × f

where:

a	: Share by vehicles	= Car transportation / all transportation (1.0)
b	: Monthly variation	= Cargo volume in the peak month / average monthly cargo volume (1.2)
c	: Daily variation	= Cargo volume in the peak day / average daily cargo volume (1.5)
d	: Rate of related vehicles	= Number of related vehicles / number of total trucks (0.1)
e	: Loaded truck ration	= Number of loaded trucks / total number of trucks (0.5)
f	: Hourly variation	= Traffic generation per peak hour / daily traffic generation volume (0.1)
W	: Loading ratio of trucks	= Cargo transportation volume per loaded truck (8MT)

In 2020 the foreign conventional cargo volume is forecasted at 756 thousand MT. The planned traffic volume is obtained as below.

Planned traffic volume (cars/hour)
= 756 thousand MT / 8MT × 1.0 / 1 × 1.2 / 12 × 1.5 / 3 0 × (1+0.1) /0.5 × 0.1
=104

c) Evaluation

The number of traffic lanes is decided by comparing the planning traffic volume of the access road with the standard design volume per lane in Japan which is given in Table 2.5.6-1.

Table 2.5.6-1 Standard Design Traffic Volume in Japan (Two Lanes)

Type of road	Standard design traffic volume (cars/hr)
Connection roads between ports and a main road (national highway etc)	650
Other roads	500

Table 2.5.6-1 Standard Design Traffic Volume in Japan (More than two lanes)

Type of road	Standard design traffic volume (cars/hr/lane)
Connection roads between ports and a main road (national highway etc)	600
Other roads	300

According to the total traffic volume (983 cars/hour) and standard design traffic volume in Table 2.5.6-1, four lanes will be necessary in 2020.

The required number of lanes of access road in 2010 is obtained from the same formula. The total traffic volume in 2010 is 392 cars/hour (326 from/to container terminal and 66 from/to multi purpose terminal) and two lanes will be necessary in 2010.

(3) Effect of the Generated Traffic of the New Cebu Port on the Cebu North Coastal Road Project

The plan of the Cebu North Coastal Road Project started before the determination of the new Cebu Port development site. Therefore the present estimated traffic volume of this road project does not include the generated traffic of the New Cebu Port. This road is planned to have four (4) lanes and a capacity of as 7,200 PCU (Passenger Car Unit) /hour from the road capacity standard in the Philippines shown in Table 7.5.6-2.

Table 2.5.6-3 Road Capacity for Multi-Lane High Ways and Expressways

Number of Lanes per Direction	Capacity, PCU/ Hour / Lane
1 (2-lane road)	1,200
2 (4-lane road)	1,800
3 (6-lane road)	1,750

The estimated traffic volume of this road project is as follows.

Table 2.5.6-4 Estimated Traffic Volume by Vehicle Type (Average Annual Daily Traffic)

Year		C/V/J	Jeepney	Buses	Trucks	Motorcycle	Tricycle	Total
2008-2013	Number	7,351	889	320	1,210	7,285	3,894	21.129
	PCU conversion Ratio	1.0	1.4	2.2	2.2	0.5	1.4	
	PCU	7,351	1,245	704	2,662	3,643	5,452	21,057
2013-2018	Number	12,650	1,356	489	1,674	10.333	5,523	21,129
	PCU	12,650	1,898	1,076	3,683	5,167	7,732	32.206

Note) C/V/J : Car/Jeep/Pick-up/Van

Source) Feasibility Study for the Cebu North Coastal Road Project

Assuming 0.1 as peak hour ratio /average day traffic, the traffic volume per hour is estimated as 2,101 PCU in 2008-2013 and 3,221 PCU in 2013-2018. Based on this trend, the number of PCU is estimated at around 4,900 in 2018-2023.

Applying PCU conversion ratio of 2.2 for the traffic volume of the New Cebu Port, because most vehicles are trucks, the number of PCU/day is estimated at 862 in 2010 and 2,163 in 2020. Adding this volume to the above mentioned estimation, it is assumed that the total number of PCU/day is approximately 3,000 in 2010 and 7,100 in 2020. As a result of the preliminary study, the traffic volume in 2020 is considered to reach almost the maximum capacity of the present Cebu North Coastal Road Project. The impact of the new Cebu Baseport development should be carefully taken into consideration for the long-term development plan of the Cebu North Coastal Road Project.

2.5.7 Restriction of Airspace

International Civil Aviation Organization (ICAO) has prescribed standards and recommended practice for aerodromes. Regarding these standards, obstacle limitation surfaces are regulated in order to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes to be conducted safely. Obstacle limitation surface defined by ICAO is shown in Fig. 2.5.7-1. But this is a standard and guidance of determining the extent of some obstacle limitation surface such as inner horizontal surface is also issued. Regarding the inner horizontal surface, all areas from the runway are included in this surface in the Philippines for the safety of aircraft navigation.

The site of the New Cebu Port is located to the northwest of the Mactan Cebu International Airport (MCIA) and the distance from the end of the north end of the runway is more than 2.5km. It is also far from the approach surface. Considering this location, the inner horizontal surface and the conical surface of MCIA affect the height limitation of the New Cebu Port. The area of the inner horizontal surface and the conical surface of MCIA is shown in Fig. 7.5.7-2

Height limitation at the New Cebu Port is assumed as follows.

(Within the inner horizontal surface)
Height limitation = 9.3m (Elevation of 22 Runway end by AIP) + 45m = 54.3 m
(Above MSL (mean sea level))

(Within the conical surface)
Height limitation
= 54.3m +(Distance from the periphery of the inner horizontal surface) x 5%
(Above MSL)

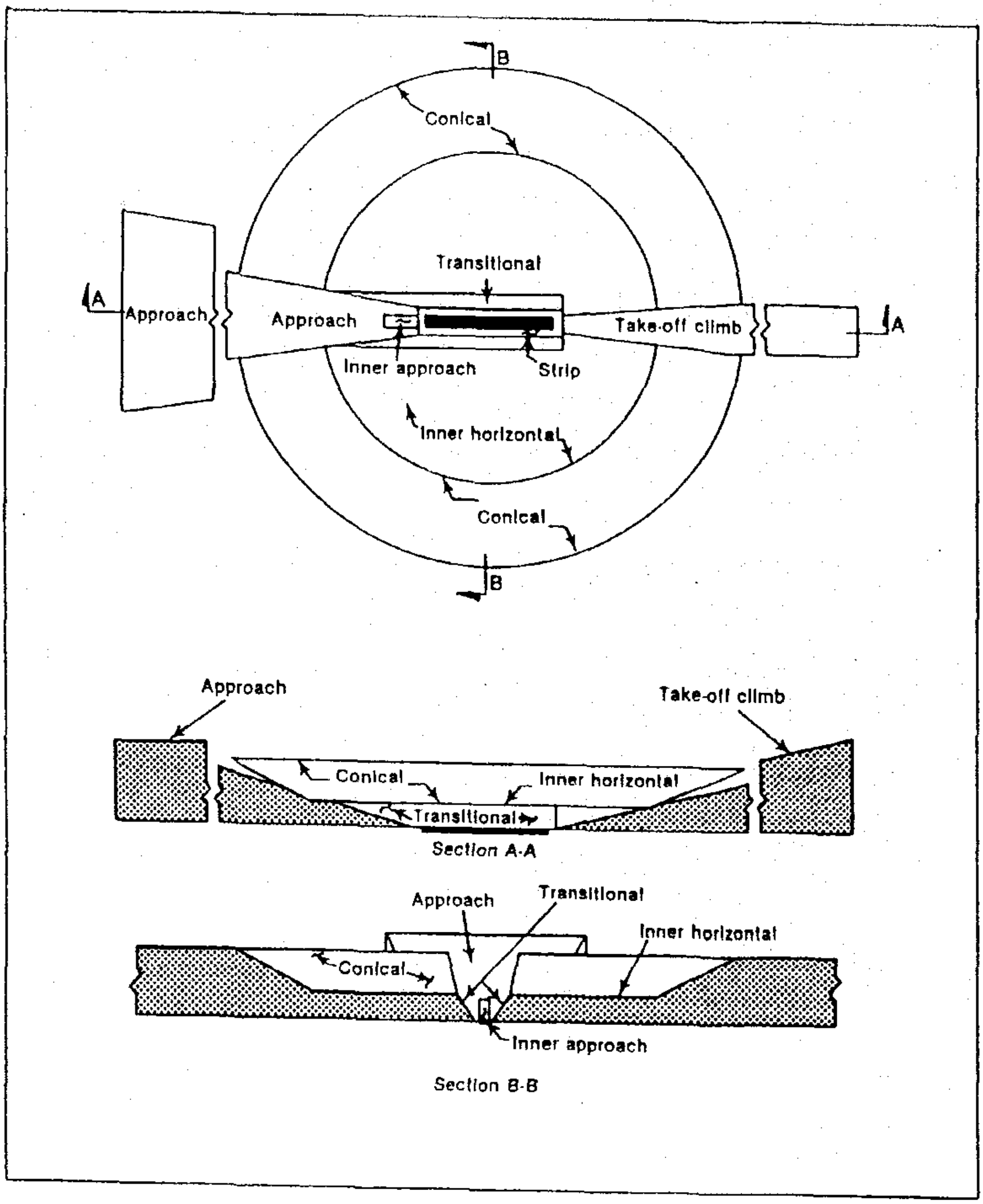
The short-term port development area is assumed under the inner horizontal surface. The height limitation above the top of quay level is calculated by the following formula.

Height limitation above the top of quay level
= Height limitation: MSL + Difference between MSL and MLLW (mean lower low water)
– Height of top at quay wall: MLLW

Difference between MSL and LLW: 0.6m
Height of top at quay wall: 3.0m (LLW)

The height limitation above the top of quay level is calculated as 51.9m. This limitation should be taken into consideration for the design of the quay cranes.

Meanwhile, the maximum vessel size calling at the New Cebu Port is assumed to be 40,000DW. According to the survey of the vessel size calling at Tokyo Bay in 2000, the maximum air draft (above sea level) of the container vessels under 40,000DW is below 50m. Therefore it is assumed that the height limitation will not affect the mast height of the calling vessels at the New Cebu Port.



(Source: International Standards and Recommended PRACTICES, Aerodromes Annex 14, International Civil Aviation Organization)

Fig. 2.5.7-1 Standards of Obstacle limitation Surface Defined by ICAO

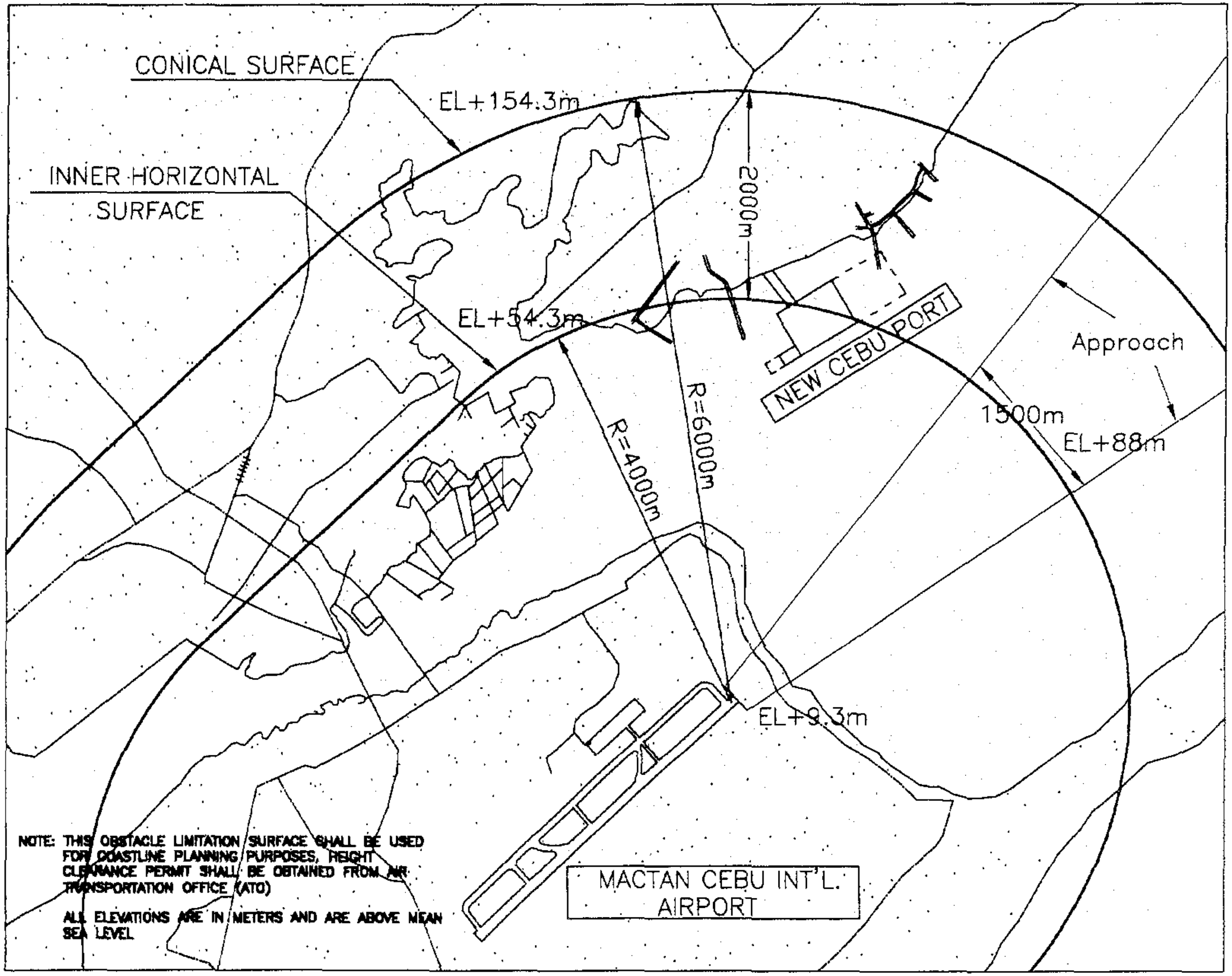


Fig. 2.5.7-2 Obstacle Limitation Surface of Inner Horizontal and Conical Surface of MACTAN CEBU International Airport