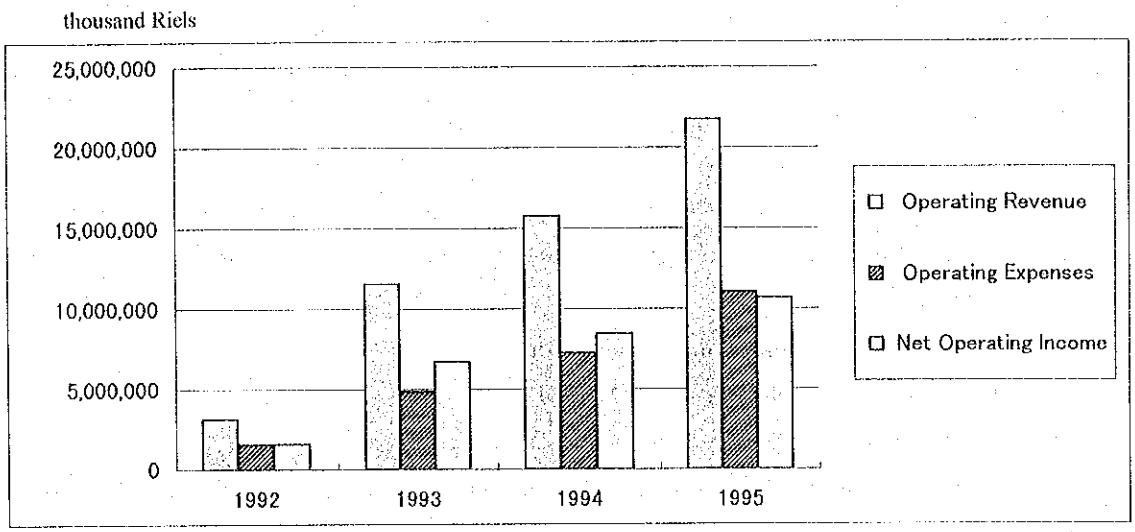


Source: Sihanoukville Port

Fig. - 2.5.2-5 Operating income

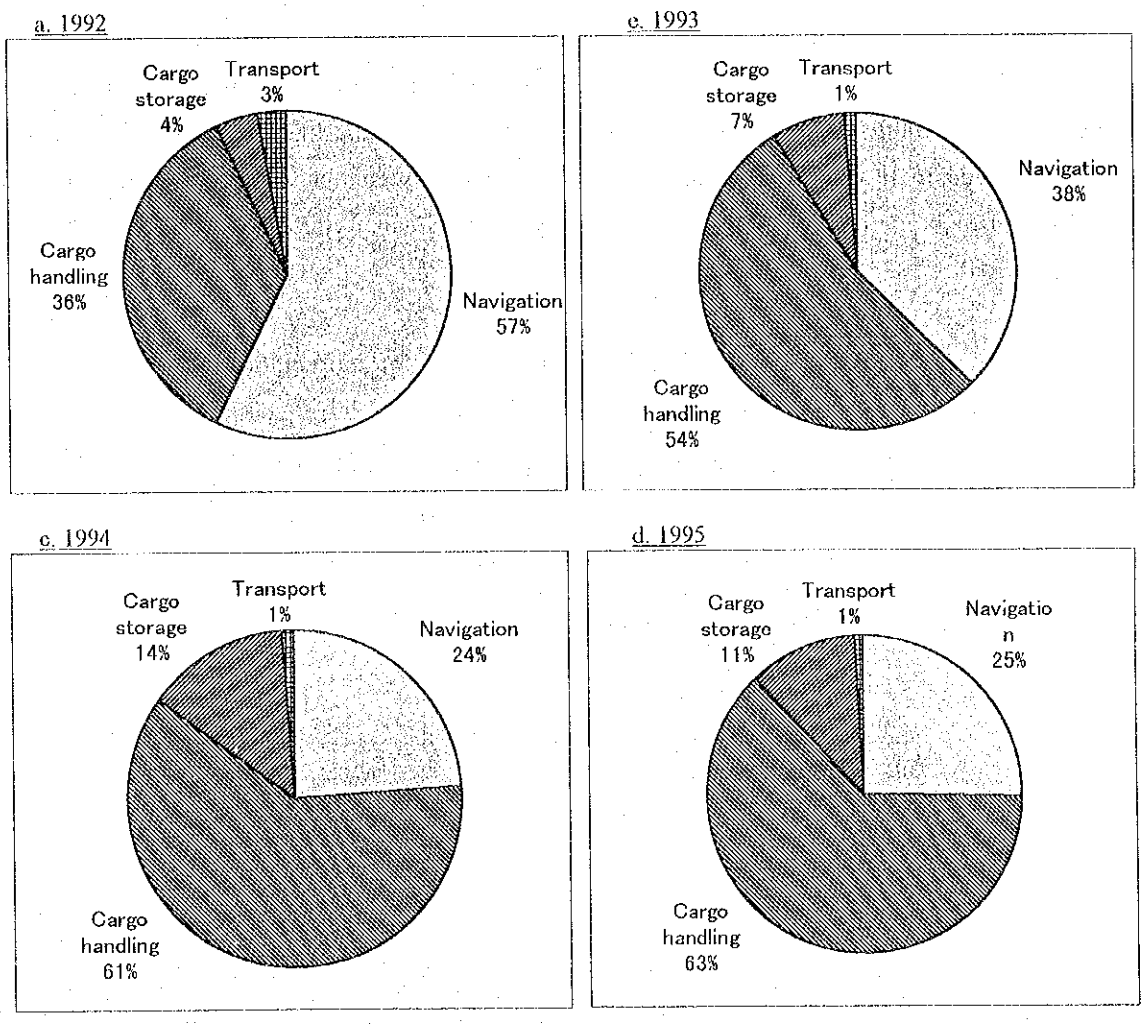


Fig. - 2.5.2-6 Operating revenue

c. Budget

The fiscal year is from January to December. The outline of budget-making procedure of Sihanoukville Port is as follows:

i) Personnel of Planning Office collect information from each office concerning the port situation. Then they prepare the summary next year's budget plan based on this information.
ii) The plan is submitted to Port Director.
iii) Then the plan is forwarded to MPWT.
iv) Approval of MPWT.
v) On the other hand, personnel of Accounting/Finance Office prepare the detail budget plan based on the summary budget plan.
vi) Then the plan is forwarded to MPWT through Port Director.
(It is not necessary to get the approval of MPWT.)

d. Method for depreciation of fixed assets

The policy of depreciation of fixed assets is based on the straight-line method. This method is more suitable for ports which require an enormous amount of initial investment than the fixed percentage method, because the depreciation of assets can be calculated on even bases annually over a comparatively long time. Durable years of Sihanoukville Port assets are shown in Table - 2.5.2-10.

Table - 2.5.2-10 Durable years of assets for depreciation

Item	Durable years
Wharf	50
Building	25
Floating equipment (Tugboat, Buoy)	16.67
Wheeled equipment (Cranes, Forklift)	10
Wheeled equipment (Truck)	10
Wheeled equipment (Trailers)	9.09
Computer equipment	10
Small equipment	12.5

Source : Sihanoukville Port

2.5.3 Port facilities

(1) Wharf, piers and other port facilities

a. General

Sihanoukville Port (former name was Kompong Som Port and changed to its present name in 1992) is located at the southeast entrance of Kompong Som Bay where several islands are lined up from north to south namely, Nord Is., Milien Is., Chenal Is. Koh Rong Is., Koh Rong Sam Lem Is., Paletuvires Is., and Koh Poah Is. which are sheltering the Kompong Som Bay from the west to southwest waves generated in the Gulf of Thailand as a natural breakwater.(see Fig. - 1-2) The location of the Port seems to be selected, considering the natural conditions mainly the effects of the Koh Poah Is., as natural breakwater and the natural navigation channel between Koh Poah Is. and mainland which connects offshore with a water depth of -8m. The development of Sihanoukville Port was started in the late 1950's under the assistance of French Government fund. As shown in Fig. - 1-3 the Port consists of three major parts, i.e.: Old Port, New Port and Oil Port. The first stage of the Port development was started in 1958 at Point Loune (see Fig. - 1-5) where, consisting of natural rock, the Old Port with jetty and some other on-land facilities were constructed. The Town of Sihanoukville was constructed following the Port development.

Location plans of existing port facilities are given in Figs. 1-5, to 1-7 and Fig. - 2.5.3 (1)-1. The description in this Section was made by using the name of facilities indicated in those Figures.

1) Chronology of the development of Sihanoukville Port

Based on information provided by Sihanoukville Port, a brief chronology of the Port development and recent activities of the rehabilitation works are summarized hereunder:

Feb. 29, 1956	Assistance of French Government for the development of the Old Port by Grant was concluded for the amount of FF 3.2 billion (equivalent to Riel 320 million) with a local counterpart fund of Riel 30 million. (Note: Exchange rate was FF 10 = Riel 1 approximately, at that time)
1956	Design of the Old Port by French companies: "De Dragages et de Travaux Publics" and " Eiffel"
May 16, 1956	Start of construction of the Old Port by French companies
Aug. 15, 1959	Completion of construction works of the Old Port
Apr. 1960	Opening of the Old Port
1960	Design of New Port by French Company : "Dumez" and local company "Chhrun"
1962	Completion of Warehouses No. 1 and 2
1964	Partial Dredging of Port Basin of New Port

1964	Completion of Tug Boat Basin Quay
1964-1965	Construction of South Breakwater
1965-1966	Dredging work of Port Basin of New Port by a dredger purchased by Port Office but the work was not completed due to mechanical troubles of the dredger
1960's	Construction of New Line (Phnom Penh - Kompong Som) of Cambodian National Railway (CFC)
1960's	Construction of National Road No. 4 (Phnom Penh - Kompong Som)
1965	Design of North Breakwater
1967	Construction of North Breakwater was started but abandoned later at the progress stage of 60%.
1967-1969	Construction of New Port by the budget of US$ 18,125,000.- including : 1) -10m Quay , 350m long 2) Warehouses No. 3, 4 and 5 3) Dredging of Port Basin of New Port 4) Reclamation of New Port area
1975-1979(?)	Construction of Groin at east side of New Quay
1986	Excavation in front of New Port Quay from -6m to -7.5m by using mobile crane with grab bucket
1987	Replacement of P/C beams by steel beams at the corner between Main Jetty and Access Bridge, and repair of P/C beams by mortar filling, at Old Port.
1989	Riprap filling underneath the P/C beams in between Pier Nos. P1 and P2 of Access Bridge of Old Jetty to recover the damaged span.
1994-1995	Restoration of the Warehouses No. 1, 2 and 4 by ADB sub-project T-23
1994	Procurement of container stacker trucks by ADB sub-project T-14
1994-1995	Procurement and installation of navigation light buoys and beacons along South Channel
1995-1996	Repairs of sea-side cantilever P/C slabs by ADB sub-project T-25
1995-1996	Construction of new fender system for the Old Jetty by ADB sub-project T-25
1995-1996	Upgrade container yard pavement and lighting by ADB sub-project T-24
May 1996	Repairs of P/C beams of the Old Jetty started by ADB sub-project T-25

2) Related on-going rehabilitation projects

Several rehabilitation works on the existing port facilities are being implemented under the ADB's special emergency rehabilitation project. An outline of the Port related rehabilitation project is given in following Tables.

Table - 2.5.3 (1)-1 Port related rehabilitation projects by ADB funding

ADB's Sub-Project No.	Project Title	ADB fund (mil. US$)	Descriptions
T-14	Procurement of Container Stacker Truck	0.4 (Delivery completed)	Procurement of a set of reach-stacker of a lifting capacity of 30 tons at 4 meters range with telescopic spreader for 20 and 40 footer containers.
T-23	Procurement and installation of warehouse roofing materials	0.3 (Repair works completed)	Repair of Warehouses No. 1, 2 and 4: i.e. 1) Replacement of roofing materials with new corrugated iron sheets and sky lights. Total area 20,800 m2. 2) Replacement of damaged roof truss and purlin and painting 3) Replacement of roof gutters and down spouts
T-24	Upgrade container yard pavement and lighting	1.7 (construction works completed)	1) Interlocking conc. block pavement: 22,760 m2 2) Storm drainage 3) Yard lighting including two sets of 350 KVA generators with power station.
T-25	Repairs of Old Jetty and New Fender System	1.4	1) Repair of cantilevered P/C slabs along sea-side edge of Main Jetty (works completed) 2) Installation of 25 sets of rubber fenders with fender piles (works completed) 3) Repair of damaged P/C beams with epoxy and Silane coating (works started in May 1996)

Source: Sihanoukville Port "Briefing Notes, Loan No. 1199-CAM, T.A. No. 1794-CAM"

Table - 2.5.3 (1)-2 Port related rehabilitation project by Cambodian local fund

Project No.	Project Title	Fund (mil. US$)	Descriptions
	Procurement and installation of Navigational Buoys	0.35 (Installation completed in 1995)	Procurement and installation of Navigation Aids consisting of: 1) Ten sets of light buoys along the South Channel 2) One set of light beacon on the south Breakwater 3) Front leading light at the west of old airfield

Source: Sihanoukville Port

b. Old Jetty

As mentioned above, the Old Jetty has a long history of construction and succeeding repair works. The basic documents of the original design, such as design calculation sheets, design drawings, construction supervision report etc. were, however, lost during the past civil-war time except for very limited outline of original design drawings (see Fig. - 2.5.3 (1)-4) and some other drawings showing the existing concrete outer-face dimensions of structures prepared by the ADB's project consultants. The structure of the Old Jetty is severely deteriorated mainly by damages on the P/C (Pre-stressed Concrete) beams. The mechanics of the damages on the P/C beams are presumed to be caused by reinforcing bars and/or P/C wires (called as "reinforcing

steel") corroded by the effects of aggressive saline permeation into the concrete members, while those steel materials embedded in the concrete were corroded and expanded within the surrounding concrete members and finally spalling of the concrete thus creating cracks on the surface of the concrete, and cyclic repetition thereof. To determine the present structural conditions of the Old Jetty, inspections were made by the Study Team through not only 1) visual inspection, but 2) saline contents test by taking some concrete test specimens from the P/C beams, which is indispensable, and by using some other test apparatus such as 3) Schmidt hammer to determine the concrete strength, and 4) electric tester (precision volt meter) to determine the corrosive activities of the reinforcing steels in the concrete. Structural evaluation was made based on those results of inspection and summarized hereunder.

1) Structure of Old Jetty

The Old Jetty consists of three parts, i.e.: Main Jetty, Access Bridge and Corner Junction located in between the former two structures (see Fig. - 2.5.3 (1)-2 and 3). Both the Main Jetty and Access Bridge are of similar structural type which consisted of T-shaped P/C beams on pneumatic caisson piers. The P/C beams of Corner Junction were seriously damaged by the waves which invaded from the north-west direction. Due to the funnel shape layout of the Piers A-1 of Main Jetty and P-6 of Access Bridge, waves were concentrated here and splashed the beams. The damaged beams thereof were replaced with H-steel beams in 1987. The caisson pier foundations were constructed on a bare rock sea-bed with water depths of -10 to -11m at intervals of 36m to each other as a span of P/C beams installed thereon (see Figs. - 2.5.3 (1)-4). As shown in the Fig., P/C beams are T-shaped with a bottom flange. This T-shaped section was adopted throughout the beam length. The thickness of the flange of T-shaped beam is, therefore, not increased at the supports of the beam. Pre-stressing was applied on the P/C beams longitudinally as well as the diaphragms and horizontal top flange of P/C beams connected with each other transversely, which is acting as top slabs. Fourteen (14) P/C beams of Main Jetty, which are numbered from No. 1 at the land-side to No. 14 at sea-side, are connected transversely by six (6) diaphragms into two lattice beam groups from No. 1 to 7 and No. 8 to 14, (see Fig. - 2.5.3 (1)-4) while, five (5) P/C beams of the Access Bridge are connected to each other also by six (6) diaphragms into one lattice beam group.

2) Inspection of existing structure

i) Visual inspection

Visual inspection was conducted throughout the P/C beams in accordance with the grading on the damage levels set up as shown below:

Grade 0 : No damage

Grade I : Small cracks. Spots of corrosion on concrete surface

Grade II : Slight damage. Cracks without corrosion. Slight swell of concrete

Grade III : Medium damage. Many spots of corrosion. Cracks with corrosion. Swelling of concrete

Grade IV : Heavy damage. Width of cracks are wide. Concrete is about to fall off

Grade V : Serious damage. Concrete sections lost. P/C wire severed. Depending on the load application, structure could collapse

Visual inspection of the P/C diaphragms was also conducted simultaneously, mainly on the fixing points of P/C wires. Condition of the P/C wires in the top slabs were not able to be inspected since the repair works of the cantilever end slabs were completed before the arrival of the Study Team in Cambodia. Due to the previous repair works (mortar patching works) on the P/C beams carried out with the assistance of former Soviet Union, some portions of P/C beams were not visible and the conditions of damages are not known. The actual damage level might be, therefore, more serious than this inspection results revealed.

The results of the inspection are summarized in Figs. 2.5.3 (1)-5 where the damage level of individual P/C beams are shown by schematic plans. The situation of the fixing points of diaphragms are also shown in the same plans.

ii) Saline contents in P/C beams

As described in the previous paragraph, the saline contents test on the P/C beams were deemed as fundamental and indispensable to know the effects of salt contents of the sea-water and to determine the corrosion on the embedded reinforcing steels.

a) Sampling of test specimens

Two (2) test specimens were taken at following points:

Test Specimen A : At the land-side face of bottom flange of P/C beam No.11 near to diaphragm D6 between Pier Nos. A5 and A6

Test Specimen B : At the land-side face of bottom flange of P/C beam No. 12 near to diaphragm D1 between Pier Nos A2 and A3.

b) Test procedure

The test procedure is described below:

i) Test specimen were taken by diamond core drilling machine.

ii) Size of test specimen : 32mm dia. x 200 mm long

iii) Test specimens were sent to a laboratory in Japan and sliced at every 1.5cm from the original concrete surface to determine the relation between depth of concrete (thickness of concrete cover) and saline contents

iv) Total saline contents were obtained for individual slices of test specimens in accordance with JIS (Japanese Industrial Standards) No. R 5202 " Method for Chemical analysis of Portland cement "

c) Results of saline contents test

The results of the test are summarized in Table - 2.5.3 (1)-6 and Fig. - 2.5.3 (1)-6. According to "Maintenance Manual of Civil Facilities of Power Plant (1989)", the grade of the deterioration can be determined by following figures of upper limits:

Grade of the deterioration	Percentage of total weight of salinity by Cl^-
(i) Upper limit of saline contents against damages on reinforcing steels	0.16 % $\leqq$ Cl^-
(ii) Upper limit of saline contents against corrosion on reinforcing steels	0.06 % $\leqq$ Cl^-

To compare the actual depth of the salt permeated into the P/C beam structure, abovementioned upper limit lines were drawn on the center cross sections of P/C beams where above test specimens were taken. The arrangement of the reinforcing steels shown in Fig. - 2.5.3 (1)-7 which is based on the actual survey and the original design data. As shown in Fig. - 2.5.3 (1)-7, which is self-explanatory, high level of salt contents has permeated much deeper than the depth where reinforcing steels were arranged. Considering the locations of the sampling of test specimens, as aforementioned, taken from the portion of "Grade III" of visual inspection, which is scattered at almost all parts of the Old Jetty, it can be concluded that the entire structure of the Old Jetty is seriously affected by the corrosion of the reinforcing steel.

iii) Non-destructive test

a) Electrochemical measurement

(i) Test procedure

In order to grasp the corrosion activity without damaging the concrete structure, natural electrical potential level on the P/C beams was measured by using a precision volt-meter which can measure to 1/100 milli-volt levels. While one terminal of the volt-meter was connected to the exposed portion of reinforcing steel, a copper-copper sulfate

half-cell connected with the other terminal was moved along the surface of P/C beams to measure the electrical potential. This test was conducted in accordance with the standard test method as designated by ASTM C876-91, which describes that " Half-cell potentials may in part or in whole reflect the chemistry of the electrode environment. For example, increasing concentrations of chloride can reduce the ferrous ion concentration at a steel anode, thus lowering (making more negative) the potential." The measurement of the potentials were made along the grid line prepared along the surface of P/C beams' bottom flange of Main Jetty, which schematic procedure is shown in Fig. - 2.5.3 (1)-9.

(ii) Results of half-cell potentials test

The test results are summarized in Fig. - 2.5.3 (1)-8 in a form of "Equipotential contour map" which indicates more negative values than -300 mV (milli-volt) over the entire area and at some areas even reached -700 mV.

According to the information attached to ASTM C876-91 the following interpretation of results on the levels of potentials are suggested:

Potential level		Interpretation
aa.	≦ - 200 mV	There is a greater than 90 % probability that no reinforcing steel corrosion is occurring
bb.	-200 mV to -350 mV	Corrosion activity of the reinforcing steel is uncertain
cc.	≦ -350 mV	There is a greater than 90 % probability that reinforcing steel corrosion is occurring

Hence, the actual measurement results show much more negative levels than the above levels of interpretation, and it can be concluded that the Old Jetty structure is seriously affected by the corrosion of the reinforcing steel.

b) Concrete strength

Concrete strength was investigated by using a Schmidt Hammer on the bottom flange of the P/C beams. The test results are summarized in the following Table, which shows large fluctuations with average of 395 kg/cm^2 to 600 kg/cm^2 or bigger. Considering the long duration of concrete hydration since the structure was built, some results among above strength seems low.

Table - 2.5.3 (1)-3 Concrete strength test by Schmidt hammer

Test No.	Pier Location (between)	Beam No.	Position	Concrete strength (kg/cm^2)		
				Max.	Min.	Average
1.	A6-A7	14	Bottom face 1)	> 600	300	460
2.	A5-A6	11	Sea-side face 1)	>600	420	560
3.	A5-A6	11	Bottom face 1)	>600	420	>600
4.	A5-A6	Dia.-5	Botom face 2)	550	185	395
5.	A5-A6	Dia.-5	Side face 2)	>600	260	460
6.	A2-A3	12	Bottom face 1)	>600	320	550
7.	A2-A3	12	Sea-side face 1)	>600	250	440

Note: 1) Bottom flange of P/C beam 2) Cast-in-situ portion of P/C diaphragm

3) Structural evaluation of Old Jetty

i) Summary of damages on the Old Jetty

Based on the above inspection and test results major damages on the Old Jetty structures are summarized below:

a) Nine (9) P/C main beams (7%) out of 132 main beams, or six (6) lattice beams groups (29%) out of 21 lattice beams groups are apparently damaged and in serious condition. In those portions, more than half of the concrete sections in the area of the bottom flange are lost and some of the P/C cables are cut or no longer effective.

b) The condition of P/C beam No. 4 on the Access Bridge between Pier Nos. 5 and 6 is precarious especially among others, since the damage has occurred at the center span. Collapse of the bridge might occur depend on the loading conditions thereon, such as, for instance, heavy load of locomotive, cargo handling equipment or any other similar loads.

c) Generally, except for above Beam No. 4, the damages and deterioration on the beams occurred at both ends of each beam where splash of the sea waves constartly wet the concrete surface. Cracks due to bending moment were also not observed.

d) At 41 ends (43%) of diaphragm members out of 96 diaphragms, on which fixing points of P/C cables were located, were damaged by ships berthing. The pre-stressing of the damaged diaphragms should be deemed to be loosened and are no longer effective as a lattice beam structure.

e) According to the Port Office, 30% of the sea-side cantilever P/C slabs along beam No. 14 were damaged by moored ships and replaced with R/C (reinforced concrete) slabs, thus they are no longer effective as P/C slabs

f) Some of the diaphragms connected to the seriously damaged P/C beams , in between Pier Nos. A4 and A5, and Pier Nos. A6 and A7, were cracked in consonance with the damages of the main beams where, probably, deflection of the main beam has occurred.

g) In addition to above visually inspected damages, saline contents test and other destructive tests results imply very possible invisible damages to the reinforcing steel. The development of those damages are presumed to grow worse in the future due to the effects of the salt permeated into structural members.

ii) Structural anlysis of the Old Jetty

Presuming the conditions, structural anlysis was made for the following three Cases:

Case I : Original structural conditions (without damages), uniform load of 1.5 t/m^2 is presumed

Case II : Present structural conditions i.e.: one half of bottom flange concrete and P/C cables are lost under the same loading conditions as Case I.

Case III: Present structural conditions i.e.: one half of bottom flange concrete and P/C cables are lost. Under the condition, maximum applicable uniform load was calculated.

The results of the structural analysis for above 3 cases are given in the following Table.

Table - 2.5.3 (1)-4 Results of structural analysis

unit :kg/cm^2

Case No.	Portion	Stress	Allowable stress	Remarks
Case I	Top of upper flange	133.6	< 140.0	OK
	Bottom of lower flange	-4.0	> -15.0	OK
Case II	Top of upper flange	145.1	> 140.0	No!
	Bottom of lower flange	-47.5	< -15.0	No!
Case III	Top of upper flange	118.6	< 140.0	Under uniform load up to 0.9 t/m^2 (*)(**)
	Bottom of lower flange	-14.6	> -15.0	

(*) Presuming no more development of damages on the structures.

(**) Equivalent to approx. 16 ton/m(transversal direction) of concentrated load.

iii) Diagnosis of the existing Old Jetty structures

Generally, the behavior of P/C (pre-stressed concrete) structures affected by corrosion is difficult to determine. Without fear of making any errors, however, it is concluded that taking the present conditions into consideration, the structure of the Old Jetty will be usable for the coming several years with careful operation under certain restrictions of loads.

c. Other port facilities

An outline of other port facilities are summarized in Table below. For the location of individual facilities, see Fig. - 2.5.3 (1)-1.

Table - 2.5.3 (1)-5 Other Port facilities of Sihanoukville Port

No	Name of facilities	Major dimensions	Built in	Description
1.	New Quay (New Port)	-Total length : 350m -Nominal water depth :-10m *1)	1969	- Concrete block type (see Fig. - 2.5.3 (1).-10) - Condition of structure is good except for accessories such as fenders and ladders which are missing - Present water depth is -7m to -8m.
2.	Tug Boat Basin	- Total length : 270m - Nominal water depth :-3m	1964	- Concrete block type (see Fig. - 2.5.3 (1)-11) - Condition of structure is good, except for some portions where deflection of the coping concrete has occurred - Present water depth -1.5m to -2.5m
3	North Breakwater (north)	- Total length Plan : 3,117.5 m Actual: 2,800 m	1967 ~?	- Riprap stone mound type.(for original design see Fig. - 2.5.3 (1)-12) - Construction was abandoned at 60% of progress stage. (for actual section see Fig. - 2.5.3 (1)-13) - Port entrance was left with opening of 500m as against the design width of 200m.
4.	NorthBreak-water (south)	- Total length: 550 m	1967	- Riprap stone mound type.(for typical section see Fig. - 2.5.3 (1)-12)
5.	South Breakwater	- Total length: 300 m	1965	- Riprap stone mound type - 80m of port side face is vertical wall type with concrete blocks as a Tug Boat Berth
6.	New Port Basin	-Original design depth :-10m with 500m radius	1969	- Dredging works was abandoned - Present water depth;: -7 to -8 m
7.	South Navigation Channel	- Length : 5500 m - Width : 80-100m - Depth : -8.4 m	_	- Natural channel - At some portions, sea bed is bare rock

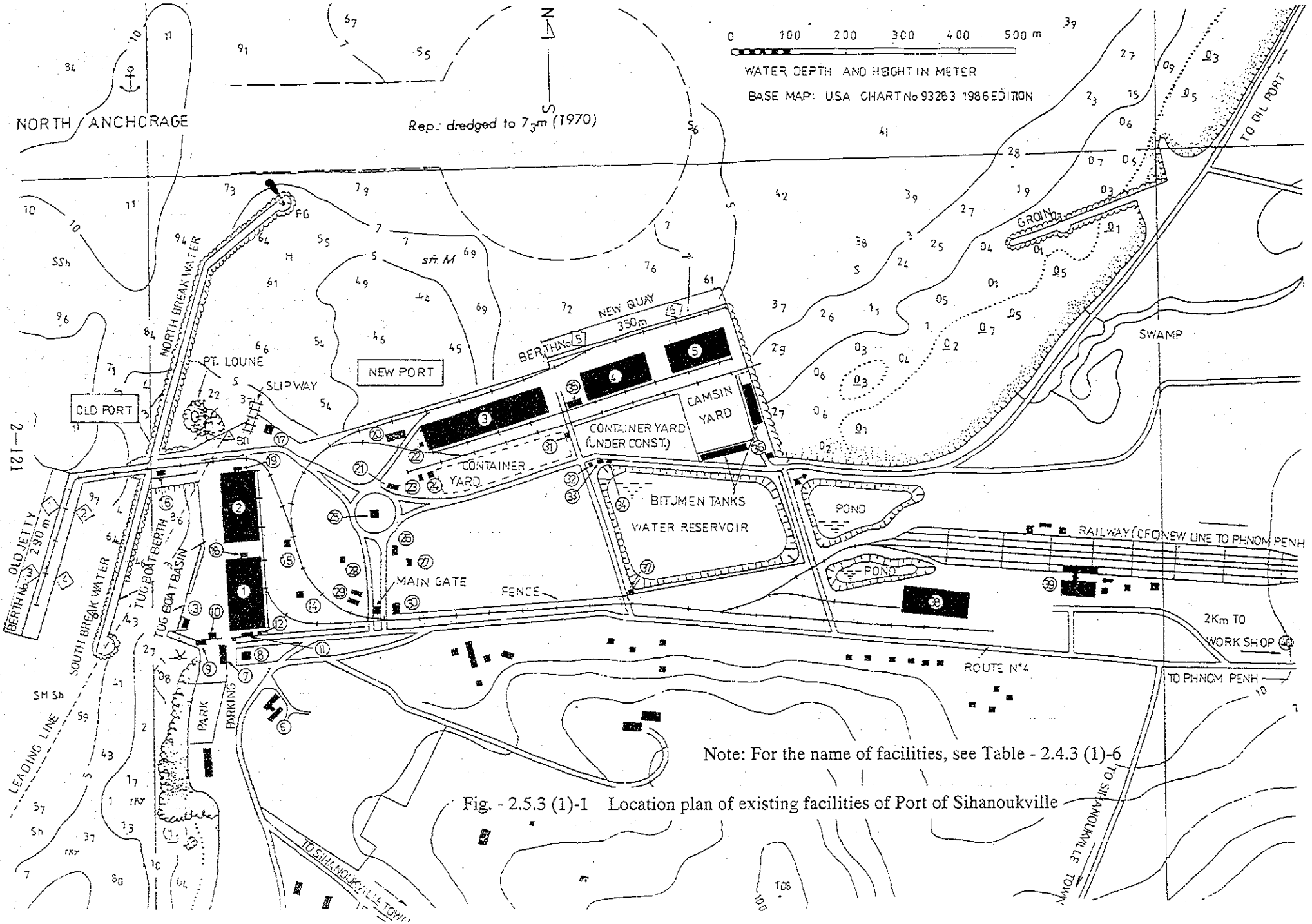
*Note: *1) The structural water depth is approx.-9.5m.*

(2) Yard and sheds

Out of 15 ha existing port area, only the container yard with approximately 2.3 ha area is paved with inter-locking blocks. Other areas are bare soil yards. A brief of existing buildings in Sihanoukville Port are shown in Table - 2.5.3 (2)-1. For the location of the individual buildings see Fig. - 2.5.3 (1)-1.

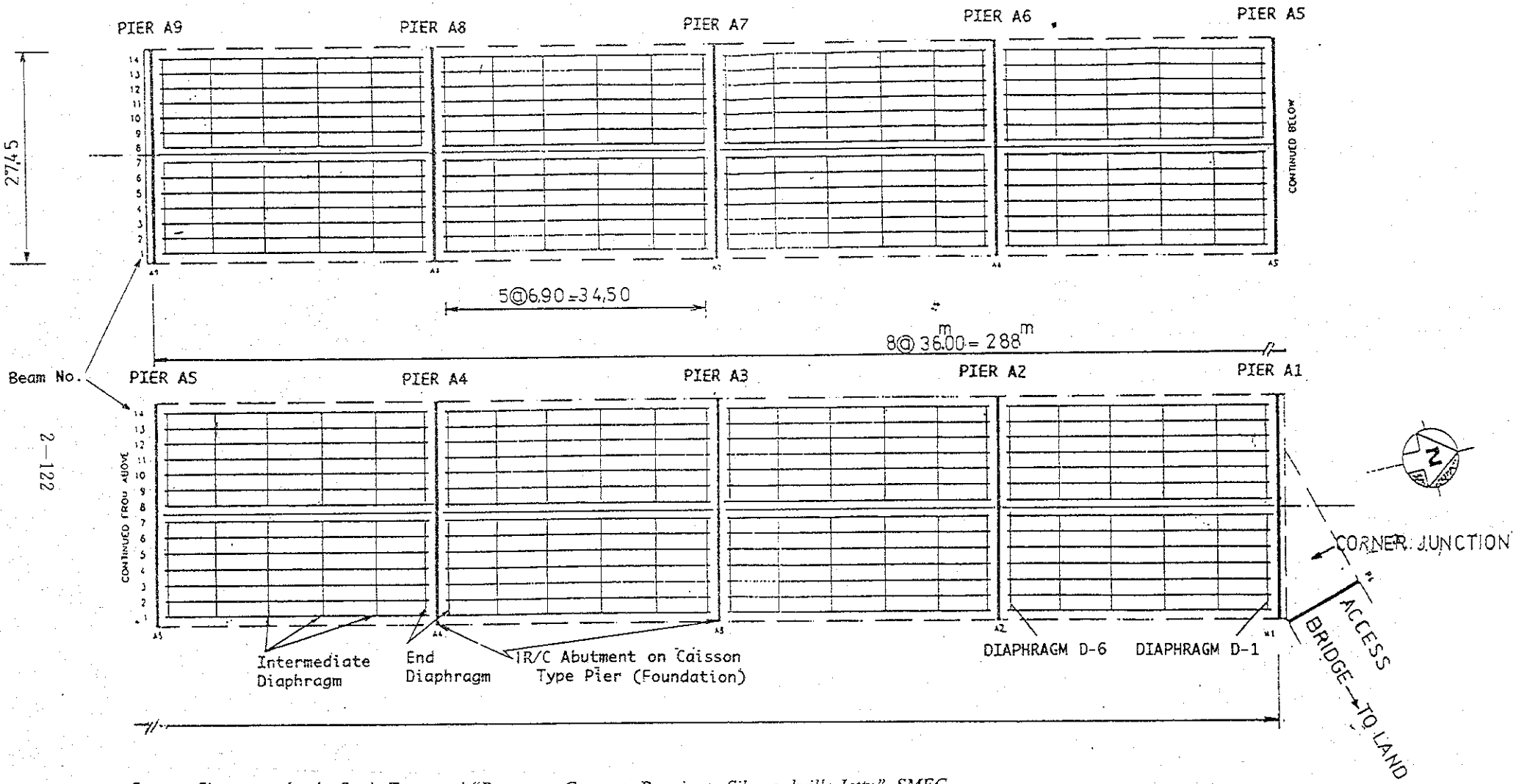
As described in Table - 2.5.3 (1)-1 warehouses No. 1. 2. and 4 were repaired recently for the roofing and roof trusses under ADB funds.

At the point of 2 km from the port area along the national road No. 4, a work shop complex owned by Sihanoukville Port is existing. (See Fig. - 2.5.3 (1)-14).



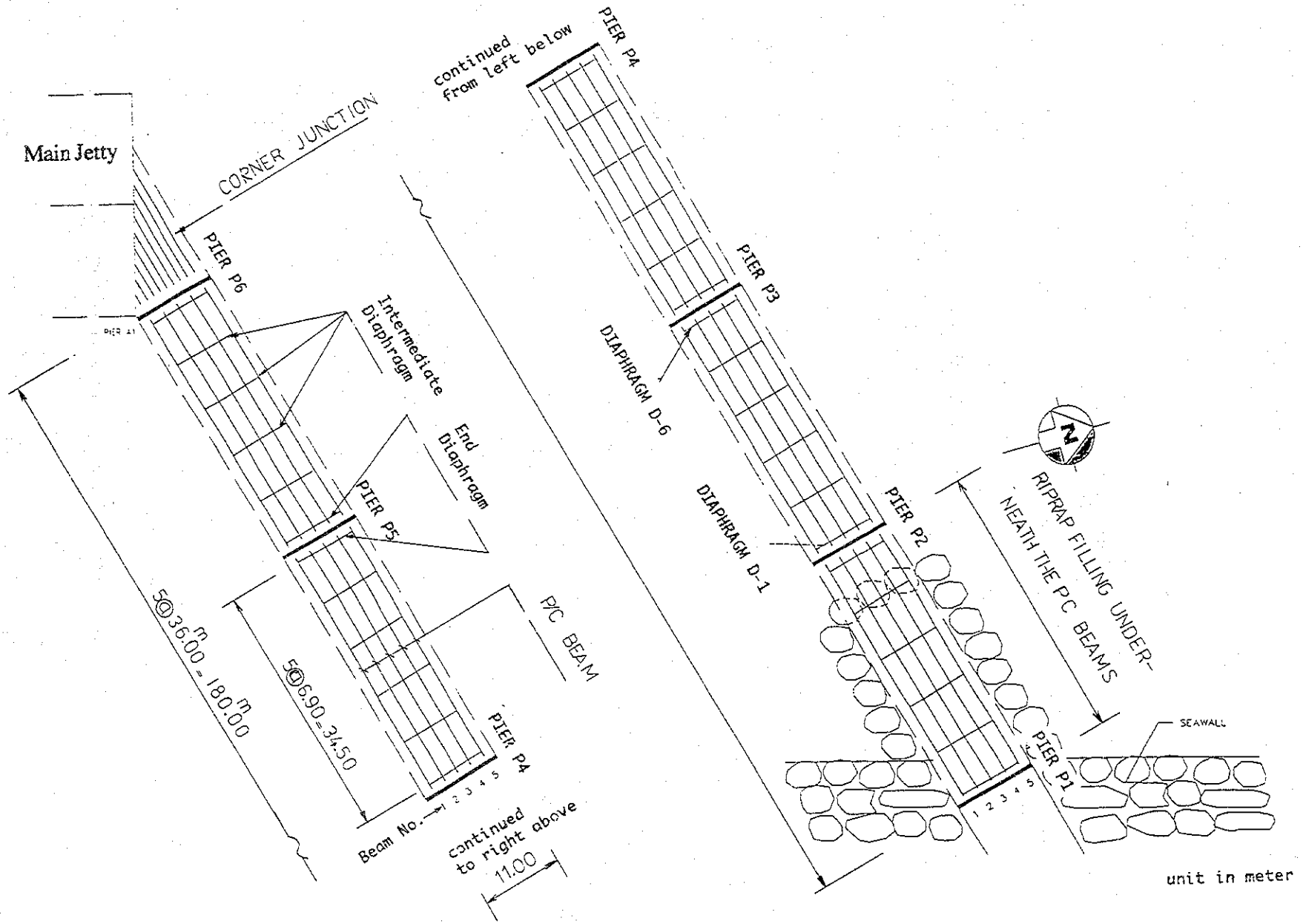
Note: For the name of facilities, see Table - 2.4.3 (1)-6

Fig. - 2.5.3 (1)-1 Location plan of existing facilities of Port of Sihanoukville



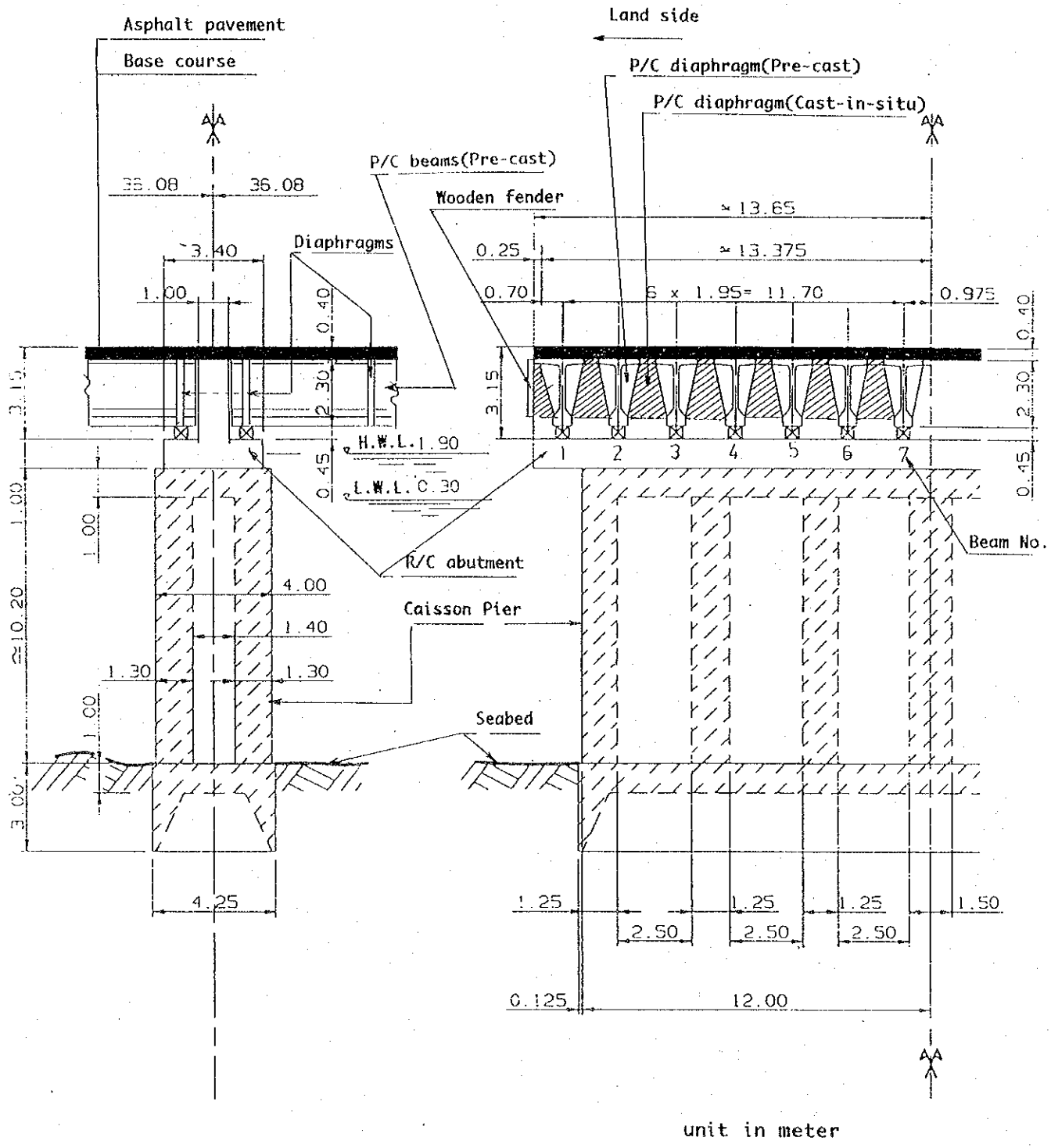
Source: Site survey by the Study Team and "Report on Concrete Repairs to Sihanoukville Jetty", SMEC

Fig. - 2.5.3 (1)-2 Structural layout plan of Main Jetty (Old Port)



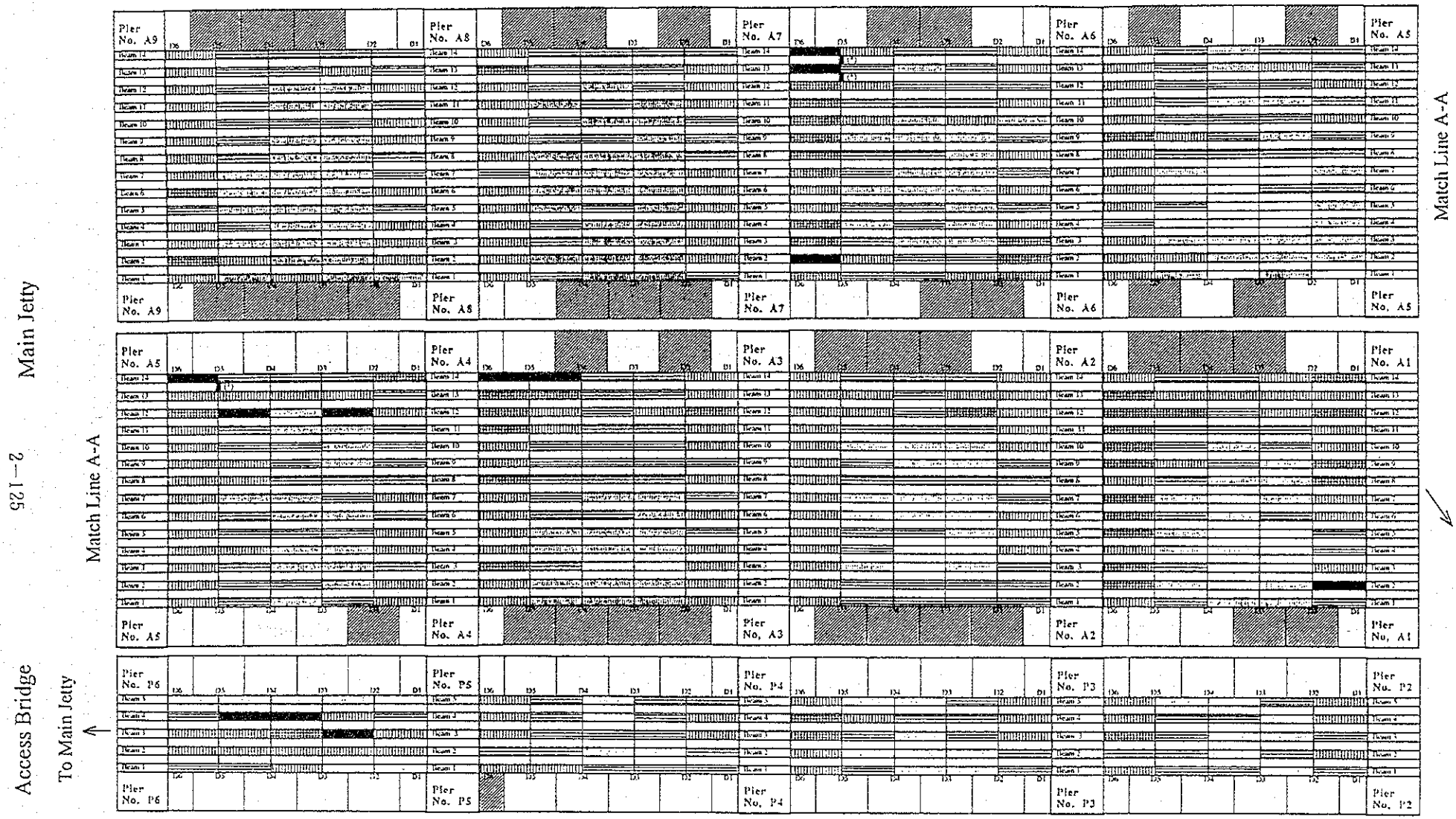
Source: Site survey by the Study Team and "Report on Concrete Repairs to Sihanoukville Jetty", SMEC

Fig. - 2.5.3 (1)-3 Structural layout plan of Access Jetty



Source: Original design (Data; by the courtesy of DUMES, France)

Fig. - 2.5.3 (1)-4 Typical section of Main Jetty (Old Port)



Legend : 1. Grade of deterioration (damage) on structural members

:Grade 0 :Grade I :Grade II :Grade III :Grade IV :Grade V

2. D1 to D6 show Diaphragm No. of which shaded column shows seriously damaged fixing point(s) of P/C strand.

Date of inspection: April 24 to 27, 1996

Fig. - 2.5.3 (1)-5 Results of visual inspection of Old Jetty

Table - 2.5.3 (1)-6 Saline contents and concrete cover (depth)

Depth(cm)	Specimen A	Specimen B
1.5	0.224	0.364
3.0	0.174	0.344
4.5	0.114	0.302
6.0	0.098	0.192
7.5	0.046	0.158
9.0	0.010	0.114
10.5	0.010	0.058
12.0	0.010	0.022
13.5	0.024	0.010
15.0	0.010	0.010

Specimen A: Beam No. 11
Pier Nos. A5 andA6
Specimen B: Beam No.12
Pier Nos.: A2 and A3

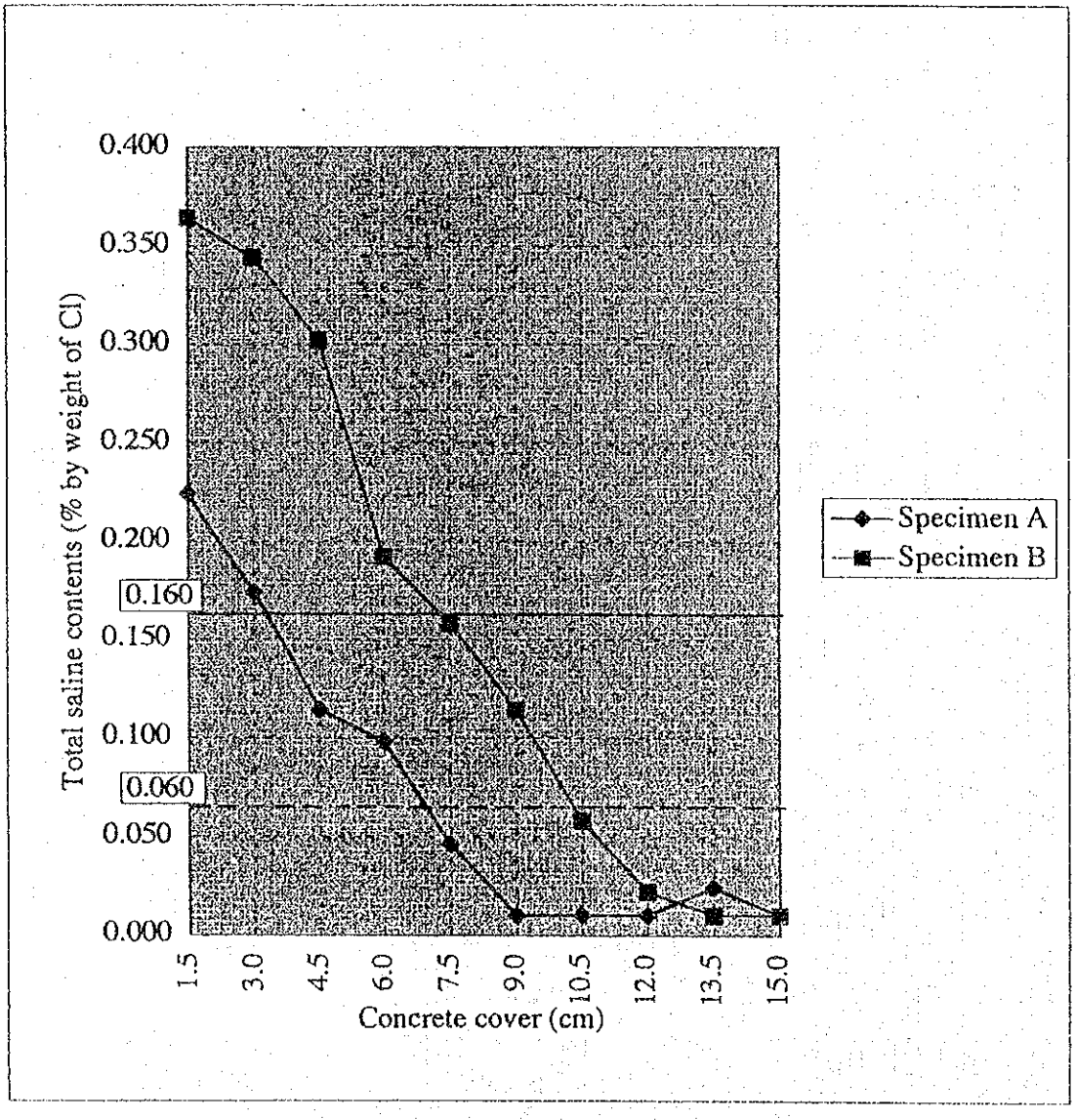
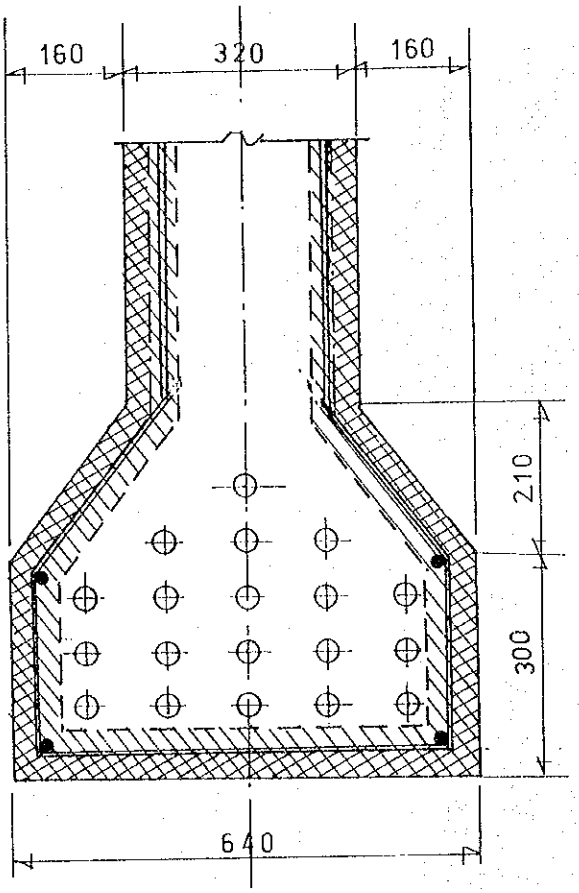
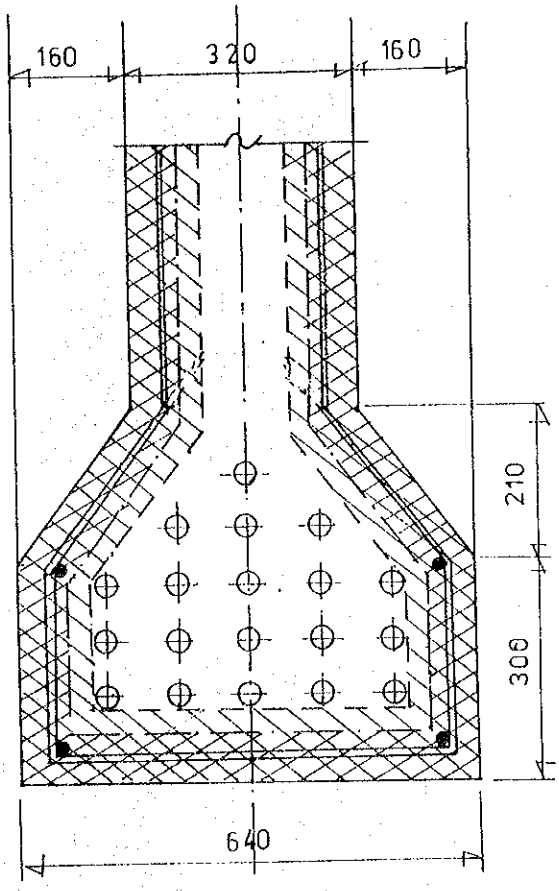


Fig. - 2.5.3 (1)-6 Saline contents and concrete cover depth



Section of Beam No. 11
between Pier Nos. A5 and A6
(Specimen A)



Section of Beam No. 12
between Pier Nos. A2 and A3
(Specimen B)

Scale 1:10 mm

LEGEND

: Reinforcing bars (DØ10 ~ 13mm)
: P/C cables (Ø7mm x 12wires/cable)
: Area of permeated total saline contents more than 0.16% by weight
: Area of permeated total saline contents more than 0.06% by weight

Note: 1. For the permeated depth of salt, see Fig. 2.5.3 (1)-6
2. Concrete dimensions, based on actual measurement
3. Size and arrangement of P/C cables, based on actual measurement and original design data.
4. Cross section at center span of lower flange of longitudinal beam

Fig. - 2.5.3 (1)-7 Cross section of P/C beam and area affected with permeated salt

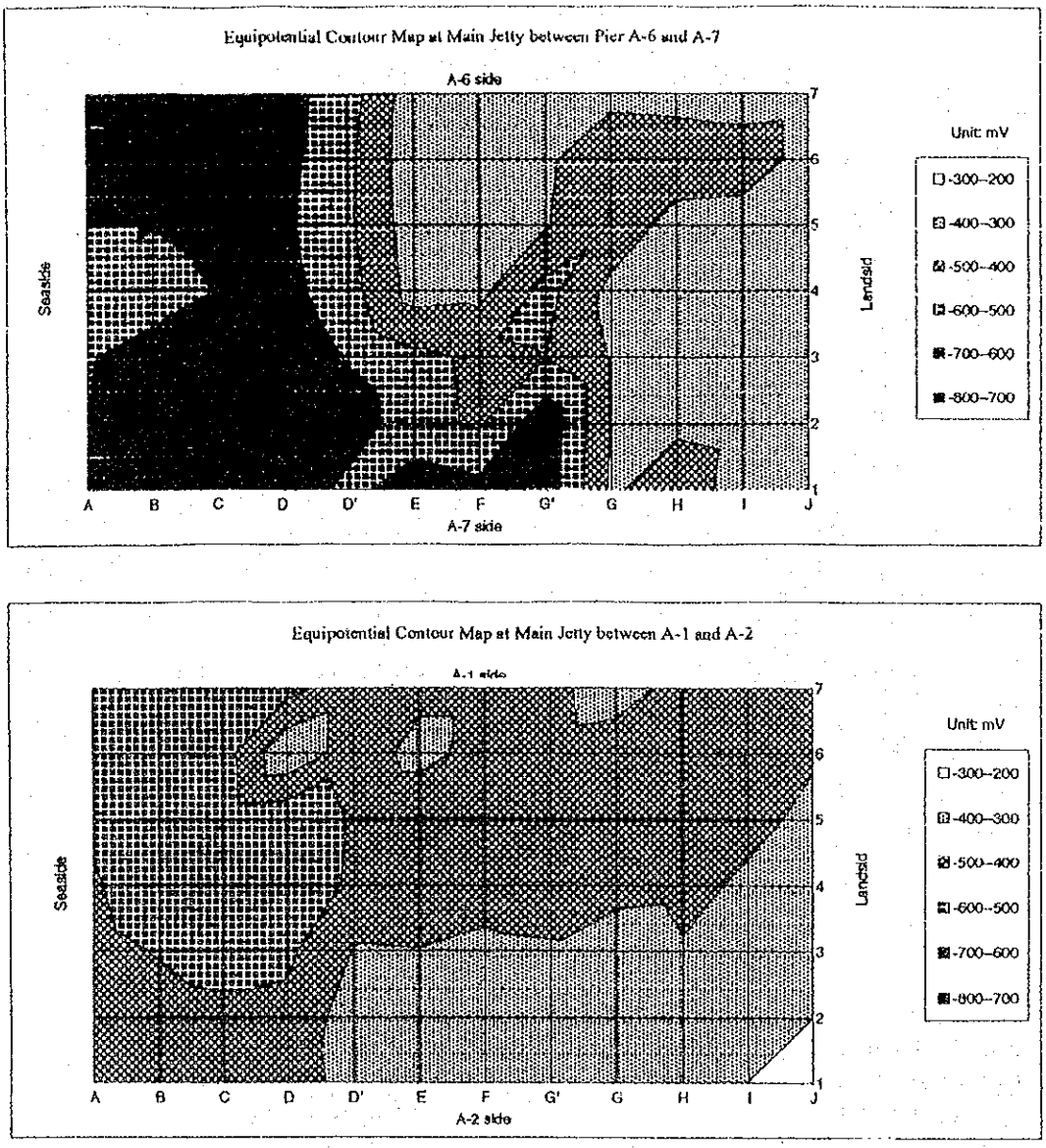


Fig. - 2.5.3 (1)-8 Equipptential contour map on the P/C beam

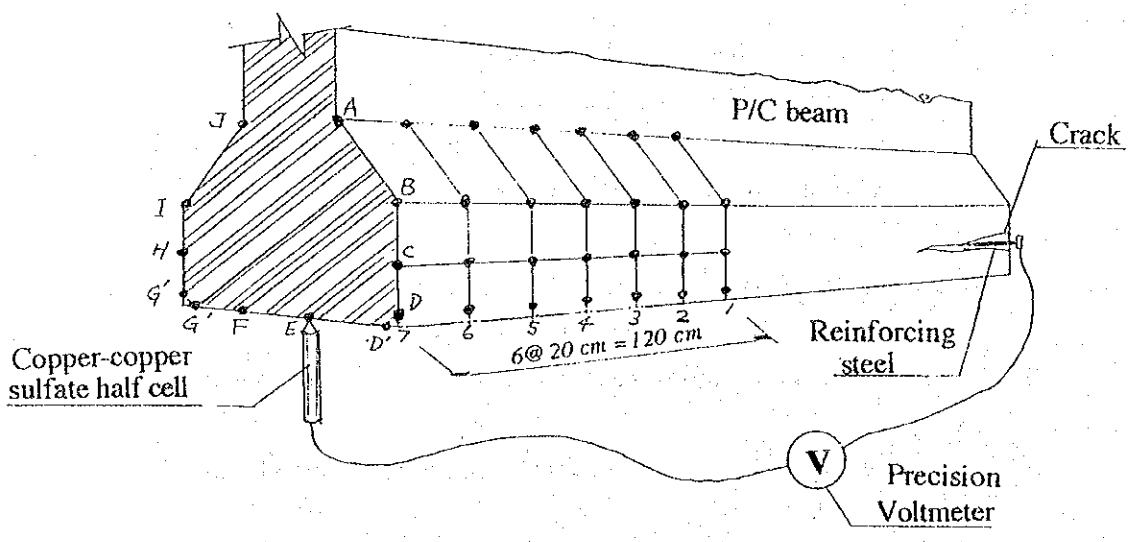
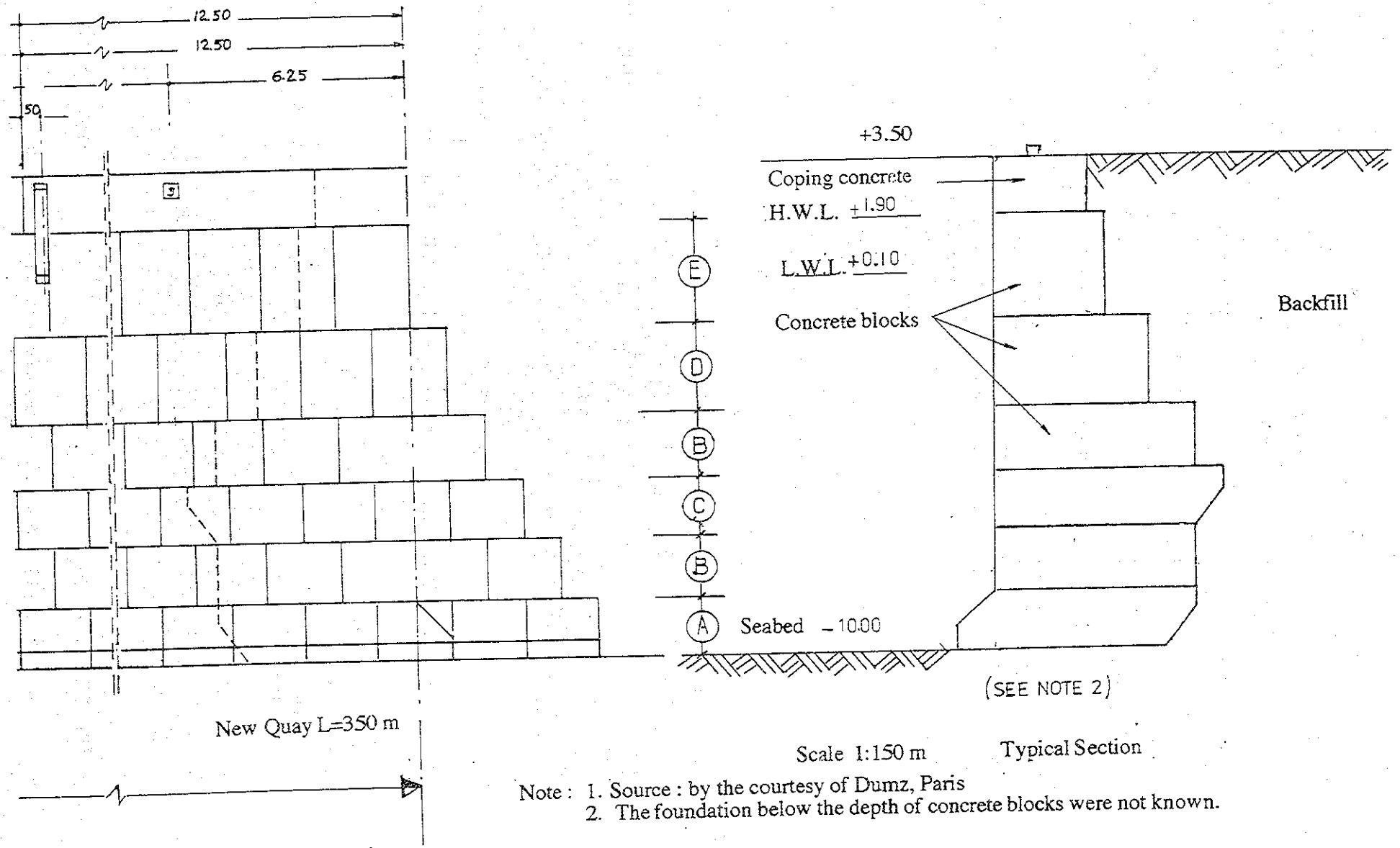


Fig. - 2.5.3 (1)-9 Test procedure of natural electric potential on the P/C beam



Note : 1. Source : by the courtesy of Dumz, Paris
2. The foundation below the depth of concrete blocks were not known.

Fig. - 2.5.3 (1)-10 Typical section of the New Quay

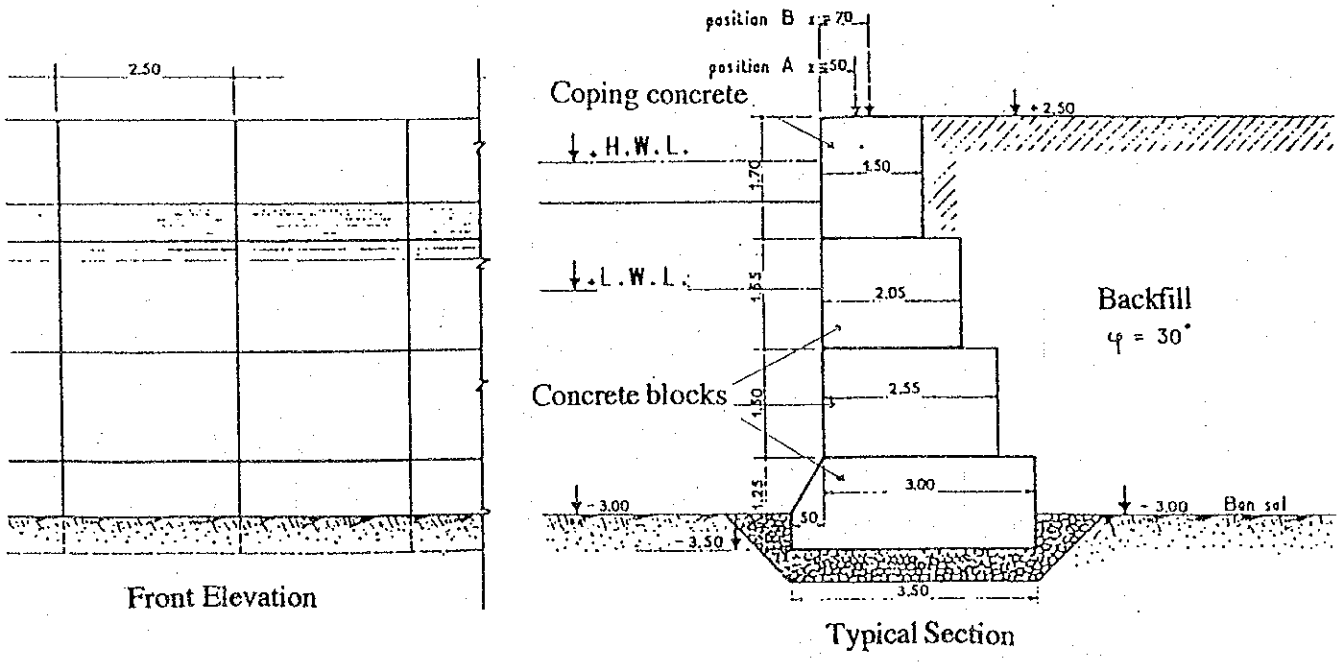


Fig. - 2.5.3 (1)-11 Typical section of Tug Boat Basin Quay

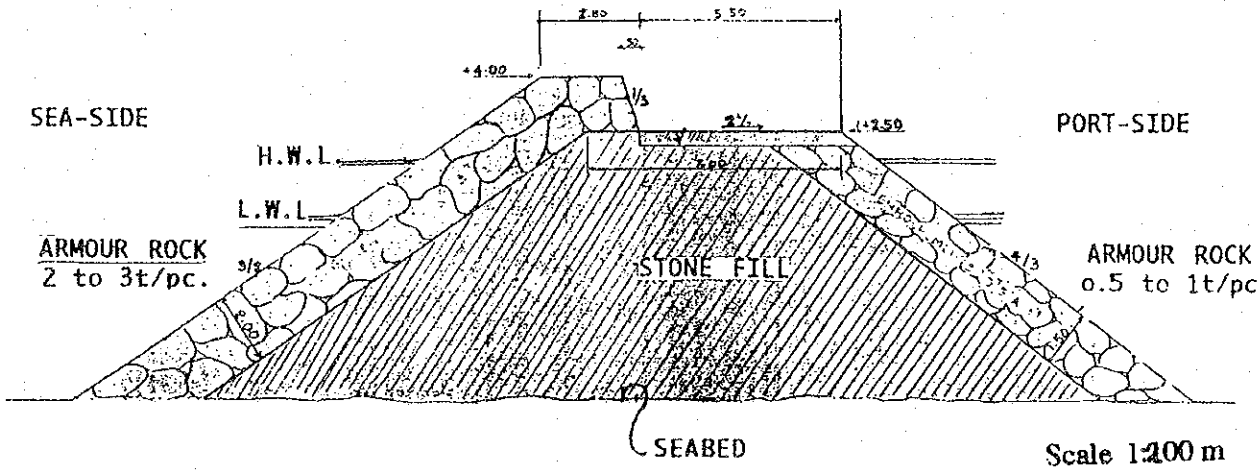


Fig. - 2.5.3 (1)-12 Original design section of North Breakwater

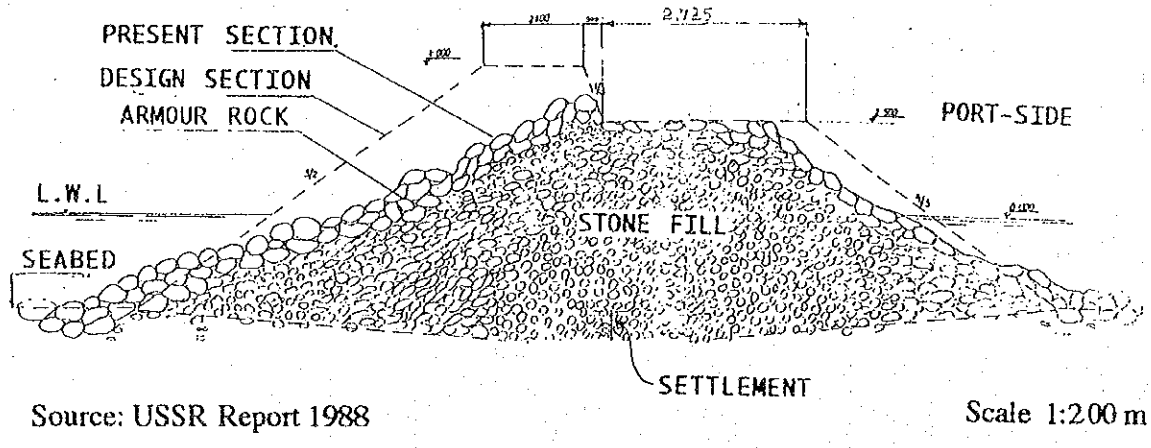


Fig. - 2.5.3 (1)-13 Present abandoned section of North Breakwater

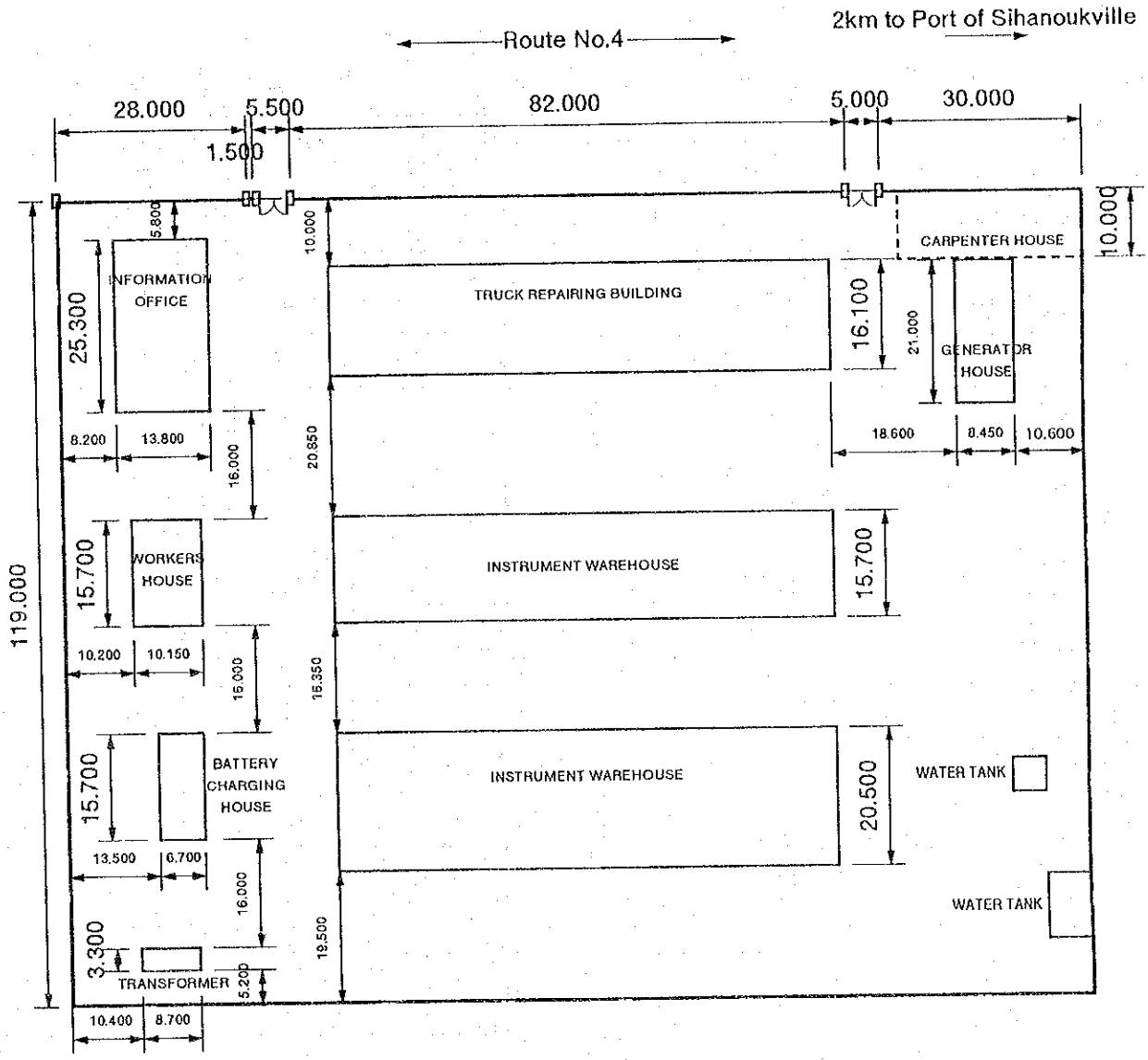


Fig. - 2.5.3 (1)-14 Layout plan of Work Shop

Table - 2.5.3 (2)-1 Existing building facilities of Sihanoukville Port

No.	Name of Building	Dimension(m2) B x L (m)	Story	Material				Built in (Year)	Dwg.	Remarks
				Strct. Frame	Roof	Wall	Floor			
1	Warehouse N1	54x120	1	Steel	GI sheet	Con.Blk.	Conc.	1964	A.	*
2	Warehouse N2	54x120	1	Steel	GI sheet	Con.Blk.	Conc.	1964	A.	*
3	Warehouse N3	50x240	1	Steel	GI sheet	Con.Blk.	Conc.	1974		
4	Warehouse N4	50x120	1	Steel	GI sheet	Con.Blk.	Conc.	1974	A.	*
5	Warehouse N5	50x120	1	Steel	GI sheet	Con.Blk.	Conc.	1974	A.	
6	Administration Office	575 m2	Prt.2	R/C,Steel	Asbestos	Con.Blk.	Conc.	1968		
7	Harbour Master's and Tech. Office	12x24	1	R/C	Asbestos	Con.Blk.	Conc.	1983		
8	Cargo Handling Service Office	17x18	1	R/C	R/C	Con.Blk.	Conc.	1968		
9	Clean Keeper Base	6x24	1	Steel	GI sheet	Con.Blk.	Conc.			
10	Guard House	5x6	1	R/C	Asbestos	Con.Blk.	Conc.	1993		
11	Public Toilet	3.5x10.5	1	R/C	R/C	R/C	Conc.	1994	A	
12	Power House (Tranformer)	4x4.8	1	R/C	R/C	R/C	Conc.	1986		
13	Repair Shop for Buoy	9x16	1	Steel	Asbestos	Con.Blk.	Conk.	1990		
14	Crane Station		1							
15	Container Yard Control Office	6x7		Wood	Asbestos	Wood	Conc	1993		
16	Guard House	4x5	1	R/C	Asbestos	Con. Blk.	Conc.	1995		
17	Repair Shop for Slipway	12x11	1	Steel	GI sheet	Metal	Conc.	1986		
18	Warehouse Office	5x8	1	R/C		Con. Blk.	Conc.	1995		
19	Warehouse Office	5x8	1	R/C		Con. Blk.	Conc.	1995		
20	Repair Shop for Cargo Handling Equipment	9x24	1	R/C	Asbestos	Conc.Blk.	Conc.	1992		
21	Truck Scale	14.3x5.3	1	Wood	GI sheet	Wood/Blk	Conc.	1984		
22	Generator House	6.8x4.9	1	Steel	GI Sheet	Sttel	Conc.	1984		
23	Cargo Handling Office	4.5x9		R/C	Asbestos	Conc.Blk.	Conc.	1989		
24	Container Yard Controll Office	5x6		R/C	Asbestos	Conc.Blk.	Conc.	1989		
25	Information Office	4.25x4.25	2	R/C	R/C	Conc.Blk.	Conc.	1989		
26	Fuel Oil Supply Station	15.27x5.25		R/C	R/C	Conc.Blk.	Conc.	1985		
27	Construction Equipment Parking Shed	10.2x20.3		R/C	GI sheet	Conc.Blk.	Conc.	1985		
28	Truck Station	5x5					Conc.	1994		
29	Police Station				Asbestos	Conc.Blk.	Conc.			
30	Gate House	4x4.5	3	R/C	R/C	Conc.Blk.	Conc.	1988	A	
31	Container Yard Control Office	6x7		R/C	Asbestos	Conc.Blk.	Conc.	1992		
32	Power House (Transeformer)	4.6x4.8		R/C	R/C	Conc.Blk.	Conc.	1986		
33	Generator House		1	Sttel	GI sheet	Wire Msh.	Conc.		A	
34	Pump House	4x5	1	Steel	GI sheet	Steel Grl.	Conc.			
35	Generator House (MCC)	4x5	1	Steel	GI sheet	Steel Grl.	Conc.			
36	Guard House	3x4	1					1988		
37	Pump & Guard House		1		GI sheet	Steel Grl	Conc.			
38	Railway Warehouse		1							
39	Railway Station		2							
40	Workshop (2km from the Port along Route No.4)									see Fig. 2.5.3.1-14

Notes; 1) * Repaired by ADB fund, 2) GI sheet: Galvanized Iron Sheet, 3) R/C: Reinforced Concrete, 4) Con. Blk.: Concrete Block, 5) Dwg. A:Available

(3) Cargo handling equipment

a. Present condition of cargo handling equipment

The cargo handling equipment of Sihanoukville Port is mainly used for container handling and general cargo handling.

Present condition of cargo handling equipment owned by the port is as follows:

1) Forklift

There are twenty-four forklifts; eighteen are in good condition most of which were purchased in 1993-1996, one is normal condition and four are bad condition in spite of being purchased in 1992-1993. Average working hours of the nineteen forklifts is 8.3 hours/day as shown in Table - 2.5.3 (3)-1(b).

2) Crane

There are fifteen cranes with a capacity of 10-80 tons; four are in good condition, nine are in normal condition, and two are in bad condition. Average working hours of twelve cranes is 6.3 hours/day as shown in Table - 2.5.3 (3)-1(a).

3) Stacker

There are two stackers with a capacity of 45 tons; both are kept in good working condition as they were purchased last year. Average working hours of the stackers is 10.1 hours/day as shown in Table - 2.5.3 (3)-1(a).

4) Tractor

There are fifteen tractors; thirteen are in normal condition, six of them have been in use for more than 10 years and are beyond their regular working lifetime, the remaining two are in bad condition as they were purchased in 1979 as shown in Table - 2.5.3 (3)-1(b) and (c).

5) Truck

There are sixteen trucks; all of them are kept in normal condition however, nine of them have been in use for more than 10 years and are beyond their regular working lifetime (see in Table - 2.5.3 (3)-1(c)).

6) Platform (Chassis)

There are thirty-eight platforms with a various dimension; twenty-eight are in normal condition, the remaining two are in bad condition as shown in Table - 2.5.3 (3)-1(c).

Table - 2.5.3 (3)-1(a) Classification of cargo handling equipment

		Puchase Year	Capa -city (ton)	Manu -facture	Operated on May			Working Condition			
					Hrs	Days	Hr/Dy	Good	Norm	Bad	
1	Crane	1980	10.0	MAZ533407	-	-	-			●	
2		1982	10.0	MAZ533407	16.5	2	8.3		●		
3		1984	16.0	K.RAZ	-	-	-			●	
4		1985	25	KC25T	26.0	6	4.3		●		
5		1986	10	MAZ	29.5	4	7.4		●		
6		1987	10	MAZ	50.5	9	5.6		●		
7		1988	10	MAZ	54.5	8	6.8		●		
8		1989	10	MAZ	40.5	11	3.7		●		
9		1989	40	BUMAR	66.5	8	8.3		●		
10		1990	10	Zil	36.5	5	7.3		●		
11		1994	50	KATO	116.3	14	8.3	●			
12		1995	25	KC25T	21.0	4	5.3	●			
13		1996	25	Locateli	34.5	5	6.9	●			
14		1996	16	Locateli	53.0	11	4.8	●			
15		1996	80	T.M80T	-	-	-		●		*1985
	Total				545.3	87	6.3	4	9	2	
1	Stacker	1995	45	F.C.H55	200.0	20	10.0	●			
2		1995	45	F.C.H55	236.0	23	10.3	●			
	Total				436.0	43	10.1	2			

Note; Good: in good operating condition

Norm: some minor repair required

Bad: almost unrepairable

Source: Sihanoukville Port

Table - 2.5.3 (3)-1(b) Classification of cargo handling equipment

		Puchase Year	Capa -city (ton)	Manu -facture	Operated on May			Working Condition			
					Hrs	Days	Hr/Dy	Good	Norm	Bad	
1	Forklift	1992	5.0	4045P	-	-	-			●	
2		1993	5.0	4045P	-	-	-			●	
3		1993	5.0	4045P	-	-	-			●	
4		1989	3.0	Bulgari	-	-	-			●	
5		1993	5.0	Hyster	240	30	8.0		●		
6		1993	25.0	Komatsu	225	24	9.4	●			
7		1994	2.5	Komatsu	247	30	8.2	●			
8		1994	2.5	Komatsu	276	30	9.2	●			
9		1994	2.5	Komatsu	269	30	9.0	●			
10		1994	5.0	Komatsu	277	30	9.2	●			
11		1994	5.0	Komatsu	288	30	9.6	●			
12		1994	10.0	Komatsu	277	30	9.2	●			
13		1993	2.5	Caterpillar	259	30	8.6	●			
14		1993	3.0	Caterpillar	256	30	8.5	●			
15		1995	1.5	Toyota	-	-	-				at workshop
16		1995	15.0	T.C.M	289	31	9.3	●			
17		1996	2.5	Lucli	193	30	6.4	●			
18		1996	2.5	Lucli	223	31	7.2	●			
19		1996	3.0	Lucli	221	30	7.4	●			
20		1996	3.0	Lucli	224	30	7.5	●			
21		1996	3.0	Lucli	213	30	7.1	●			
22		1996	3.0	Lucli	245	30	8.2	●			
23		1996	5.0	Lucli	237	30	7.9	●			
24		1996	5.0	Lucli	233	30	7.8	●			
	Total				4,692	566	8.3	18	1	4	
1	Tractor	1979	4.0	Belaruss	-	-	-			●	
2		1979	4.0	Belaruss	132	20	6.6		●		
3		1979	4.0	Belaruss	136	20	6.8		●		
4		1979	4.0	Belaruss	240	31	7.7		●		
5		1979	4.0	Belaruss	124	18	6.9		●		
6		1979	4.0	Belaruss	128	19	6.7		●		
7		1979	4.0	Belaruss	-	-	-			●	
	Total				760	108	7.0		5	2	

Note; Good: in good operating condition
Norm: some minor repair required
Bad: almost unrepairable

Source: Sihanoukville Port

Table - 2.5.3 (3)-1(c) Classification of cargo handling equipment

As of June, 1996

Kind of Equipment	Purchase Year	Capacity (ton)	Manufacture	No. of Units	Working Condition			
					Good	Norm	Bad	
Truck	1979	5	FUSO F.K.	1		●		
	1979	10	FUSO F.K.	6		●		
	1981	7	MAZ 5335	1		●		
	1988	7	MAZ 5335	1		●		
	1990	7	MAZ 5335	2		●		
	1986	10	KAMA	1		●		
	1988	10	KAMA	1		●		
	1989	10	KAMA	2		●		
	1991	10	KAMA	1		●		
	Total			16		16		
Tractor	1985	20	MAZ P.L	2		●		
	1988	20	MAZ P.L	4		●		
	1990	20	MAZ P.L	1		●		
	1992	20	MAZ P.L	1		●		
	Total			8		8		
Platform	1979	4		6			●	
	1990	4		4		●		
	1992	4		4		●		
	1986	10		1		●		
	1989	10		1		●		
	1991	10		3		●		
	1985	20	length = 6m	1			●	
	1989	20	length = 6m	3		●		
	1992	20	length = 6m	3		●		
	1989	18	length = 9m	3			●	
	1990	18	length = 9m	1		●		
	1985	20	for 40'	1		●		
	1992	20	for 40'	6		●		
	1986	30		1		●		
	Total			38	0	28	10	

Note; *Good: in good operating condition*

Norm: some minor repair required

Bad: almost unrepairable

Source: Sihanoukville Port

b. Present condition of maintenance and repair of cargo handling equipment

1) Organization and number of employees

The maintenance and repair of cargo handling equipment is the responsibility of the technical office. This office is responsible not only maintenance and repair of cargo handling equipment but also construction and repair including ship repair in the port. The technical office consists of a main office, three sections, three groups and two supply offices with 129 employees as shown in Table - 2.5.3 (3)-2.

Table - 2.5.3 (3)-2 Organization of Technical Office

		Function	Employees						
			Chief	D.Chief	Engineer	Technic	Driver	Worker	Total
Office	Office		1					7	8
	Engineer Group				4	4			8
Section	Garage, Workshop and Ship repair								
		Mainte. and repair of equipment	1	2	1	11		30	45
		Ship repair	1					7	8
	Construction Equipment								
		Civil construction work	1	1			25		27
	Construction								
		Construction and repair building	1					10	11
	Electric Supply								
		Electric supply and control	1			1		6	8
Group									
	Fuel storage					1	3	3	7
	Instru., Spare-parts storage							2	2
	Const.-instrument storage							2	2
	Fuel supply							2	2
	Instru./spare-parts supply							1	1
Total			6	3	5	17	28	70	129

Source: Sihanoukville Port

2) Maintenance and repair

All maintenance and repair of cargo handling equipment in the port is carried out by the garage and workshop, which consists of forty-five employees. The workshop is situated about 2 km from the port and has a area of about 1.8 ha with three main buildings, one of them is used for maintenance and repair, one is used for the storage of spare parts, the remaining one is not utilized. However, they have become superannuated.

Generally, small scale maintenance work is carried out by the workshop and machinery and transport office, while all repair works are performed by the workshop. At present, maintenance of two stackers purchased in 1995 is carried out every week, because, stacker operators were trained by manufacturer at the time of purchase.

Repair of tugs owned by the port and local boats is carried out by ship repair section, which is situated at the base of the north-breakwater in the new port, and consists of eight employees. Type of equipment currently installed in the workshop and ship repair is shown in Table - 2.5.3 (3)-3.

Table - 2.5.3 (3)-3 Present condition of workshop and ship repair

As of Jnue,1996

No.	Kind of Equipment	Unit	Manufacture (Country)	Condition		
				Good	Norm	Bad
Workshop						
1	Grinding machine	1	Russia	●		
2	Milling machine table	1	Russia		●	
3	Milling machine table	1	Czecho			●
4	Drill machine	1	Russia		●	
5	Drill machine	1	China		●	
6	Drill machine	1	Russia		●	
7	Iron cutting machine	1	Russia		●	
8	Universal grinding machine	1	Russia			●
9	Lathe	1	Russia			●
10	Lathe	1	Czecho		●	
11	Welder	2	Russia			●
12	Pressing machineure	2	Russia		●	
13	Fuel pump	1	Czecho			●
14	Pully	1	Czecho			●
15	Hydraulic Jack	2	Russia			●
16	Forklift	1	Bulgaria			●
Ship repair						
1	Welder	1	Russia		●	
2	Electric drill	1	China			●
3	Electric scissor	1	-			-
4	Electric saw	1	Russia		●	
5	Motor	1	Russia		●	
6	Lathe	1	Russia			●
7	Engine	1	Russia		●	
8	Pully 1ton	1	Russia		●	

Note; Good: in good operating condition

Norm: some minor repair required

Bad: almost unrepairable

Source: Sihanoukville Port

3) Spare parts

Spare parts is directly managed by the technical officer. Inventory control of spare parts is carried out by instrument and spare parts office which situated in the same area as the workshop.

When new equipment is received, the office makes up a spare parts list and keeps it in stock; the spare parts are supplied according to the annual budget. The spare parts inventory is controlled by recording book.

Table - 2.5.3 (3)-4 shows the present condition of construction equipment and generators, which is managed by construction equipment section and electricity section, respectively.

Table - 2.5.3 (3)-4 Present condition of construction equipment and generators

As of June,1996

No.	Kind of Equipment	Unit	Manufacture (Country)	Condition		
				Good	Norm	Bad
Construction equipment section						
1	Dump Truck	1	Russia		●	
2	Dump Truck	1	Russia		●	
3	Dump Truck	1	Russia		●	
4	Dump Truck	1	Russia			●
5	Dump Truck	1	Russia		●	
6	Heavey Lorry	1	Russia			●
7	Heavey Lorry	1	Russia			●
8	Heavey Lorry	1	Russia		●	
9	Heavey Lorry	1	Russia		●	
10	Grader	1	Russia			●
11	Chassis	1	Russia			●
12	Bulldozer	1	Russia			●
13	Bulldozer	1	Russia		●	
14	Bulldozer	1	Russia			●
15	Road Roller	1	Russia			●
16	Road Roller	1	Russia			●
17	Compressor	1	Russia		●	
Electricity section						
1	Generator 30 KVA	1	Japan		●	
2	Generator 75 KVA	1	Japan			●
3	Generator 75 KVA	1	Japan		●	
4	Generator 50 KVA	1	Japan		●	●
5	Generator 100 KVA	1	Czecho		●	

Note; Good: in good operating condition

Norm: some minor repair required

Bad: almost unrepairable

Source: Sihanoukville Port

(4) Navigational aids

The navigational aids, lateral/safe water marks, of the S channel were replaced completely in 1994with new ones equipped with solar battery and radar reflector, and are now functioning properly. However, the lights of Dekcol Is., Rong Sam Is. and the South Breakwater Entrance of the New Port have been extinguishing for several years. The details of those marks are shown in Table - 2.5.3 (4)-1.

Table - 2.5.3 (4)-1 List of existing navigational aids

Kind	Name	Position	Light	Characterisics	Condition	Remark
Safe water	SV	S. Channel entrance	White	Fl. ev.10s	Replaced, 1994	Refl./solar
Lateral (port)	No.2	Port side S. Channel	Red	Occ. ev. 5s	Replaced, 1994	Refl./solar
Lateral (starboard)	No.3	Star'd side S. Channel	Green	Occ. ev. 5s	Replaced, 1994	Refl./solar
Lateral (port)	No.4	Port side S. Channel	Red	Fl. ev. 5s	Replaced, 1994	Refl./solar
Lateral (starboard)	No.5	Star'd side S. Channel	Green	Fl. ev. 5s	Replaced, 1994	Refl./solar
Lateral (port)	No.6	Port side S. Channel	Red	Q. Fl. ev. 1.2s	Replaced, 1994	Refl./solar
Lateral (port)	No.8	Port side S. Channel	Red	Fl. ev. 6s	Replaced, 1994	Refl./solar
Safe water	A	N. Channel entrance	White	Occ. ev. 2s	Replaced, 1994	Refl./solar
Lateral (port)	B	S. Channel	Red	Fl. ev. 6s	Replaced, 1994	Refl./solar
Safe water	C	S. Tanker berth	Red	-	Replaced, 1994	Refl./solar
Lateral (starboard)	S. BW	S. BW. New port	Green	Fl. ev. 6s	Replaced, 1994	-
Leading light	S. channel	P't Lonne S. BW.	-	F.	Good	-
Leading beacon	Airfield Bn	W. coast Airfield	-	-	Good	-
Lighthouse	Dekcol Is.	Dekcol Is.	-	-	Extinguished	-
Lighthouse	Koh Thas Is.	Koh Thas Is.	-	-	Extinguished	-
Lighthouse	Rong Sam Is.	Rong Sam Is.	-	-	Extinguished	-
Lighthouse	Koh Tang Is.	Koh Tang Is.	-	-	Extinguished	-

2.5.4 Port activities

(1) Cargo throughput

a. General aspect of port activities in Cambodia

In Cambodia, there are two major external trade ports, namely, Sihanoukville Port and Phnom Penh Port. Sihanoukville Port is the sole sea port and the cargo throughput has increased sharply in these several years. Phnom Penh Port, located in the capital of Cambodia, has an important role as the gate port for imports. Furthermore, the cargo throughput at each port influences the other. Hence a general description of port activities at the two major port, Phnom Penh Port and Sihanoukville Port, is first given.

Figure - 2.5.4-1 shows the cargo volume at the two major ports. Total cargo volume was 1.25 million tons in 1995. The total cargo volume increased by 1.03 million tons (5.84 times) from 1985 to 1995.

Total cargo volume of these two ports during the above increased period, with an average annual growth rate of 19.3 %. Negative growth in 1991 was attributable to the decline in imports in 1991, probably because of the change of foreign trade pattern (from with CMEA to the West). Annual growth rate was 8.73 % including fuels and 2.07 % excluding fuels in 1995.

Regarding imports, general cargo rose slowly till 1990, fell in 1991, suddenly increased in 1992, and has remained stable since, recording 366 thousand tons in 1995. General cargo leveled off after 1993 because of the increase of container cargo. Import of fuels has been steadily increasing, reaching 459 thousand tons in 1995, an increase of 7.4 times over 1985. Annual growth rate of import was 7.15 % including fuels and -2.58 % excluding fuels in 1995.

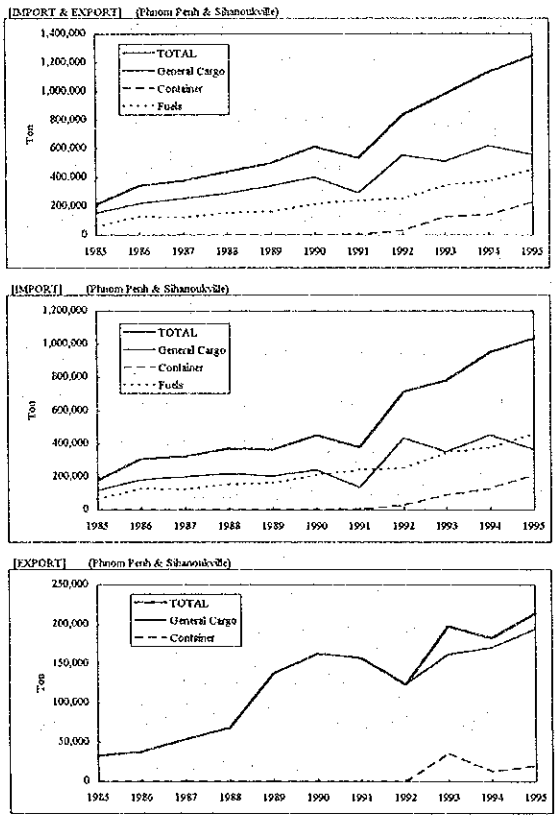
On the other hand, export cargo volume had been increasing till 1990 but decreased in 1991 and 1992. Then the volume greatly increased in 1993, stop rising during 1994 - 1995, and 214 thousand tons in 1995. Container cargo volume peaked in 1993 (36 thousand tons), and registered 20 thousand tons in 1995. Annual growth rate of export was 17.1 % in 1995.

Figure - 2.5.4-2 shows the ratio of imported fuels to total imported cargo and exported cargo to imported cargo (in case of including fuels and in case of excluding fuels). Fuels occupied more than 40 % of imported cargo volume in most years. Export cargo volume was less than 20 % of total cargo volume including fuels except during 1989 to 1991. In case of excluding fuels, 21 % - 31 % of total cargo was exported during 1989 -1991, two or three times of export cargo has been imported.

Table - 2.5.4-1 shows the cargo volume by commodity in the two major ports. In import, fuels (459 thousand tons), cement (118 thousand tons), rice (43 thousand tons), fertilizer (30 thousand tons) and sugar (21 thousand tons) are the five major commodities in 1995 (except container and others), occupying about 65 % of the imported cargo volume in 1995. In case of excluding fuels, these four commodities occupy about 37 % of the total. The share of fuels to import cargo volume was about 44 % in 1995. Fuels are imported and handled by private (or

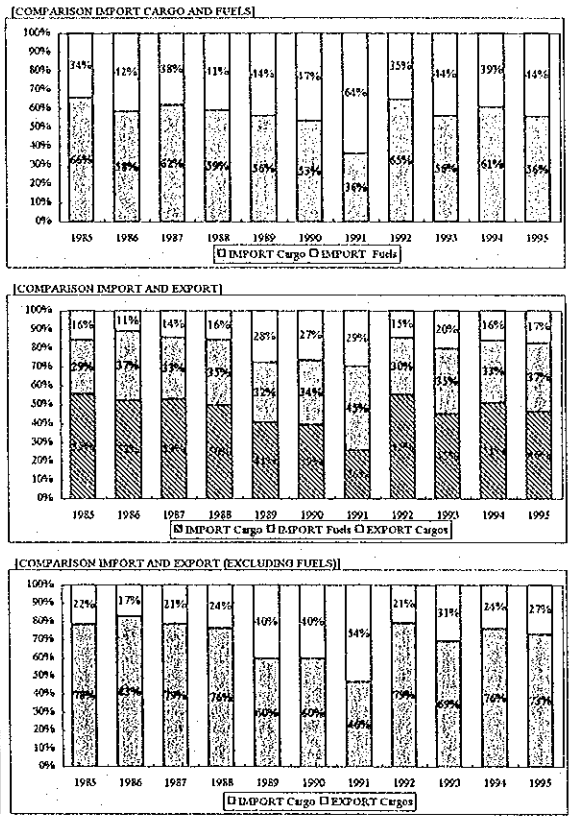
public) companies in both Phnom Penh Port and Sihanoukville Port.

In export, log wood, lumber, natural rubber and ply wood are the major commodities, which occuping about 84.4 % of the exported cargo volume in 1995. Exported volumes of these commodities are 47 thousand tons, 91 thousand tons, 26 thousand tons and 16 thousand tons respectively in 1995. The volume of log wood suddenly increased in 1991, decreased in 1993 and increased in 1994 and 1995 again. The reason for the increase in 1994 and 1995 is that log wood was quickly exported before the ban on log wood export come into effect. Lumber increased dramatically in 1993 and an export level of more than 60 thousand tons has been maintained.



Source: Phnom Penh Port, Sihanoukville Port

Fig. - 2.5.4-1 Trend of cargo
(Sum of Sihanoukville Port and Phnom Penh Port)



Source: Phnom Penh Port, Sihanoukville Port

Fig. - 2.5.4-2 Share of cargo
(Sum of Sihanoukville Port and Phnom Penh Port)

Table - 2.5.4-1 Cargo volume by commodity
(Sum of Sihanoukville Port and Phnom Penh Port)

[IMPORT] (Phnom Penh & Sihanoukville) (Unit: Ton)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
General Cargo	118,244	179,675	198,981	217,446	201,960	239,527	133,969	431,962	350,059	450,051	365,863
Cement	9,057	28,096	44,170	26,319	33,877	54,342	17,243	173,044	143,070	185,325	117,630
Fertilizer	25,291	20,788	35,696	65,271	19,989	11,501	2,373	13,532	34,852	28,437	30,053
Machinery	3,657	6,554	7,804	7,925	16,449	20,353	3,338	17,370	2,353	2,587	6,917
Rice	1,524	25,501	24,063	14,646	12,440	21,976	13,094	26,984	29,089	30,489	43,257
Special Goods	7,615	10,575	8,338	4,692	14,105	4,638	846	0	0	0	0
Sugar	0	3,013	0	0	1,110	0	2,011	2,027	11,987	28,654	21,067
Steel	0	0	0	0	0	0	0	8,881	2,570	22,711	17,936
Bitumen	0	0	0	0	0	0	0	0	0	10,074	19,987
Fibro	1,290	1,107	0	0	10,267	2,049	0	0	0	564	0
Wheat	0	0	2,014	2,517	0	100	0	0	1,317	7,700	12,510
Cotton Wool	0	501	502	996	997	992	0	0	0	0	0
Cast-iron	0	0	0	0	471	0	0	570	0	0	0
Sea Fish	0	160	0	0	0	0	0	0	0	0	0
Cigarettes	0	0	0	0	0	0	0	2,452	8,753	13,137	0
Others	69,810	83,380	76,394	95,080	92,255	123,576	95,064	187,102	116,068	120,373	96,506
Container	0	0	510	680	1,200	1,560	2,810	31,275	89,600	126,822	208,961
Fuels	62,207	127,487	123,914	152,479	159,996	211,862	241,712	251,403	344,581	375,246	459,437
TOTAL	180,451	307,162	323,405	370,605	363,156	452,949	378,491	714,640	784,240	952,119	1,034,261

[Export] (Phnom Penh & Sihanoukville) (Unit: Ton)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
General Cargo	33,179	38,084	54,091	68,742	137,974	163,378	157,761	123,576	161,476	170,124	193,817
Log wood	9,948	6,998	10,422	10,940	28,064	28,992	69,403	63,663	8,930	27,583	47,135
Lumber	0	0	0	0	0	4,336	4,574	9,617	97,655	67,515	90,714
Scrap Iron	0	0	2,002	946	22,827	52,972	7,630	6,436	9,678	2,473	0
Soybean	1,600	500	2,119	6,492	17,673	1,164	16,190	5,071	26	4,130	0
Natural Rubber	17,469	21,373	25,550	28,827	33,835	34,664	26,687	24,685	26,345	50,419	26,029
Ply Wood	0	0	0	0	0	0	0	0	0	6,630	16,460
White Sesame	0	0	0	1,896	6,071	0	0	102	0	0	0
Machinery UN	0	0	0	0	0	0	0	0	5,070	205	0
Tobacco	901	461	543	51	0	0	0	0	0	0	0
Rattan	6	0	0	0	0	494	609	481	138	0	164
Kapok	0	0	97	191	187	139	32	129	60	0	0
Pepper	0	0	0	34	460	35	22	56	0	0	0
Shoe	0	0	16	0	0	148	0	0	0	0	0
Charcoal, Silk	1	0	0	0	0	0	0	0	0	0	0
Corn	0	0	0	0	0	0	0	4,110	8,966	7,170	2,705
Paddy	1,010	0	20	1,736	0	1,057	0	0	0	0	0
Cashew Nut	0	0	0	0	0	0	0	167	0	0	0
Agriculture Product	2,179	6,957	11,455	15,272	21,319	25,136	15,979	0	0	0	0
Jute	0	0	0	0	0	2,522	0	511	0	0	0
Others	65	1,795	1,867	2,357	7,538	11,719	16,635	8,548	4,608	3,999	10,610
Container	0	0	0	0	0	0	0	212	36,151	12,338	19,804
TOTAL	33,179	38,084	54,091	68,742	137,974	163,378	157,761	123,788	197,627	182,462	213,621

Source: Phnom Penh Port, Sihanoukville Port

b. Handling cargo at Sihanoukville Port

1) Cargo throughput at Sihanoukville Port

i) External cargo

Table - 2.5.4-2 and Fig. - 2.5.4-3 shows the cargo volume and number of ship calling at Sihanoukville Port. Total cargo volume at Sihanoukville Port was 708 thousand tons in 1995. The total cargo volume decreased by 194 thousand tons (0.33 times) from 1980 to 1983, and increased by about 610 thousand tons (7.27 times) from 1983 to 1995. Cargo volume in 1995 was 2.43 times larger than that in 1980.

Total cargo volume of Sihanoukville Port during 1987 to 1995 increased with an average annual growth rate of 29.3 % in 1995. Negative growth in 1991 was attributable to a decrease in the total cargo volume in Cambodia while the ratio of Phnom Penh Port increased. Furthermore, large increase of cargo volume in these several years was mainly due to the increase of cargo volume of Cambodia and decrease of share of Phnom Penh Port.

Comparing cargo volume in 1995 with 1969 (peak year), import volume has recovered 83 %, but the export was only 54 % of 1969. Hence, total cargo volume at Sihanoukville Port has not recovered to the 1969 level.

Figure - 2.5.4-4 shows the trend of cargo throughput at Sihanoukville Port. Import cargo has been rapidly increasing since 1992 because of the increase of container cargo and fuels. General cargo had been increasing till 1994 but slightly decreased in 1995.

In export, general cargo was increased in 1989 and 1993, reaching 153 thousand tons in 1995 (87 % of export cargo). Container cargo has been exported since 1992, increased in 1993 (36 thousand tons), but decreased in 1994. Export container cargo amounted to 20 thousand tons in 1995.

Import cargo ratio to total cargo was 78.3 % in case of including fuels and 75.9 % in case of excluding fuels in 1995.

ii) Domestic cargo

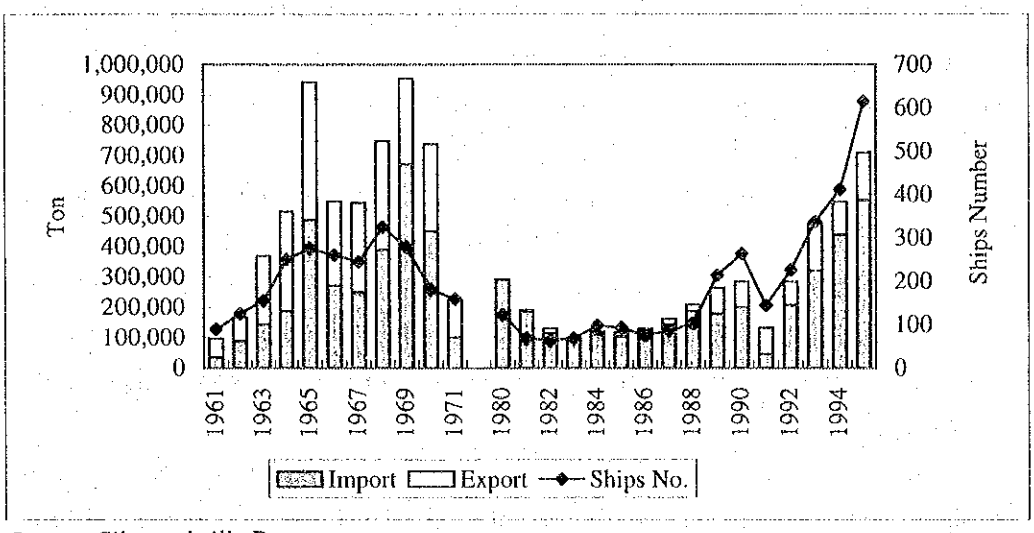
In Sihanoukville Port, domestic cargo was handled only in 1987 (0.5 thousand tons), 1988 (0.4 thousand tons) and 1994 (1.1 thousand tons). The contents of the cargo were rice (1987 and 1988) and general cargo (1994).

Table - 2.5.4-2 Number of calling vessel and cargo volume at Sihanoukville Port

(Unit: Ton)

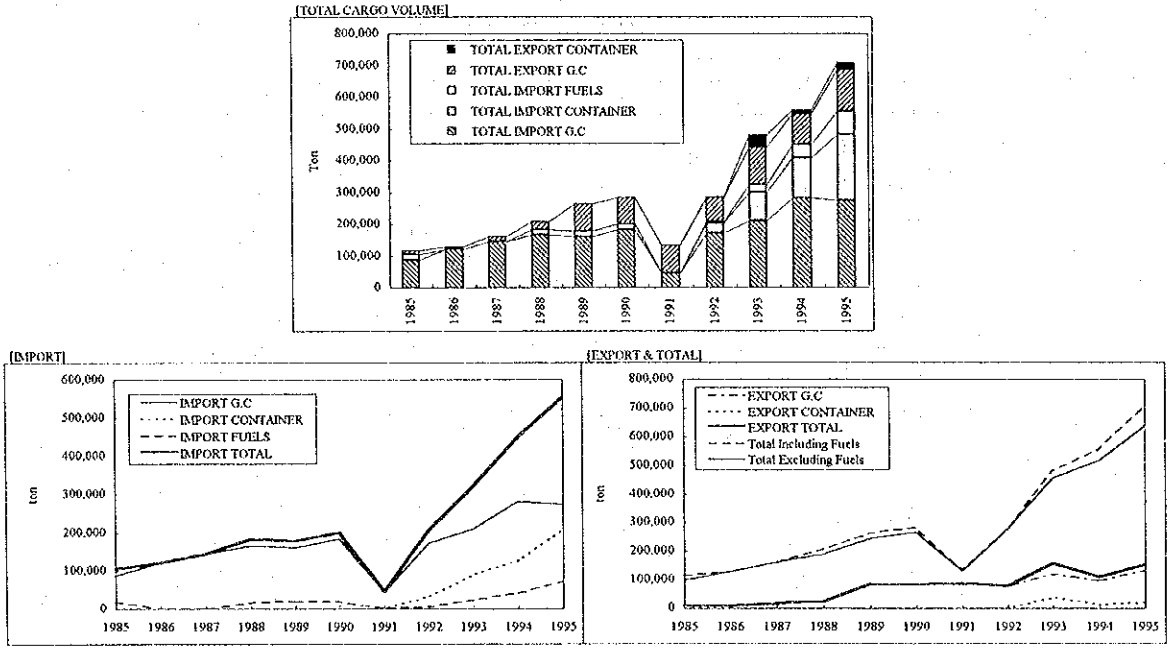
	Ships No.	Import	Export	Total
1961	89	35,084	60,491	95,575
1962	125	88,421	77,918	166,339
1963	155	143,123	226,436	369,559
1964	250	186,834	328,000	514,831
1965	276	487,413	454,815	942,228
1966	261	270,376	278,149	548,525
1967	245	249,625	293,948	543,573
1968	325	389,767	358,081	747,848
1969	279	671,671	282,538	954,210
1970	180	451,361	285,565	736,926
1971	159	101,079	122,245	223,324
:				
1980	122	289,801	1,725	291,526
1981	68	185,695	5,032	190,727
1982	63	115,473	14,355	129,828
1983	68	95,142	2,182	97,324
1984	98	110,448	7,979	118,427
1985	93	104,642	11,544	116,186
1986	74	121,463	8,017	129,480
1987	86	143,931	17,466	161,397
1988	103	187,787	19,466	207,253
1989	214	177,951	85,999	263,950
1990	264	200,069	83,658	283,727
1991	144	45,677	86,873	132,550
1992	226	206,642	77,350	283,992
1993	337	322,194	152,193	474,387
1994	411	439,738	107,574	547,312
1995	615	554,278	153,427	707,705

Source: Sihanoukville Port



Source: Sihanoukville Port

Fig. - 2.5.4-3 Trend of calling vessel and cargo volume



Source: Sihanoukville Port

Fig. - 2.5.4-4 Trend of cargo volume

2) Commodity

Commodity trends from 1985 to 1995 are presented in Table - 2.5.4-3. In import, cement, fuels, rice and fertilizer are over 20 thousand tons and followed by bitumen, sugar and steel (over 10 thousand tons) in 1995. Cement has generally increased in the last 11 years, though there have been some fluctuations. Fuels imported by public and private companies had been kept about 17 thousand tons during 1988 to 1990, suddenly decreased in 1991, then increased again, reaching 72 thousand tons in1995. Rice was imported in 1985, 1990 and since 1993; increase rate was very high during 1992 to 1995 and 37 thousand tons in 1995, 6.1 times of 1992. Fertilizer peaked in 1988 (61.6 thousand tons), then decreased till 1992 and increased again since 1992, reaching 29 thousand tons in 1995.

In export, lumber, log wood and ply wood are three major commodities, occupying about 87 % of the export cargo. Cargo volumes of these commodities are 28.6 thousand tons, 88.2 thousand tons and 16.5 thousand tons respectively. The volume of log wood generally increased till 1992, and decreased in 1991, then increased. Lumber has been exported since 1990 and steadily increased after the year 20.3 times of 1990. Exports of ply wood began in 1994, and increased 2.48 times in 1995.

Container cargo has been handled since 1992 and has rapidly increased, reaching 200 thousand tons in 1995. Container cargo represented 38 % of imported cargo, 13 % of exported cargo and 32 % of total cargo.

Table - 2.5.4-3 Cargo volume by commodity

[IMPORT] (Sihanoukville Port) (Unit: Ton)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
General Cargo	87,313	121463	143931	165865	160247	182303	44582	171071	209531	281961	273203
Cement	9,057	28,096	31,802	14,887	28,833	46,560	14,200	83,903	137,295	153,679	93,386
Fertilizer	25,291	20,788	35,696	61,569	18,797	11,439	2,038	5,499	23,898	28,437	29,808
Machinery	3,657	6,554	7,804	7,925	16,449	20,353	3,130	12,689	2,261	2,587	6,530
Rice	1,524	0	0	0	0	4,688	0	5,970	10,449	18,867	36,684
Special Goods	7,615	10,575	8,338	4,692	14,105	4,638	846	0	0	0	0
Sugar	0	3,013	0	0	1,110	0	2,011	0	4,294	17,410	19,898
Steel	0	0	0	0	0	0	0	7,446	2,570	16,115	17,936
Bitumen	0	0	0	0	0	0	0	0	0	10,074	19,987
Fibro	1,290	1,107	0	0	10,267	2,049	0	0	0	564	0
Wheat	0	0	2,014	2,517	0	100	0	0	0	0	0
Cotton Wool	0	501	502	996	997	992	0	0	0	0	0
Cast-iron	0	0	0	0	471	0	0	570	0	0	0
Sea Fish	0	160	0	0	0	0	0	0	0	0	0
Cigarettes	0	0	0	0	0	0	0	0	0	0	0
Others	38,879	50,669	57,775	73,279	69,218	91,484	22,357	54,994	28,764	34,228	48,974
Container	0	0	0	0	0	0	0	30,459	89,546	126,659	208,832
Fuels	17,326	0	0	16,922	17,560	17,766	1,095	5,112	23,119	41,684	72,243
TOTAL	104,639	121,463	143,931	182,787	177,807	200,069	45,677	206,642	322,196	450,304	554,278

[EXPORT] (Sihanoukville Port) (Unit: Ton)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
General Cargo	11,545	7,970	16,966	24,151	84,979	83,659	86,873	77,350	120,158	96,026	133,623
Log wood	7,448	6,129	10,099	9,608	25,916	22,080	68,686	63,663	7,177	21,773	28,616
Lumber	0	0	0	0	0	4,336	4,574	8,396	96,020	63,495	88,156
Scrap Iron	0	0	2,002	946	22,827	48,192	6,883	4,751	7,671	0	0
Soybean	1,600	500	2,119	6,492	17,673	1,164	4,822	0	0	0	0
Natural Rubber	1,589	880	2,090	3,841	7,535	6,923	1,240	95	492	3,086	227
Ply Wood	0	0	0	0	0	0	0	0	0	6,630	16,460
White Sesame	0	0	0	1,896	6,071	0	0	0	0	0	0
Machinery UN	0	0	0	0	0	0	0	0	5070	205	0
Tobacco	901	461	543	51	0	0	0	0	0	0	0
Rattan	6	0	0	0	0	494	609	178	0	0	164
Kapok	0	0	97	191	187	139	32	0	0	0	0
Pepper	0	0	0	34	460	35	22	56	0	0	0
Shoe	0	0	16	0	0	148	0	0	0	0	0
Charcoal, Silk	1	0	0	0	0	0	0	0	0	0	0
Corn	0	0	0	0	0	0	0	0	0	0	0
Paddy	0	0	0	0	0	0	0	0	0	0	0
Cashew Nut	0	0	0	0	0	0	0	0	0	0	0
Agriculture Product	0	0	0	0	0	0	0	0	0	0	0
Jute	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	1,092	4,310	148	5	211	3,728	837	0
Container	0	0	0	0	0	0	0	212	36,151	12,338	19,804
TOTAL	11,545	7,970	16,966	24,151	84,979	83,659	86,873	77,562	156,309	108,364	153,427

Source: Sihanoukville Port

3) Package type

In import, general cargo handling volume was the largest in package type till 1991. Then bag cargo volume became the largest because some general cargo was changed to container cargo. In 1995, container cargo represented the largest ratio to imported cargo (43.3 % excluding fuels).

In export, solid bulk which refers to large size cargo such as log wood, lumber, ply wood, scrap iron and so on, has been the main package type, accounting for 87.1 % of exported cargo in 1995. Export of container was at a low level compared with imported cargo; 12.9% of imported cargo in 1995. Table - 2.5.4-4 and Fig. - 2.5.4-5 show cargo volume by package type.

Table - 2.5.4-4 Cargo volume by package type

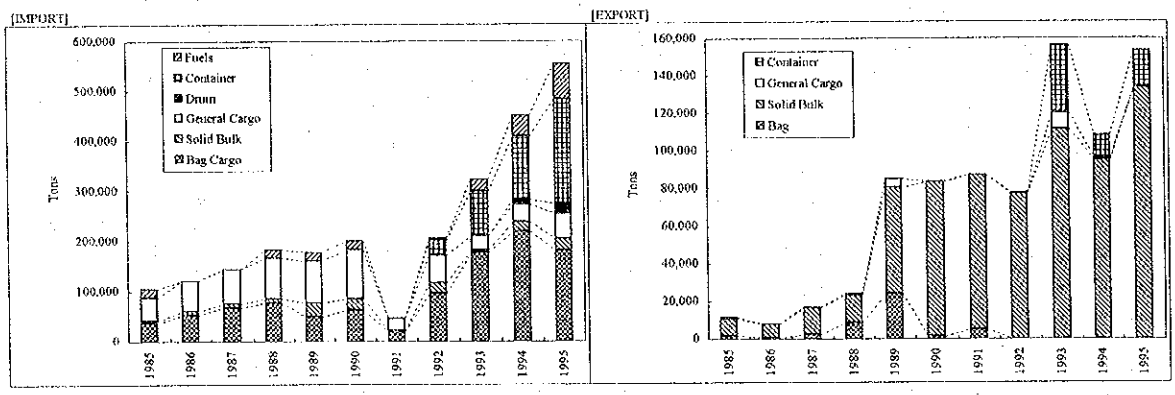
[IMPORT] (Sihanoukville Port) (Unit: Ton)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Bag Cargo	35,872	51,897	67,498	76,456	48,740	62,687	18,249	95,372	175,936	218,393	179,776
Solid Bulk	4,947	7,661	7,804	7,925	27,187	22,402	3,130	20,705	4,831	19,266	24,466
General Cargo	46,494	61,905	68,629	81,484	84,320	97,214	23,203	54,994	28,764	34,228	48,974
Drum (Bitumen)	0	0	0	0	0	0	0	0	0	10,074	19,987
Container	0	0	0	0	0	0	0	30,459	89,546	126,659	208,832
Fuels	17,326	0	0	16,922	17,560	17,766	1,095	5,112	23,119	41,684	72,243
TOTAL	104,639	121,463	143,931	182,787	177,807	200,069	45,677	206,642	322,196	450,304	554,278

[EXPORT] (Sihanoukville Port) (Unit: Ton)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Bag	1,600	500	2,216	8,579	23,931	1,303	4,854	0	0	0	0
Solid Bulk	9,043	7,009	14,191	14,395	56,278	82,025	81,992	77,083	111,360	94,984	133,623
General Cargo	902	461	559	1,177	4,770	331	27	267	8,798	1,042	0
Container	0	0	0	0	0	0	0	212	36,151	12,338	19,804
TOTAL	11,545	7,970	16,966	24,151	84,979	83,659	86,873	77,562	156,309	108,364	153,427

Source: Sihanoukville Port



Source: Sihanoukville Port

Fig. - 2.5.4-5 Trend of package type

4) Container cargo

Container cargo has been handled at Sihanoukville Port since 1992. In 1995, 228.6 thousand tons, 17,979 CONT container cargo was handled. Annual growth rate was 95 % in weight and 67 % in number from 1992 to 1995. Judging from the manifest, major commodities in containers are probably consumer goods, electric household appliance, motorbike, used car, cigarette, cloths & textile and so on.

Ratio of container cargo volume (21,824 TEU) to total cargo volume was 36 %, of which 43 % (19,399 TEU) in case of import and 13 % (2,425 TEU) in case of export in 1995. Average weight of a container was approximately 10.8 tons / TEU in case of import, 8.2 tons / TEU in 1995. Summary of container cargo is shown in Table - 2.5.4-5. Figure - 2.5.4-6 illustrates the past records of container cargo by import and export operations. Import container TEU and cargo volume has been in excess of export.

Total container volume including empty was 31,940 CONT, 38,942 TEU. TEU of empty container was 44.0 % of total container and 87.6 % of export container.

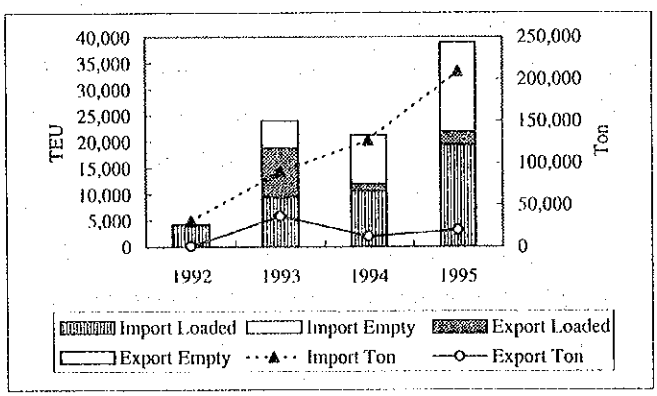
Table - 2.5.4-6 shows the summary of reefer container in 1995. The number of reefer container was 147 CONT in total, 116 CONT in import and 31 CONT in export, or 0.8 %, 0.7 % and 1.7 % to container cargo respectively.

Table - 2.5.4-5 Container traffic at Sihanoukville Port

CONTAINER TRAFFIC

			1992	1993	1994	1995
Import	Loaded	20'	3,454	4,077	8,040	12,911
		40'	350	2,670	1,290	3,244
		Total	3,804	6,747	9,330	16,155
		TEU	4,154	9,417	10,620	19,399
		Ton	30,459	89,546	126,659	208,832
	Empty	TEU	0	0	0	0
Export	Loaded	20'	20	6,430	809	1,223
		40'	10	1,460	266	601
		Total	30	7,890	1,075	1,824
		TEU	40	9,350	1,341	2,425
		Ton	212	36,151	12,338	19,804
	Empty	20'		2,719	5,945	10,804
		40'		1,250	1,640	3,157
		Total		3,969	7,585	13,961
		TEU		5,219	9,225	17,118
Total	Loaded	20'	3,474	10,507	8,849	14,134
		40'	360	4,130	1,556	3,845
		Total	3,834	14,637	10,405	17,979
		TEU	4,194	18,767	11,961	21,824
		Ton	30,671	125,697	138,997	228,636
	Empty	20'		2,719	5,945	10,804
		40'		1,250	1,640	3,157
		Total		3,969	7,585	13,961
		TEU	0	5,219	9,225	17,118
	Total	20'	3,474	13,226	14,794	24,938
		40'	360	5,380	3,196	7,002
		Total	3,834	18,606	17,990	31,940
		TEU	4,194	23,986	21,186	38,942

Source: Sihanoukville Port



Source: Sihanoukville Port

Fig. - 2.5.4-6 Trend of container traffic

Table - 2.5.4-6 Reefer container

			20'	40'	TOTAL	Remark
Import	Total Weight	(Ton)	480.0	1,672.0	2,152.0	Fresh Fruit
	Number	(CONT)	40	76	116	
	Average Weight	(Ton)	12.0	22.0		
Export	Total Weight	(Ton)	300.0	15.5	315.5	Frozen Fish and Shrimp
	Number	(CONT)	30	1	31	
	Average Weight	(Ton)	10.0	15.5		
TOTAL	Total Weight	(Ton)	780.0	1,687.5	2,467.5	
	Number	(CONT)	70	77	147	

Source: Sihanoukville Port

5) Share of cargo volume at Sihanoukville Port

i) Commodity

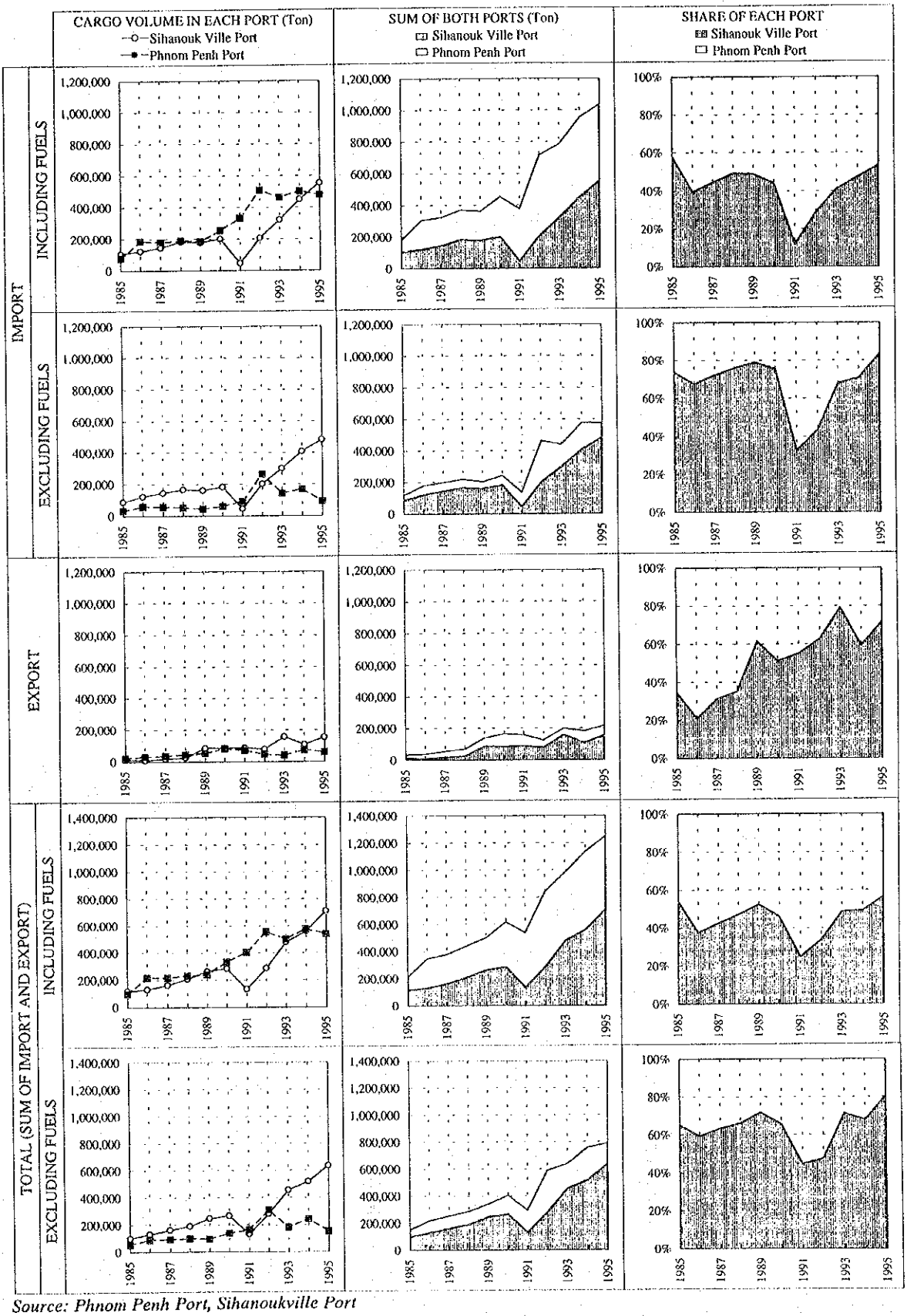
In Fig. - 2.5.4-7, the cargo volume of Sihanoukville Port is compared with Phnom Penh. More than half has been imported in Phnom Penh Port during 1986 to 1994. Ratio of Sihanoukville has been increasing since 1991 and reached 53.6 % in 1995. In case of excluding fuels, most of import cargo volume (more than 70 %) had been handled at Sihanoukville Port till 1990, but the ratio suddenly fell in 1991 (about 32.5 %). Since 1992, the ratio has rapidly been recovering and reached 83 % in1995, because of the increase of container cargo.

More than 65 % of the export cargo had been handled at Phnom Penh till 1988, but the ratio of Sihanoukville Port grew in 1989, and since then more than half has been handled at Sihanoukville Port; in 1995 71.8 % of the export cargo was handled at Sihanoukville Port.

The total cargo volume (including fuels) at Sihanoukville Port has been increasing since 1992, and accounted for 56.7 % in 1995. The total cargo volume (excluding fuels) shows a similar tendency, accounting for 80 % of the total in1995, even though there was only a slight increase in the total cargo volume of both ports. Therefore, this increase was the result of a shift of cargo from Phnom Penh Port to Sihanoukville Port.

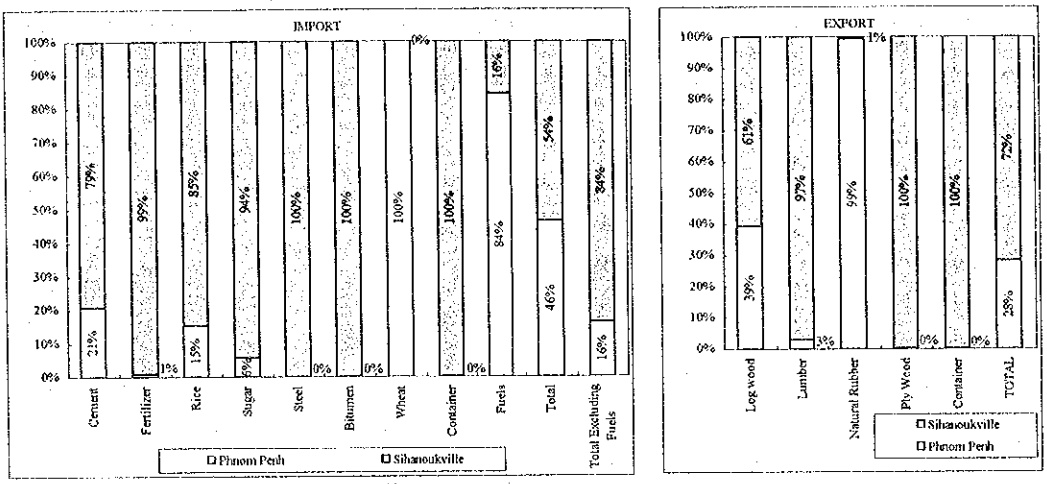
Figure - 2.5.4-8 shows ratio of each port by major commodity in 1995. Most of imported cement, fertilizer, rice, sugar and container are handled at Sihanoukville Port. Steel and bitumen are handled only at Sihanoukville Port. Phnom Penh Port imported all of wheat and 84 % of fuels.

In export, more than half of log wood (61 %), lumber (97 %), ply wood (100 %) and container (100 %) were handled at Sihanoukville Port. The majority of natural rubber (99 %) was exported in Phnom Penh Port.



Source: Phnom Penh Port, Sihanoukville Port

Fig. - 2.5.4-7 Comparison between Phnom Penh Port and Sihanoukville Port

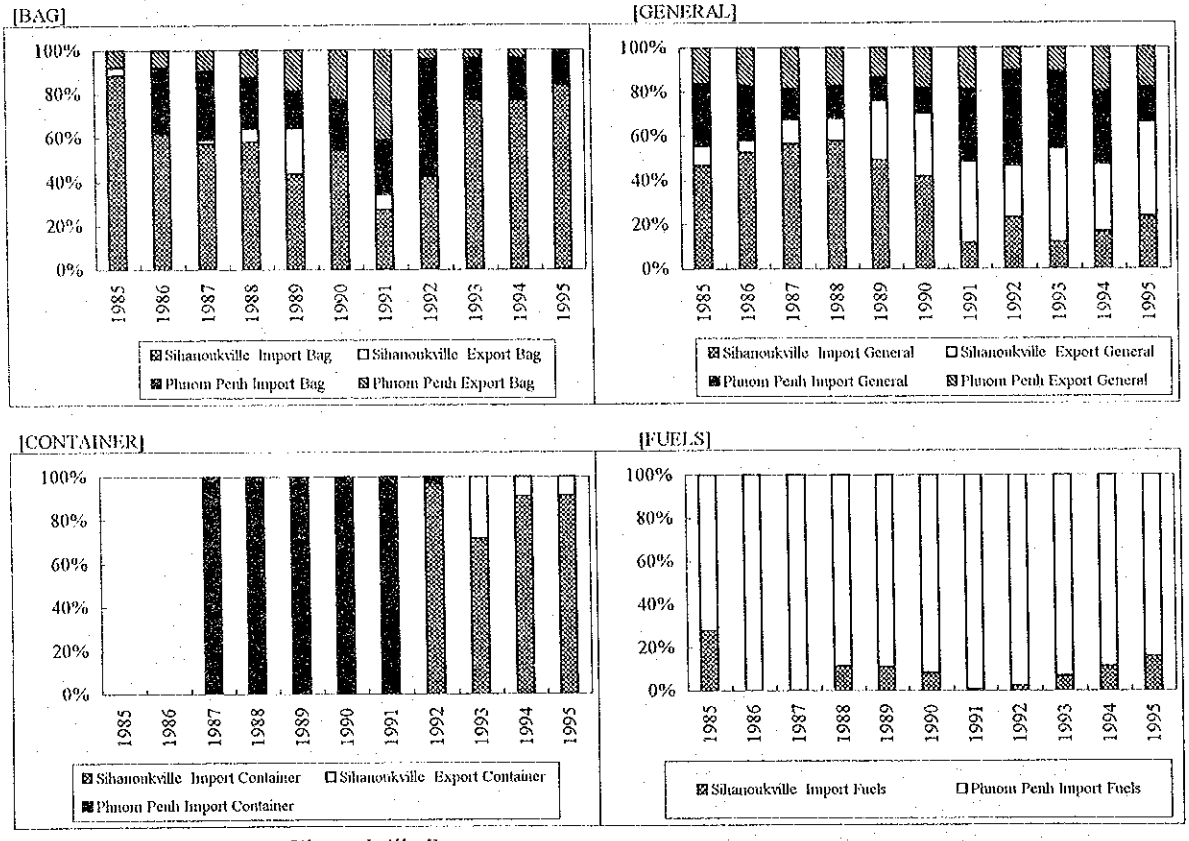


Source: Phnom Penh Port, Sihanoukville Port

Fig. - 2.5.4-8 Share in each port by commodity

ii) Package type

Figure - 2.5.4-9 shows the ratio of the two major ports by each package type. The majority of bag and container has handled at Sihanoukville Port since 1993 and 1992 respectively. About half of the general cargo had been handled in Phnom Penh Port from 1991 to 1995, but the ratio of Sihanoukville Port suddenly increased in 1995 and reached to 65 %.



Source: Phnom Penh Port, Sihanoukville Port

Fig. - 2.5.4-9 Share in each port by package type

6) Cargo movement of origin and destination

Table - 2.5.4-7 shows the origin of import and the destination of export by major commodities in 1995. Major import countries are Singapore (44 %), Thailand (24 %), Australia (15 %) and China (5 %). Total share of three counties was 88%. The origin of import container was Singapore and Thailand (Bangkok) and these two countries occupied almost 100 % of import container. Rice was imported from Australia (75 %), Thailand (Bangkok) (13 %), and USA (7%). Cement was imported from Thailand (Bangkok) (62 %), Korea (18 %), China (12 %) and Hong Kong (7 %). Fuels were imported from Singapore (94 %) and Thailand (Bangkok) (6 %)

In export, major countries were Thailand (42 %), China (26 %), Singapore (14 %) and Hong Kong (7 %) in 1995. Total share of these three countries was 89%. As to container cargo, 49 % was transported to Singapore, followed by Thailand (including Songkhla and Bangkok) (43 %). Timber was exported to Thailand (Bangkok) (57 %), Hong Kong (10 %), China (9 %), Singapore (9 %) and Malaysia (include Kualatanjung). Veneer & ply wood were to China (67 %) and Thailand (Bangkok) (33%). Wood was exported to Hong Kong (75 %) and Thailand (Bangkok) (25 %).

Figure - 2.5.4-10 shows cargo movement of destination to provinces from Sihanoukville Port (1993 - 1995). Main destination is Phnom Penh (60 - 65 %), followed by Kampot province (15 %) and Takeo province (5 - 10 %). This trend has remained unchanged not changed during the years. On the other hand, main transport way is road all years and rail way was used for transport only in 1993 (15 % of transported cargo).

Table - 2.5.4-7 Cargo movement by commodity

[IMPORT]

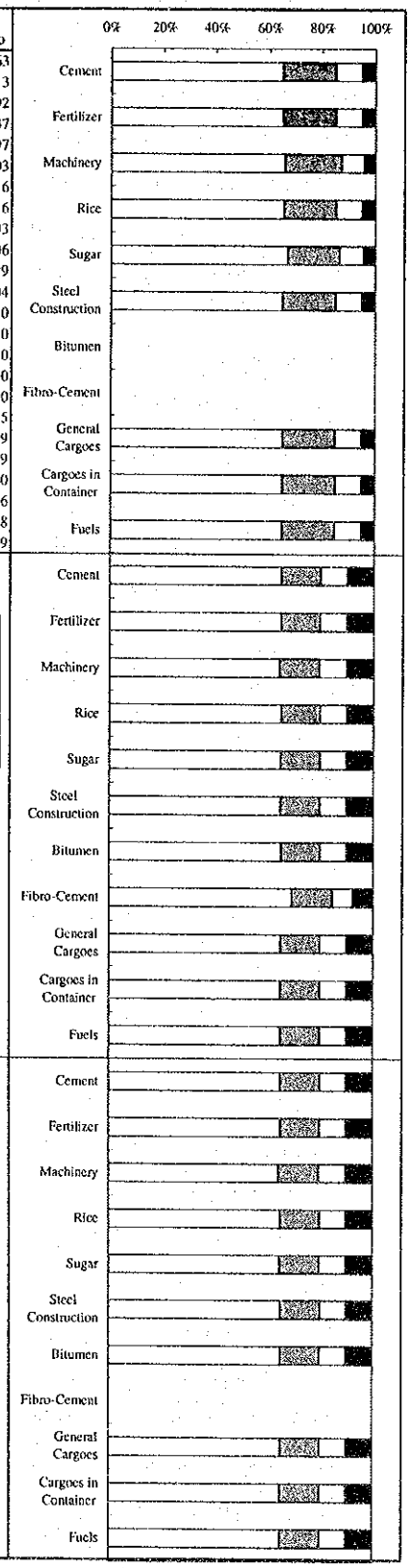
	CONTAINER			RICE			OTHERS			TOTAL	
1	SINGAPORE	84.7%	1	AUSTRALIAN	75.0%	1	BANGKOK	31.8%	1	SINGAPORE	43.6%
2	BANGKOK	14.5%	2	BANGKOK	13.4%	2	SINGAPORE	25.5%	2	THAILAND	24.4%
3	JAPAN	0.3%	3	U.S.A	6.8%	3	CHINA	13.5%	3	AUSTRALIAN	14.8%
4	THAILAND	0.2%	4	TAICHUNG	2.1%	4	JAPAN	12.1%	4	CHINA	5.1%
5	HONGKONG	0.2%	5	CHINA	2.0%	5	KUALATANJUNG	9.7%	5	KOREA	2.8%
6	VIETNAM	0.2%	6	TAIWAN	0.7%	6	SAIGON	2.2%	6	JAPAN	2.6%
						7	HAIPHONG	1.3%	7	MALAYSIA	2.2%
	CEMENT			FUEL		8	VIETNAM	1.0%	8	U.S.A	1.3%
1	BANGKOK	61.5%	1	SINGAPORE	93.5%	9	MALAYSIA	1.0%	9	HONGKONG	1.2%
2	KOREA	18.3%	2	BANGKOK	6.5%	10	COLOMBO	0.7%	10	VIETNAM	1.0%
3	CHINA	12.2%				11	HONGKONG	0.7%	11	TAIWAN	0.6%
4	HONGKONG	6.5%				12	OTHERS	0.6%	12	SLILANKA	0.1%
5	INDONESIA	1.5%							13	OTHERS	0.3%

[EXPORT]

	CONTAINER			TIMBER			VENEER & PLY WOOD			TOTAL	
1	SINGAPORE	48.7%	1	BANGKOK	56.6%	1	CHINA	96.8%	1	THAILAND	42.4%
2	SONGKHLA	28.3%	2	HONGKONG	10.0%	2	BANGKOK	3.2%	2	CHINA	26.5%
3	BANGKOK	8.4%	3	CHINA	9.3%				3	SINGAPORE	14.1%
4	THAILAND	7.0%	4	SINGAPORE	9.0%				4	HONGKONG	7.1%
5	KUALATANJUNG	3.5%	5	MALAYSIA	5.0%				5	MALAYSIA	4.1%
6	MALAYSIA	3.0%	6	KOREA	4.5%		WOOD		6	KOREA	2.6%
7	LEAMCHABANG	0.5%	7	TAIWAN	2.8%	1	HONGKONG	75.5%	7	TAIWAN	1.6%
8	HAIPHONG	0.2%	8	JAPAN	2.7%	2	BANGKOK	24.5%	8	JAPAN	1.6%
9	OTHERS	0.6%	9	KUALATANJUNG	0.1%				9	VIETNAM	0.0%
									10	OTHERS	0.1%

Source: Sihanoukville Port

YEAR	COMMODITY	UNIT	BY ROAD					BY RAIL		
			TOTAL	P. Penh	Kampot	Takeo	Others	P. Penh	Kampot	Takeo
1993	Cement	Volume (ton)	137,295	82,386	20,588	6,863	6,863	6,863	6,863	6,863
		Ratio (%)	42.61	25.57	6.39	2.13	2.13	2.13	2.13	2.13
	Fertilizer	Volume (ton)	23,898	14,338	3,609	1,192	1,192	1,192	1,192	1,192
		Ratio (%)	7.42	4.45	1.12	0.37	0.37	0.37	0.37	0.37
	Machinery	Volume (ton)	2,261	1,385	387	97	97	97	97	97
		Ratio (%)	0.70	0.43	0.12	0.03	0.03	0.03	0.03	0.03
	Rice	Volume (ton)	10,449	6,315	1,547	516	516	516	516	516
		Ratio (%)	3.24	1.96	0.48	0.16	0.16	0.16	0.16	0.16
	Sugar	Volume (ton)	4,294	2,674	644	193	193	193	193	193
		Ratio (%)	1.33	0.83	0.2	0.06	0.06	0.06	0.06	0.06
	Steel Construction	Volume (ton)	2,570	1,547	387	129	129	129	129	129
		Ratio (%)	0.80	0.48	0.12	0.04	0.04	0.04	0.04	0.04
	Bitumen	Volume (ton)	0	0	0	0	0	0	0	0
		Ratio (%)	0.00	0	0	0	0	0	0	0
	Fibro-Cement	Volume (ton)	0	0	0	0	0	0	0	0
		Ratio (%)	0.00	0	0	0	0	0	0	0
	General Cargoes	Volume (ton)	28,764	17,237	4,285	1,450	1,450	1,450	1,450	1,450
		Ratio (%)	8.93	5.35	1.33	0.45	0.45	0.45	0.45	0.45
	Cargoes in Container	Volume (ton)	89,546	53,710	13,436	4,479	4,479	4,479	4,479	4,479
		Ratio (%)	27.79	16.67	4.17	1.39	1.39	1.39	1.39	1.39
	Fuels	Volume (ton)	23,119	13,854	3,480	1,160	1,160	1,160	1,160	1,160
		Ratio (%)	7.18	4.3	1.08	0.36	0.36	0.36	0.36	0.36
	Total	Volume (ton)	322,196	193,446	48,362	16,078	16,078	16,078	16,078	16,078
		Ratio (%)	100.00	60.04	15.01	4.99	4.99	4.99	4.99	4.99
1994	Cement	Volume (ton)	153,679	102,084	23,551	15,761	15,761			
		Ratio (%)	34.90	22.67	5.23	3.5	3.5			
	Fertilizer	Volume (ton)	28,437	18,913	4,323	2,927	2,927			
		Ratio (%)	6.46	4.2	0.96	0.65	0.65			
	Machinery	Volume (ton)	2,587	1,711	405	270	270			
		Ratio (%)	0.59	0.38	0.09	0.06	0.06			
	Rice	Volume (ton)	18,867	12,609	2,882	1,936	1,936			
		Ratio (%)	4.30	2.8	0.64	0.43	0.43			
	Sugar	Volume (ton)	17,410	11,573	2,657	1,801	1,801			
		Ratio (%)	3.96	2.57	0.59	0.4	0.4			
	Steel Construction	Volume (ton)	16,115	10,717	2,477	1,666	1,666			
		Ratio (%)	3.67	2.38	0.55	0.37	0.37			
	Bitumen	Volume (ton)	10,074	6,755	1,531	1,036	1,036			
		Ratio (%)	2.30	1.5	0.34	0.23	0.23			
	Fibro-Cement	Volume (ton)	564	405	90	45	45			
		Ratio (%)	0.13	0.09	0.02	0.01	0.01			
	General Cargoes	Volume (ton)	34,228	22,785	5,269	3,512	3,512			
		Ratio (%)	7.79	5.06	1.17	0.78	0.78			
	Cargoes in Container	Volume (ton)	126,659	81,820	18,868	12,609	12,609			
		Ratio (%)	27.96	18.17	4.19	2.8	2.8			
	Fuels	Volume (ton)	41,684	23,236	5,314	3,602	3,602			
		Ratio (%)	7.94	5.16	1.18	0.8	0.8			
	Total	Volume (ton)	450,304	292,608	67,365	45,165	45,165			
		Ratio (%)	100.00	64.98	14.96	10.03	10.03			
1995	Cement	Volume (ton)	93,386	60,693	14,079	9,312	9,312			
		Ratio (%)	0.00	10.95	2.54	1.68	1.68			
	Fertilizer	Volume (ton)	29,808	19,400	4,434	2,993	2,993			
		Ratio (%)	0.00	3.5	0.8	0.54	0.54			
	Machinery	Volume (ton)	6,530	4,213	998	665	665			
		Ratio (%)	1.18	0.76	0.18	0.12	0.12			
	Rice	Volume (ton)	36,684	23,889	5,487	3,658	3,658			
		Ratio (%)	6.62	4.31	0.99	0.66	0.66			
	Sugar	Volume (ton)	19,898	12,915	2,993	1,995	1,995			
		Ratio (%)	3.59	2.33	0.54	0.36	0.36			
	Steel Construction	Volume (ton)	17,936	11,695	2,716	1,774	1,774			
		Ratio (%)	3.24	2.11	0.49	0.32	0.32			
	Bitumen	Volume (ton)	19,987	13,026	2,993	1,995	1,995			
		Ratio (%)	3.61	2.35	0.54	0.36	0.36			
	Fibro-Cement	Volume (ton)	0	0	0	0	0			
		Ratio (%)	0.00	0	0	0	0			
	General Cargoes	Volume (ton)	48,974	31,871	7,372	4,878	4,878			
		Ratio (%)	8.84	5.75	1.33	0.88	0.88			
	Cargoes in Container	Volume (ton)	208,832	135,743	31,372	20,841	20,841			
		Ratio (%)	37.67	24.49	5.66	3.76	3.76			
	Fuels	Volume (ton)	72,243	46,892	10,864	7,206	7,206			
		Ratio (%)	13.02	8.46	1.96	1.3	1.3			
	Total	Volume (ton)	554,278	360,336	83,308	55,317	55,317			
		Ratio (%)	100.00	65.01	15.03	9.98	9.98			



Source: Sihanoukville Port

Fig. - 2.5.4-10 Imported cargo destination

(2) Calling ships

The size of the ships which called on Sihanoukville Port in 1995 fall on the following ranges:

The dead weight tonnage(DWT); 700 - 19,000tons
(majority of them fall on the range 1,000 - 4,000tons),
The length over all (LOA) ; 80 - 180 m (majority of them fall on the range 60 - 105)
Draft (laden) ; 1.0 - 8.5 m (majority of them fall on the range 2.5- 6.5m)

The ship sizes broken down by the type of cargoes are as shown in Table - 2.5.4 -8.

Table - 2.5.4-8 Ship sizes classified by type of cargoes (in 1995)

Cargo Type	Ship size(DWT)	Ship calls	Ships used	Origin and/or Destination
Container	1,000- 1,200	48	2	Singapore(S.P.)
	3,000	55	1	Singapore
	4,200	48	1	from Singapore, to Songkhla
	4,300	21	1	Bangkok
	5,000 - 20,000	11	6	S.P., Japan, Haiphong, Malaysia, Thailand
Cement	-3,000	21	5	Bangkok
	3,000-5,000	12	5	Bangkok., Korea
	5,000-10,400	5	5	China, Hongkong, Korea
Fertilizer	4,300-4,500	3	2	S.P., China
	7,000	1	1	Bangkok
	10,000	1	1	Japan
Rice	-2,000	2	2	Bangkok
	3,000-5,000	3	3	Taiwan, China
	8,000-10,000	2	2	Bangkok
	13,000	1	1	U.S.A
	17,000	2	2	Australia
Bitumen	-2,000	3	3	S.P.
	2,000-3,000	17	2	Bangkok, (Singapore)
	3,000-5,000	5	4	Bangkok
Sugar	1,000-2,700	30	13	Bangkok
General Cargo	-1,000	14	5	S.P., Bangkok, China
	1,000-2,000	41	17	S.P., B.K., H.K., Malaysia
	2,000-5,000	6	6	B.K., S.P., Chaina
	5,000-8,000	15	12	Vietnam, Japan, B.K., H.K., China
	8,300	1	1	Korea
Oil	1,000-2,000	41	8	Singapore, (Bangkok)
	2,000-3,000	9	9	Singapore
	4,050	7	1	Singapore
Timber	-2,000	28	19	Bangkok, Hongkong
	2,000-3,000	29	4	Bangkok, Singapore
	3,000-5,000	18	7	B.K., China, Japan, Taiwan
	5,000-7,000	10	10	B.K., Malaysia, Hong Kong. Taiwan
	7,800	1	1	Bangkok

(3) Cargo handling operation

a. Present condition of cargo handling operation

1) Related organization for cargo handling operation

At present, the cargo handling operation concerned at Sihanoukville Port is managed by the following offices.

- Harbor Master Office
- Stevedoring Office
- Warehouse Office
- Machinery/Transport Office
- Technical Office
- Business Office

The cargo handling operation is controlled by the Operation Center, which consists of stevedoring office, warehouse office and machinery/transport office. Main functions of the related offices for cargo handling operation at the port are summarized as shown in Table - 2.5.4.-9.

Table - 2.5.4-9 Main functions of the related offices for cargo handling operation and others at Sihanoukville Port

Function	Harbor Master Office	Stevedor -ing Office	Ware -house Office	Machin. /Trans. Office	Techni -cal Office	Busi -ness Office
Information on vessels	●	●				
Assignment of pier	●					
Cargo handling planning		●				
Arrangement of gang		●				
Operation of cargo handling at pier		●				
Arrangement of handling equipment		●		●		
Arrangement of operators		●		●		
Document control of imp./exp. cargoes			●			
Receiving/delivering cargo at warehouse and yard			●			
Checking cargo(imp./exp.) at pier (tally)			●			
Checking cont.(imp./exp.) at warehouse and yard			●			
Storage control at warehouse and yard			●			
Maintenance of cargo handling Equipment				●	●	
Repairing cargo handling equipment and others					●	
Arrangement of fuel					●	
Arrangement of spare parts					●	
Preparation of bill						●
Ship repair					●	
Construction works					●	

Notes: This table was made based on Port' materials and field survey by the study team

Source: Sihanoukville Port

2) Formation of gang and workers

At present, the cargo handling operations at each pier are managed by the Operation Center and are classified into two categories; a) by vessel type, b) by combination of handling equipment.

Formation of gang is decided one day before ship's arrival according to the two categories of operation mentioned above.

Formation of gang and total number of workers belonging to the Operation Center are shown in Table - 2.5.4-10

Table - 2.5.4-10 Formation of gang and total number of workers

(1) Formation of gang

Workers;

Type of Vessel	Formation	By Ship Gear		By Crane		Warehouse and Container Yard	
		No.of Workers		No.of Workers		No.of Workers	
		Ship-side	Land-side	Ship-side	Land-side	Warehouse	Con./Yard
Container	Tally Clerk		1		1		
	Foreman	1	1	1	1		1
	Crane Operator	2			2		
	Fofklift Operator		1		1		1
	Tractor Driver		3		3		
	Worker	1	6	4	6		11
	Total	4	12	5	14		13
General Cargo	Tally Clerk		1		2		
	Foreman	1	1	1	1		
	Crane Operator	2					
	Fofklift Operator		2		2	1	
	Tractor Driver		3		3		
	Worker	6	8	6	8	3 + 6	
	Total	9	15	7	16	10	

3: from warehouse office
6: from stevedoring

(2) Total number of workers

	Number of Workers
Tally Clerk	30
Foreman	4
Crane Operator	39
Fofklift Operator	41
Tractor Driver	13
Mobil Crane Operator	51
Truck Driver	45
Heavy Lift Operator	8
Worker	316
Warehouse and C/Y	68
Total	615

Source: Sihanoukville Port

3) Utilization of cargo handling facilities

The existing layout for utilization of cargo handling facilities at Sihanoukville Port is shown in Fig. - 2.5.4-11.

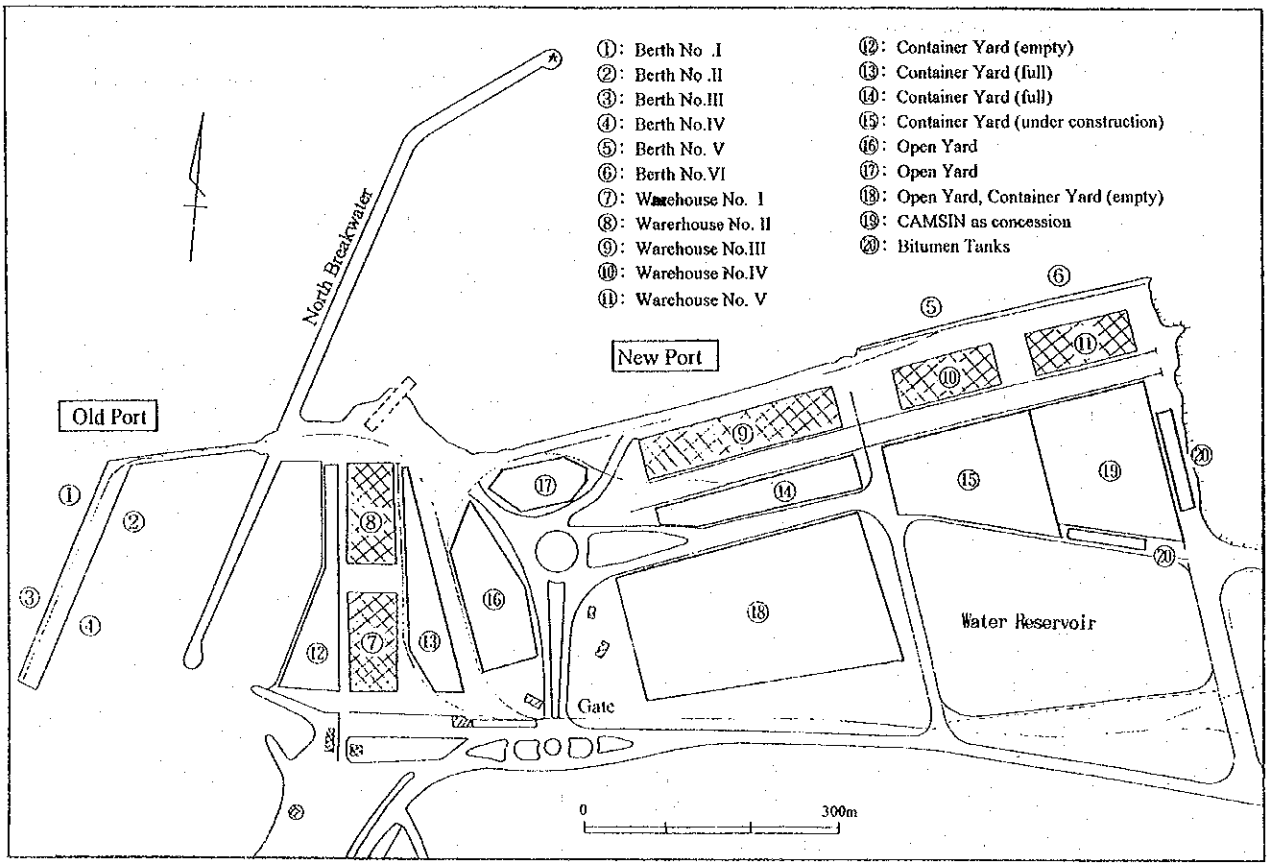


Fig. - 2.5.4-11 Existing layout of cargo handling facilities

i) The port is divided into two port areas; Old port has four alongside berths with a length of 290m and a water depth of -8m, New port has two alongside berths with a length of 350m and a water depth of -7m.

ii) There are five warehouses in the backup area of Old port (two warehouse: 6,480 m^2 x 2) and New port (three warehouses: 6,000 m^2 x 2, 12,000 m^2 x 1).

iii) There are two container yards for temporary use; one is allocated around the warehouse Nos.I and II, another is behind warehouse No.III and beside warehouse No.IV. However, they are not paved compeletely, therefore, new container yard of 2.3 ha is under construction at present. Refrigerated container facility is located beside warehouse No.IV, which is equiped by a private company.

iv) There are open storage yards for temporary use which are divided into many sections by roads and rail ways. However, these are also not paved.

4) Performance of cargo handling

The cargo handling operation is carried out by stevedores belonging to the stevedoring office, which consists of two teams and one technical stevedore. One team with two chiefs is divided into four groups, with each group containing 42 workers. The technical stevedore, composed of 40 workers, refer to skilled workers for container and heavy cargo handling.

The loading/discharging of general cargo is carried out from 07:00 to 23:30 (1st shift: 07:00 - 11:30, 2nd shift: 14:00 - 17:30, 3rd shift: 19:00 - 23:30, Monday - Friday) and the night shift is extended (overtime) when necessary up to the completion of work. However, the port has nine special days "no working" holidays such as New Year's day and the organization's anniversary.

The loading/discharging of container is not conduced in the same manner as general cargo in which work continues until completion. when its started. Instead of overtime, the port has introduced a bonus system (US$ 5/unit for normal days, US$ 7.5/unit for national holidays including Sunday).

i) Discharging of cargo

- General cargo

The general cargo vessels calling at Sihanoukville Port are classified into two types, " vessel laden with one kind of cargo such as foodstuffs packed in sacks " and "vessel co-stowed with various kinds of general cargo.

The imported sugar, rice and cement in sacks are generally stowed in bags, while cargoes unitized with preslings represent a very small share at Sihanoukville Port.

The vessels are mainly allocated to the berth Nos. I, II, III and IV, and the cargoes are unloaded by ship cargo gears and truck cranes with sling wire and/or rope and the majority of cargoes (about 84% of conventional cargo) are directly landed onto trucks arranged by consignees and brought out from the port. Few cargoes other than valuable cargoes are stored in warehouse and open storage yard.

- Container

The loaded container vessels calling at the port are divided into two kinds of vessels: container vessels and conventional vessels. Almost all container vessels have two ship cranes.