As a result, existing Oil Jetty is anticipated to have sufficient capacity even in 2000 for handling mineral oil and fuel / crude oil.

3) New JFI-1 Berth

According to PC records, 100 percent of calling vessels assigned for this berth were livestock vessels (276 calls) in 1994. This berth will be suitable for this cargo because of its remote location from the town. On the other hand large sized livestock vessels are assigned for other berths such as Container Berth, Mo'ta Floating Berth or Al-Mushtarack Berth because length and depth of JFI-1 are insufficient for berthing of these sized vessels. Twenty-one livestock vessels more than 150 meters in length called at this port from January, 1994 to July, 1995 with the largest sized vessel among them being 206 meters in length and having 9.8 meters draft. As livestock cargo volume in 2000 is forecasted as 3.7 times greater than that in 1994, it is no doubt that number of the large sized vessels will be greatly increased.

On the other hand, it is not practical to send large sized livestock vessels to other berths, because of the nature of cargo and increased occupancy of other berths in 2000.

In conclusion, it is recommended to improve this berth as follows ;

- Increase berth length to 200 meters and depth to 11 meters
- Build temporary stock yard equipped with sewage disposal behind the berth

5.4.3 Cargo Handling Equipment up to 2000

(1) Main Port

1) Phosphate

As described in the above 5.4.2, Phosphate Berth B (New Phosphate Berth) will be exclusively assigned for phosphate vessels in 2000, otherwise Phosphate Berth A (Old Phosphate Berth) will be used for vegetable oil, break bulk cargo and bunkering, though Berth A has one phosphate loader with the capacity of 1,000 tons per hour. Therefore in this Item a study is executed concerning the productivity of two loaders of Berth B, having each capacity of 2,000 tons per hour. Loading productivity of the loaders is calculated by the following formula.

Loading productivity ; Bp = 2,000 tons x 2 loaders x 0.7 x 24 H x 0.8
= 53,760 tons /day

As far as loaders capacity is concerned, the productivity is more than 50 thousand tons a day, but efficiency will drop by the condition of stock piles. Therefore efficient communication and management by both operators engaged in the berth and stock pile works are required to improve handling productivity.

2) Break Bulk Cargoes (General Cargoes)

(a) Handling productivity

Cargo volume of break bulk for import, export and transit through this port is forecasted as 2.748 million tons in 2000, the nearly same as at present. As mentioned in the

previous Chapter, even though total cargo volume of general cargo could be increased and considerable amount of general cargo like palletized, drums, boxes would be containerized, a lot of bagged cargoes, steel products and cars / vehicles are expected to remain as break bulk cargo. Meanwhile transit cargo will rather decline with progress of the peace process in the Middle East. Assuming cargo operation could be improved by 2000 according to the Basic Concept of Cargo Handling which is mentioned in the section (3) of the previous Chapter 4.6.5, following cargo handling productivity will be anticipated in case of the above typical cargo operation.

- Handling Productivity per day for Bagged Cargo

Qd = 50 kgs/bag x 36 bags/sling x 30 cycles/H x 4 gangs x 18H x 0.8
= 3,110 tons / day

- Handling Productivity per day for Steel Products

Qd = 5 tons x 12 cycles/H x 18H x 4 gangs x 0.8
= 3,450 tons / day

As a result, average handling productivity per day for break bulk is expected to be not less than 2,500 tons, including the case of cars and other general cargoes.

(b) Handling equipment

Present kinds and number of cargo handling equipment will be sufficiently usable in 2000, assuming the current maintenance system could be maintained as it is now. But to improve cargo handling productivity more, it is recommended to use portable solid conveyors with rollers for the operation of unified cargoes like bags and cartons as described in Chapter 3.1.3.

PC possesses currently 30 tug masters(RO/RO Trailer Head), 47 low bed chassis (RO/RO trailer) for tug master, 39 towing tractors and 137 trailers for towing tractors, and uses them effectively assorted in the Main Port and the Container Terminal. Towing tractor with trailer shall be used mainly for general cargo operation in the Main Port, while tug master with low bed chassis shall be mainly used for container operation in the Container Terminal in the future.

3) Grain

As described in the above 5.4.2, existing 3 unloaders could be used by extending belt conveyor to the New Grain Berth in 2000, even though the berth would be relocated near the existing Berth No.3 to make depth up to 14 meters. At present there are two pneumatic unloaders with capacity 240 tons per hour each and one mechanical with capacity 500 tons per hour, while the capacity of existing belt conveyor is 720 tons. Handling productivity is decided by the conveyor capacity which is lower than the capacity of 3 unloaders. In case that grain operation is made by means of these three unloaders, unloading productivity is calculated by the following formula.

Handling productivity ; Qd = 720 tons x 1 conveyor x 0.7 x 24 H x 0.8
= 9,677 tons / day

As a result, assuming a vessel will discharge 40,000 tons of grain at this berth, it is expected that berthing time of the vessel will be more than 4 days including necessary time for matters other than cargo handling. On the other hand, unloading operation by means of portable evacuators is as described in the previous Chapter.

4) Vegetable Oil

Existing Phosphate Berth A will be assigned for vegetable oil tankers in 2000 as it is now. The capacity of existing pipe lines connected to 12 storage tanks is 480 tons per hour. Currently unloading operation is made through pipe lines to storage tanks and / or directly in tank lorries, because the capacity of storage tanks is small (11.5 million tons) and the tank capacity is sometimes fully occupied. The capacity is expected to increase up to 27.5 thousand tons by 2000 according to PC. Cargo handling productivity by unloading pipe lines is calculated by following formula.

Handling productivity ; Qd = 480 tons x 0.7 x 24 H x 0.7
= 6,451 tons /day

As a result, though it is possible to raise productivity up to maximum 8,000 tons per day by unloading it through pipe lines to storage tanks and to tank lorrys simultaneously, average productivity will be expected to be about 6.5 thousand tons per day. Assuming average cargo volume to be unloaded per vessel is 15,000 tons, vessel berthing time will take 2.5 days including necessary time for matters other than cargo handling.

(2) Container Port

1) Container

(a) Handling productivity

The year 2000 marks the transition period from present operation system to transfer crane system. Average handling productivity will be expected to be around 16 boxes per hour. It is difficult to expect high productivity in 2000, because eastern partial yards of existing Yard 2 and Yard 3 to be utilized as temporary yards are more than 400 meters from the berth apron.

Container exchanged productivity (Loading / unloading) per one gantry crane is calculated by the following method.

Qd = 16 Boxes x 1.3 x 18 H
= 374 TEUs / day / crane
Qy = Qd x 351 D x 0.7
= 91.9 thousand TEUs / year / crane

As a result, container exchanged productivity by one gantry crane is 374 TEUs per day and 91.9 thousand TEUs per year, which are about 2,500 tons per day and 614 thousand tons per year, according to the above Table 5.4.5.

(b) Number of container gantry cranes

Required number of gantry cranes is calculated by the following formula.

n = Q / (Nh x Kc x Hd x Dy x Ew)
n ; Number of container gantry cranes (unit)
Q ; Container throughput (TEUs/year)
Nh ; Number of container boxes to be handled per crane per hour
(Boxes / crane /H)
Kc ; Conversion ratio from boxes to TEUs
Hd ; Working hours per day (H / D)
Dy ; Annual operation days (D / Y)
Ew ; Working Time efficiency

n = 227,100 Teas / (16 boxes x 1.3 x 18 H x 351 D x 0.7)
= 2.47 < 3

As a result, total of 3 gantry cranes will be required to handle number of containers by 2000. Therefore one additional gantry crane (Panamax type) shall be installed in addition to the existing two cranes by 2000.

(c) Number of other container handling equipment

In 2000, number of container throughput is forecasted more than twice that of 1994. To cope with such an increase, additional equipment must be supplied to supplement the current 9 straddle carriers and 16 top lift handlers. In addition to the existing equipment, transfer cranes shall be introduced to convert the system from current straddle carrier to transfer crane, finally to be established in 2010. During this transitional period, straddle carrier, top lift handlers and transfer cranes shall be used together effectively in the marshalling yard.

i) Transfer Cranes (Transtainers)

Assuming southern half pavement of whole new yards would be completed including a yard on a 60 meter berth extended to south, possible ground slots to be operated by transfer cranes would become nearly 2,000 TEUs. Therefore transfer cranes could be engaged in vessel operation by gantry quay cranes in 2000.

3 gantry cranes x 1.5 times = 4.5 transfer cranes

As a result, 5 transfer cranes will be required in 2000.

ii) Straddle carriers and top lift handlers

Even though the above mentioned southern half yards would become available as container stacking yards, eastern half of existing Yard 2 and Yard 3 must still be used as temporary stacking yards due to the shortage of required grand slots. Existing equipment shall be engaged in these temporary yards and also existing container freight station.

iii) Tug master with low bed chassis (two Twenty Footers or one Forty Footer container to be loaded)

It is very difficult to decide the most practical number of this type of equipment to be engaged in container operation in 2000. One gantry quay crane will need four tug masters with chassis for vessel operation. On the other hand, operation other than the vessel operation will require at least 10 units because of container movement between the temporary container stacking yards and transfer crane operating yards and also movement between container yards and container freight station (CFS). As a result, 12 units for vessel operation and about 10 units for yards and CFS operation will be required (total 22 units).

Following assumption is executed regarding the required number of towing vehicles for general cargo operation in the Main Port and container operation in the Container Terminal in 2000 and 2010.

Table 5.4.6 Required Number of Towing Vehicles in 2000 and 2010

(Unit)

Year	kind	Main Port	Container Terminal	Maintenance Shop	Total
1995 Year	Tug Master	5	22	3	Existing 30
	Chassis	15	30	2	47
	Tractor	30	7	2	39
	Trailer	127	7	3	137
2000 Year	Tug Master	5	22	3	Assumption 30
	Chassis	20	38	3	61
	Tractor	30	7	2	39
	Trailer	127	7	3	137
2010 Year	Tug Master	6	26	3	35
	Chassis	21	36	4	61
	Tractor	30	7	2	39
	Trailer	127	7	3	137

Remark ; (1) Chassis (Low Bed Chassis or RO/RO trailer) is connected to Tug Master
(2) Trailer is connected to Tractor (Towing Tractor)
(3) Existing number of Chassis = 4 x 20' + 43 x 40'
(4) In addition to (3), 4 x 20' and 10 x 40' will be supplied within 1995.
Source of number in 1995 ; PC

(d) Dangerous cargo in container

Highly dangerous cargoes such as some of IMO class 1 (explosives) and class 7 (radioactive materials) are not allowed to be stored in the port area, according to the PC regulation. Highly DG containers are recommended to be stacked in the extreme northwest end of the container yard due to the considerable distance from berth, gate and office. (Refer to Figure 4.6.1)

(e) Computerization

Complete computerization of the Container Terminal can not be introduced in the

Short-Term Improvement Plan, because the new terminal will still be under construction in 2000 and it takes more time to establish the new system. But it is recommenced to operate container stacking control in yards by the existing computer for the time being. Details will be described in Chapter 5.6.

2) Cement

Al-Mushtarak Berth is used for loading this cargo by Jordan Cement Factories Company which is located behind the berth. Bulk cement stowed in two storage domes is loaded to bulk cement vessel at the berth by one loader through belt conveyor. The capacity of this loader is 400 tons per hour.

Handling productivity ; Qd = 400 tons x 0.7 x 24 H x 0.8
= 5,376 tons / day

Assuming average loading cargo volume per vessel in 2000 would be 20,000 tons, it takes average 3.72 days to load it. Average berthing time per vessel is expected to be nearly 4 days including time other than loading.

On the other hand, a part of cement in bulk will be packed in bag and palletized, and then exported as general cargo or containers (currently 20 percent of cement is exported as bags on pallet).

3) Rice

Mo'ta Floating Berth is used for unloading rice by Arab Packaging Company (APC) which is located behind this berth. There are three hoppers connected to 7 rice storage tanks by belt conveyor. The capacity of belt conveyor is 500 tons per hour. Unloading operation is made by grabs of vessels gears and / or mobile cranes on shore. Handling productivity will be decided by the capacity of conveyor.

Handling productivity ; Qd = 500 tons x 0.7 x 24 H x 0.8
= 6,720 tons / day

Assuming average unloading cargo volume per vessel would be 18,000 tons, average vessel berthing time is expected to be about 3 days. Unloading operation for this kind of cargo might require more time to sweep up to collect remaining cargo in vessel's hold. Meanwhile imported rice in bulk is packed in bag in this factory and delivered for domestic use or re-export .

(3) Industrial Port

1) Industrial Cargoes

These cargoes will be handled at JFI West and East Berths in 2000, and the improvement of cargo handling operation at these berths is required as soon as possible due to present low productivity and great increase of cargo volume in the near future.

(a) Potash / DAP / NPK / Salt / MgO

Potash and DAP are currently exported and the export of NPK, Salt and MgO will start by 2000 through JFI West, East and North (new berth). These cargoes will be loaded

by same loaders and conveyors, according to JPMC. The capacity of each loader on each berth including new berth is 1,500 tons per hour.

Handling productivity ; Qd = 1,500 tons x 0.7 x 24 H x 0.8
= 20,160 tons / day

Assuming average cargo volume per vessel would be 20,000 tons, average vessel berthing hours is expected to be about 26 hours, as required time for matters other than cargo operation will be 2 to 3 hours. To achieve the above productivity in 2000, it is indispensable to make close communication and efficient management by both side operators engaged in between the loading operation at quay and cargo delivery operation at stock pile.

(b) Sulfur

As described in the above 5.4.2, the improvement of this cargo operation is most required in the industrial cargoes. Existing one mechanical unloader which is chain bucket elevation system is frequently out of order which results in low productivities.

Assuming handling productivity could be improved at the existing undoaler, the handling productivity of this cargo would become as follows ;

Handling productivity ; Qd = 500 tons x 1 loader x 0.7 x 24 H x 0.8
= 6,720 tons / day

Assuming average cargo volume per vessel would be 20,000 tons, average vessel berthing hours is expected to be about 75 hours as required time for matters other than cargo operation will be about 4 hours.

(c) Liquid Ammonia

This cargo is unloaded at JFI East Berth by special tanker for liquid ammonia. The capacity of unloading pipe lines for liquid ammonia is 680 tons per hour.

Handling productivity ; Qd = 680 tons x 0.7 x 24 H x 0.8
= 9,140 tons / day

Assuming average cargo volume per vessel would be 20,000 tons, average berthing hours is expected to be about 55 hours, as required time for matters other than cargo operation will be 2 to 3 hours.

(d) Phosphoric Acid

As mentioned in the above 5.4.2, this cargo volume is expected to increase greatly in 2000. One loader connected to shore storage tanks by pipe lines is existing at JFI East Berth and the capacity of the loader is 560 tons per hour.

Handling productivity will be improved as following ;

Handling productivity ; Qd = 560 tons x 1 unloader x 0.7 x 24 H x 0.8
= 7,526 tons / day

Assuming average cargo volume per vessel would be 20,000 tons, average vessel berthing hours is expected to be about 67 hours as required time for matters other than cargo operation will be 3 to 4 hours.

2) Oil

Fuel oil / crude oil imported by Jordan Electricity Authority and mineral oil by Solvochem-Holland B.V will be handled at Oil Jetty.

(a) Fuel / Crude Oil

The scheduled capacity of newly equipped pipe line to the power station will be 1,500 tons per hour, according to the Authority. Provided this unloading pipe line would be equipped by 2000, the productivity is calculated by the following formula ;

Handling productivity ; Qd = 1,500 tons x 0.7 x 24 H x 0.8
= 20,160 tons / day

Assuming average cargo volume per vessel would be 25,000 tons, average vessel berthing hour at this jetty is expected to be about 34 hours as required time for matters other than cargo operation will be 3 to 4 hours.

(b) Mineral Oil

The capacity of existing unloading three pipe lines is 450 tons per hour.

Handling Productivity ; Qd = 450 tons x 0.7 x 24 H x 0.8
= 6,048 tons / day

Assuming average cargo volume per vessel would be 20,000 tons, average vessel berthing days is expected to be about 3.5 days as required time for matters other than cargo operation will be 3 to 4 hours.

3) Livestock

All of this cargo (almost all sheep) is to be handled at New JFI-1 Berth after the improvement of existing JFI-1 will be made by 2000. As far as present handling productivity is seen, it is possible to achieve the productivity of 1,500 heads per hour, though it depends on the condition to receive cargo on shore. Currently, cargo is usually unloaded on truck directly because there is no space to stock livestock in the port area. Therefore handling productivity will be decreased once number of trucks to receive cargo is reduced. To cope with such unreliable factor against handling productivity, it is recommended to prepare temporary stock yard adjacent to the berth. On the other hand, number of livestock (sheep) to be unloded per vessel ranges from 5,000 heads to 85,000 heads at present, depending on the trade and size of vessels, and also these circumstances will not change in 2000.

Taking the above various factors into consideration, average handling productivity is expected as 1,500 heads per hour in 2000. Handling productivity is calculated by the following formula, assuming working hour is 18 hours per day because this cargo is categorized in break bulk, though 24 hour operation might be provided in special cases.

Handling productivity ; Qd = 1,500 heads x 40 kgs /head x 18 H x 0.8
= 864 tons (21,600 heads) / day

Assuming average cargo volume per vessel would be 300 tons (7,500 heads), average vessel berthing hours is expected to be about 11 hours as required time for matters other than cargo operation will be 2 to 3 hours.

5.4.4 Required Number of Berths

As a result of the above study, required number of berths in the Short-Term Improvement Plan is calculated by the same method as in the previous Chapter.

(1) Main Port

Table 5.4.7 Required Number of Berth in the Main Port (2000)

Item	Phosphate	Break Bulk	Grain	Vegetable Oil
Forecast Cargo Volume (x 1,000 tons)	5,700	2,748	1,550	320
Average Cargo Volume per Vessel (tons)	50,000	3,000	40,000	15,000
Cargo Handling Productivity (tons/day)	53,760	2,500	9,677	6,451
Number of Days Necessary other than Cargo Handling per Day	0.15	0.10	0.20	0.15
Total Berthing Days per Vessel	1.08	1.30	4.33	2.48
Total Berthing Days per Year	123	1,191	168	53
Annual Workable Days	351	351	351	351
Berth Occupancy Ratio	0.7	0.7	0.7	0.7
Required Number of Berth	0.50	4.85	0.68	0.21

1) Phosphate Berth B is quite sufficient for the handling of forecast phosphate cargo volume in 2000.

2) New Berth No. 3, 4, 5, 6 and 7 are sufficient for the handling of forecast break bulk cargo volume in 2000.

3) New Grain Berth is sufficient for the handling of forecast grain cargo volume in 2000.

4) New Oil Berth is quite sufficient for the handling of forecast vegetable oil cargo volume in 2000 and can be used for the handling of break bulk cargo and bunkering if necessary.

(2) Container Port

Table 5.4.8 Required Number of Berth in the Container Port (2000)

Item	Container	Cement	Rice
Forecast Cargo Volume (x 1,000 tons)	1,517	700	520
Average Cargo Volume per Vessel (tons)	4,080	20,000	18,000
Cargo Handling Productivity (tons /day)	7,500	5,376	6,720
Number of Days Necessary Other Than Cargo Handling per Vessel	0.15	0.20	0.20
Total Berthing Days per Vessel	0.69	3.92	2.88
Total Berthing Days per Year	258	137	83
Annual Workable Days	351	351	351
Berth Occupancy Ratio	0.7	0.7	0.7
Required Number of Berth	1.05	0.56	0.34

1) New Container Berth No. 1 and 2 are quite sufficient for the handling of forecast containerized cargo volume in 2000.

2) Mo'ta Floating Berth is quite sufficient for the handling of forecast cement cargo volume in 2000.

3) Al-Mushtarak Berth is quite sufficient for the handling of forecast cargo volume of rice in bulk in 2000.

(3) Industrial Port

Table 5.4.9 Required Number of Berth in the Industrial Port (Fertilizer Berths)(2000)

Item	Potash / DAP / NPK / Salt / MgO	Sulfur	Liquid Ammonia	Phosph. Acid	Total
Forecast Cargo Volume (x 1,000 tons)	5,300	1,000	310	1,000	7,610
Average Cargo Volume per Vessel (tons)	20,000	20,000	20,000	20,000	Average 20,000
Cargo Handling Productivity (tons/day)	20,160	6,720	9,140	7,526	Average 10,887
Number of Days Necessary other than Cargo Handling per Vessel	0.10	0.15	0.15	0.15	Average 0.14
Total Berthing Days per Vessel	1.09	3.13	2.34	2.81	Average 2.34
Total Berthing Days per Year	289	156	36	140	621
Annual Workable Days	351	351	351	351	Average 351
Berth Occupancy Ratio	0.7	0.7	0.7	0.7	Average 0.7
Required Number of Berth	1.18	0.64	0.15	0.57	2.54

* JFI West and East berths are not sufficient for the handling of forecast industrial cargo volume in 2000, even though cargo handling productivity could be improved. Therefore an additional berth will be required by 2000 to cope with increasing cargo volume to be handled here.

Table 5.4.10 Required Number of Berth in the Industrial Port (Oil Jetty/JFI-1) (2000)

Item	Fuel / Crude Oil	Mineral Oil	Livestock
Forecast Cargo Volume (x 1,000 tons)	720	550	81
verage Cargo Volume per Vessel (tons)	25,000	20,000	200
Cargo Handling Productivity (tons /Day)	20,000	6,048	860
Number of Days Necessary other than Cargo Handling per Vessel	0.15	0.15	0.15
Total Berthing Days per Vessel	1.40	3.46	0.38
Total Berthing Days per Year	40	95	155
Annual Workable Days	351	351	351
Berth Occupancy Ratio	0.7	0.7	0.7
Required Number of Berth	0.16	0.39	0.63

1) Oil Jetty is quite sufficient for the handling of forecast cargo volume of fuel / crude oil and mineral oil in 2000.

2) New JFI-1 is sufficient for the handling of forecast livestock cargo volume and can be used for break bulk cargo if necessary in 2000.

5.5 Proposed Short-Term Improvement Plan

5.5.1 General

In the three alternative cases, Case 5 is finally proposed as the most appropriate one. In Case 5, cargo volume to be handled in this port is forecasted as 22 million tons in the year 2000 of the Short-Term Plan and 29 million tons in the year 2010 of the Master Plan. To cope with the increasing cargo volume and to improve port function by the best berth assignment of calling vessels, the layout plan of port facilities is examined, taking mainly the best use of existing facilities into consideration. Meanwhile Short-Term Improvement Plan will constitute first phase en route to the Master Plan.

The main facilities to be improved in the Master Plan are as follows.

- Grain Berth in the Main Port
- Container Terminal in the Container Port
- JFI-1 Berth and an additional industrial berth in the Industrial Port

On going and planning development scheme for the Master Plan, Short-Term Improvement Plan contains the following components.

5.5.2 Layout of Facility

(1) Main Port

1) New Grain Berth

The berth is planned to be 280 meters in length and 14 meters in depth so as to accommodate Panamax sized vessels with full load at any time.

There are two alternatives in regard to the location of the berth. One is near the existing Berth No.1 and other is near the Berth No.3. The two alternatives are compared below.

Table 5.5.1 Comparison of Two Alternatives for New Grain Berth Location

Alternative	Construction Work	Construction Cost	Overall Layout	Phosphate Dust Contamination
Alt-1 (Near Berth No.1)	Grain operation is suspended at Berth No.1	6 million JD	Locates at extreme south end of Grain Cargo berths	Contamination problem due to near Phosphate Berth B
Alt-2 (Near Berth No.3)	Grain operation can be continued at Berth No.1	2 million JD	Grain Cargo berths divided into two	No contamination due to 700 meter distance from Phosphate Berth B

(a) In case of the former (Alternative 1), New Grain Berth grain vessel can not only berth for unloading grain, but also 3 unloaders installed in existing Berth No.1 can not be utilized during the construction work.

(b) Also, the construction cost of the former is estimated to be 3 times higher than the latter. The main reason for such a difference is for the great work required to ensure that Berth No.1 is only 11 meters in depth and the face line of the berth is inclined by two degrees, while Berth No.3 is 13 meters and the line is straight.

As a result, it is finally proposed to adopt Alternative 2.

2) New Break Bulk Cargo (General Cargo) Berths

As New Grain Berth is proposed to be located near existing Berth No.3, the New Break Bulk Cargo Berths will be arranged as follows ;

From south end to north end
- 170 meters in length and 10 meters in depth for 10,000 DWT ; two berths (Existing Berth No.1 and 2)
- New Grain Berth ; one berth (Near existing Berth No.3)
- 240 meters in length and 12 meters in depth for 30,000 DWT ; one berth (Near existing Berth No.4)
- 170 meters in length and 10 meters in depth for 10,000 DWT ; one berth (Existing Berth 6)
- 150 meters in length and 8 meters in depth for less than 10,000 DWT ; one berth (Existing Berth No.7)

3) Other Berths

Existing Phosphate Berth A is proposed to be assigned mainly for Vegetable Oil tankers as New Oil Berth, otherwise to be assigned for the vessels of break bulk cargo and bunkering when berth is rehabilitated after 35 years of service. Existing Phosphate Berth B will be exclusively used for loading phosphate as it is now.

(2) Container Port (Container Terminal)

Passenger Berths (Yarmouk Floating Berths), Cement Berth (Al-Mushtarak Berth) and Rice Berth (Mo'ta Floating Berth) could be used as today, existing facilities being retained. But it is definitely necessary for the Container Berths and the terminal facilities to be improved in order to cope with the handling of more than 400 thousand TEU containers in 2010 and also to accommodate two large sized container vessels simultaneously.

The layout of the proposed container facilities in the Short-Term Impovement Plan in 2000 and the Master Plan in 2010 is described below.

1) Container Berths

(a) Two Berths are proposed to accommodate two Panamax container vessels at the same time by 2000, because size of vessels is expected to become larger than today due to increasing number of containers handled.

- Berth length ; 300 meters x 2 = 600 m
- Berth depth ; 13 m
- Standard type of calling vessel ; LOA 260 m / Breadth 32.2 m / Draft 12 m / 35,000 DWT

Therefore a 60 m extension of the berths is proposed by 2000 as existing berths are 540m, while the current depth of 14.5 m is sufficient. The direction of the extension berth should be southward, because RO/RO Berth is existing at the north end of the berth and shall be used even in the future.

2) Container Terminal (See Figure 4.5.1)

Although there are many handling systems at container terminals throughout the world such as straddle carrier system, transfer crane system, chassis system and combined system, transfer crane system is proposed in the Master Plan for the following reasons.

- Required grand slots can be minimized.
- Safe operation is expected because the movement flow of transfer crane and tug master with chassis is usually stable.
- High technical skill to handle transfer crane is not required.
- Cost involved in this system is expected to be relatively low from long term point of view, because work force and maintenance rate of equipment are small, though initial investment is large.
- This system is most suitable for computerization.
- Existing system which is being operated by straddle carrier, top lifter handler and tug master with chassis is similar to transfer crane system.

(a) Apron width

Required apron width is decided mainly by ;

i) Clearance between berth face and quay crane rail on sea side
ii) Span of quay crane rail
iii) Back reach distance for vessels hatch cover to be placed on the apron

The i) and ii) of existing two quay cranes are 21 m and iii) is decided by the width of vessels hatch cover and mobility of container handling machines which is expected to be nearly 30 m. The apron width is proposed to be 50 m.

(b) Scale of Container Yard

The shape of container yard is desirable to be square or rectangular to make up safe and efficient movement of container handling equipment. To minimize travelling distance of tug master with chassis, the depth of container yard from berth face line is desirable to be short. It is usually 300 to 350 m in case of typical container yards in the world. In the plan it is proposed as 300 m. On the other hand, the length of container yard along the two berths is proposed to be approximately 900 m, taking account of the gate location and the hill at the back of the terminal.

(c) Arrangement of Container Yard

Grand slots per block in the yard is proposed to be 6 lanes by 18 rows (total 108 TEUs) based on the specification of proposed transfer crane. Thirty-seven blocks are required in the final plan. The arrangement of the blocks is as shown in the

Figure 4.6.1. It is decided by the following basic concept.

- Traffic roads by tug master and trucks in the yard are basically 33 m to make two way system in consideration of safe turning space by vehicles.
- To make space for transfer crane to move into other block line, 14 m is prepared. This space will make additional grand slots on number of handling containers increasing after the target year.

(d) Layout of facilities other than container yard

i) Gate

Gate is proposed to be located at the northeast of the terminal, because it is close to the access road and the Main Port in which there is a PC administration office located on the north side. On the other hand, the gate must be more than 200 m apart to the south from the rotary of the access road to make a gentle slope because the height difference is about 5.5 m.

ii) Office / Maintenance Shop / Cleaning Area / Container Equipment Yard

Terminal Office must be close to the Gate and Maintenance Shop is preferable to be adjacent to the office. Meanwhile Container Cleaning Area and Equipment Yard is desirable to lie next to Maintenance Shop. In conclusion, it is proposed to place these facilities on the east side of the yard.

(e) Proposed Transitional Layout in the Short-Term Improvement Plan

- To extend the berth by 60 m to south
- To complete yard pavement up to the southern half of the final planned yard so that transfer crane can work
- To found new office and maintenance shop in the final planned place

(3) Industrial Port

Oil Jetty can be used as it is now in the year 2000 of the Short-Term Improvement Plan. But the enlargement of JFI-1 Berth and the construction of an additional industrial berth are proposed, according to the Short-Term Plan, as described in the 5.4.2.

1) Enlargement of JFI-1 Berth

- Berth length to be 200 m and depth to be 11 m for 20,000 GRT.

This berth shall be assigned for all livestock vessels including large sized ones and conventional vessels if necessary.

As the length of existing JFI-1 Berth is 80.6 m and the depth is 7 m, 119.4 m extension of the berth and deepening by 4 m are required. On this account it is proposed that the extension of the berth is 29.4 m to north and 90 m to south, and the berth apron is spread seaward to obtain depth up to 11 m. The apron of extension berth is proposed to be 25 m wide. (Improved JFI-1 Berth would be called New JFI-1 Berth).

2) Construction of one Industrial Berth

- Berth length to be 230 m and depth to be 15 m for 50,000 DWT

This berth would be located in between JFI-West/East and New JFI-1 Berth so that the southwest end of the berth could be connected with the north end of existing JFI-West/East Jetty when an another additional berth would become necessary in the future.

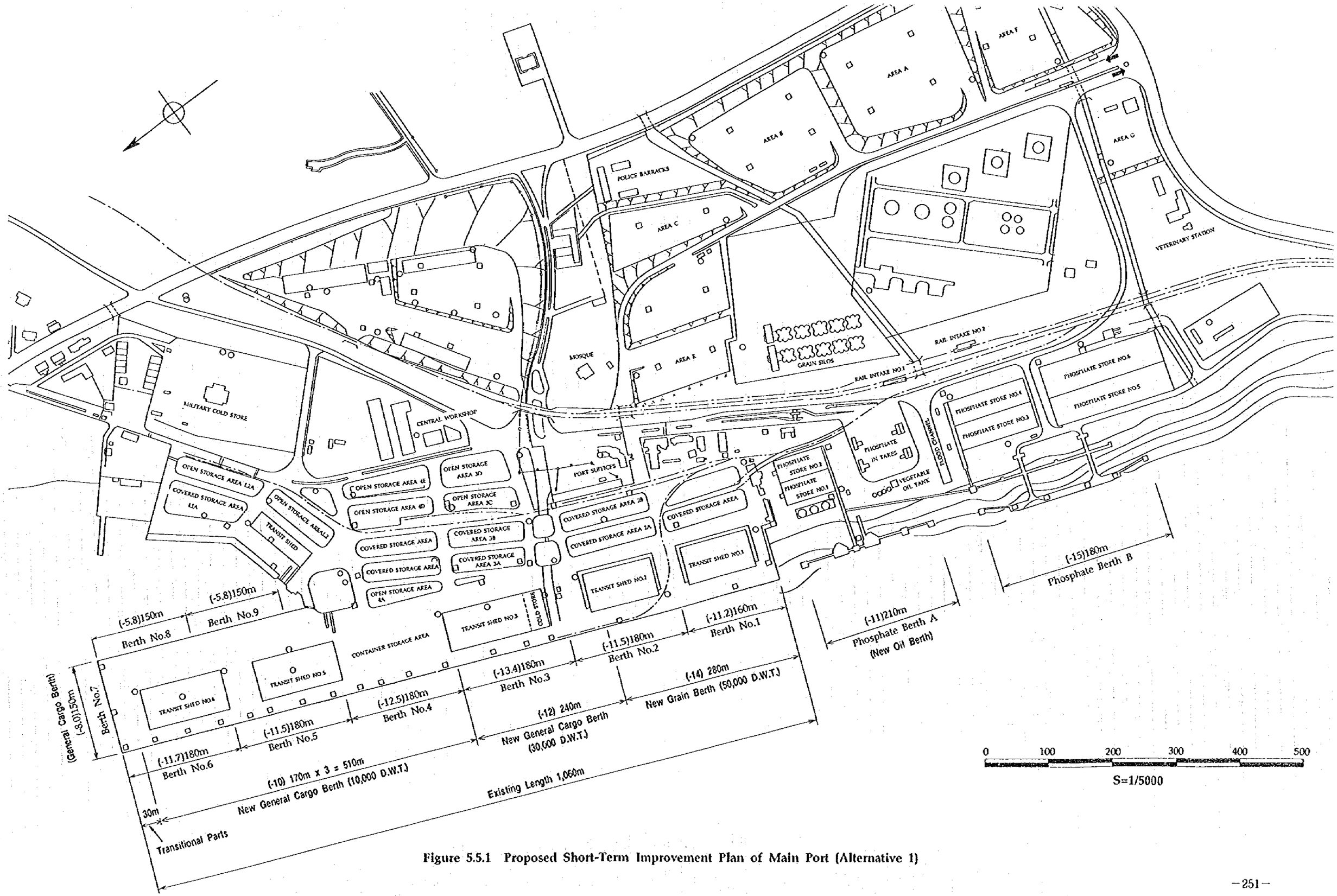


Figure 5.5.1 Proposed Short-Term Improvement Plan of Main Port (Alternative 1)

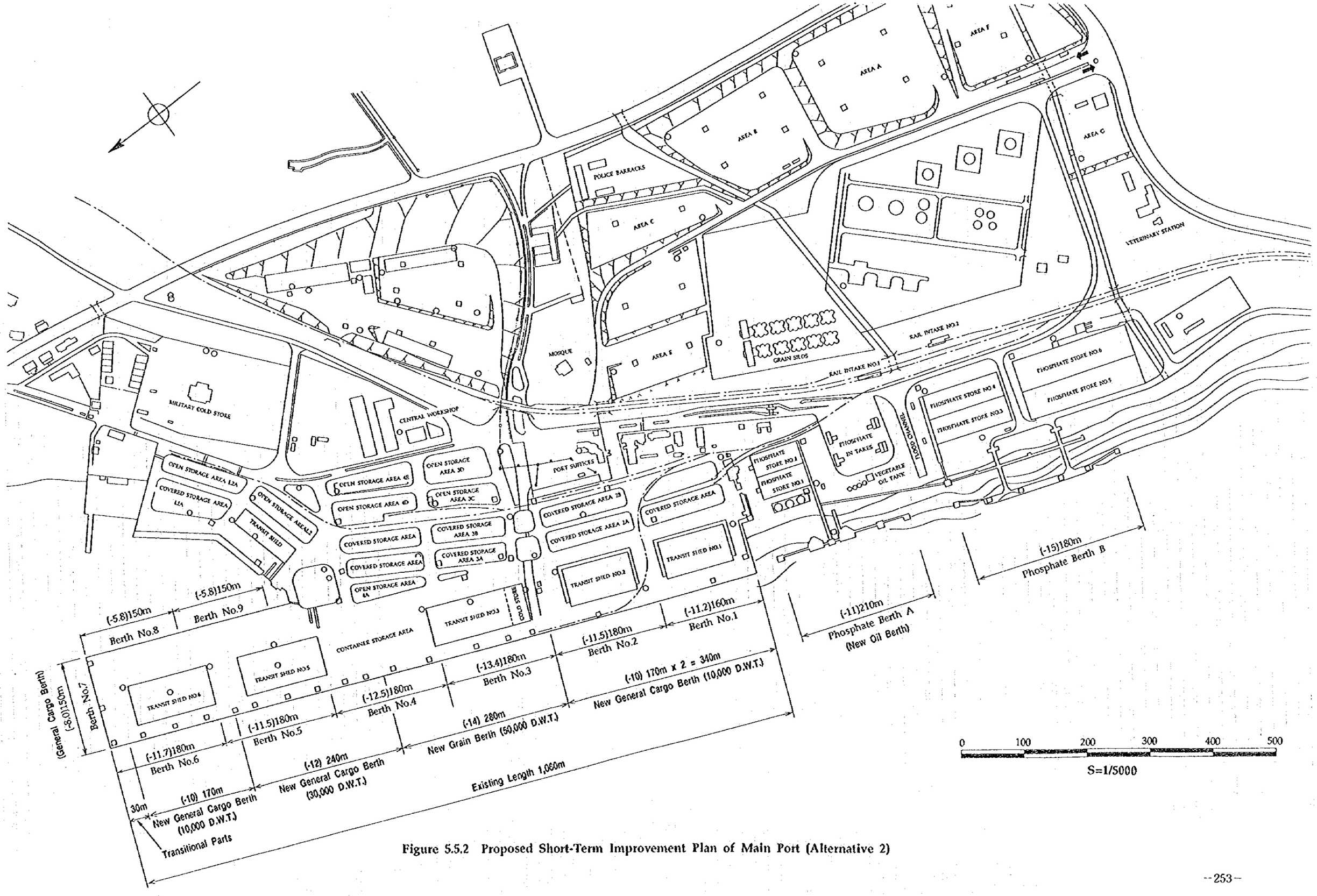


Figure 5.5.2 Proposed Short-Term Improvement Plan of Main Port (Alternative 2)

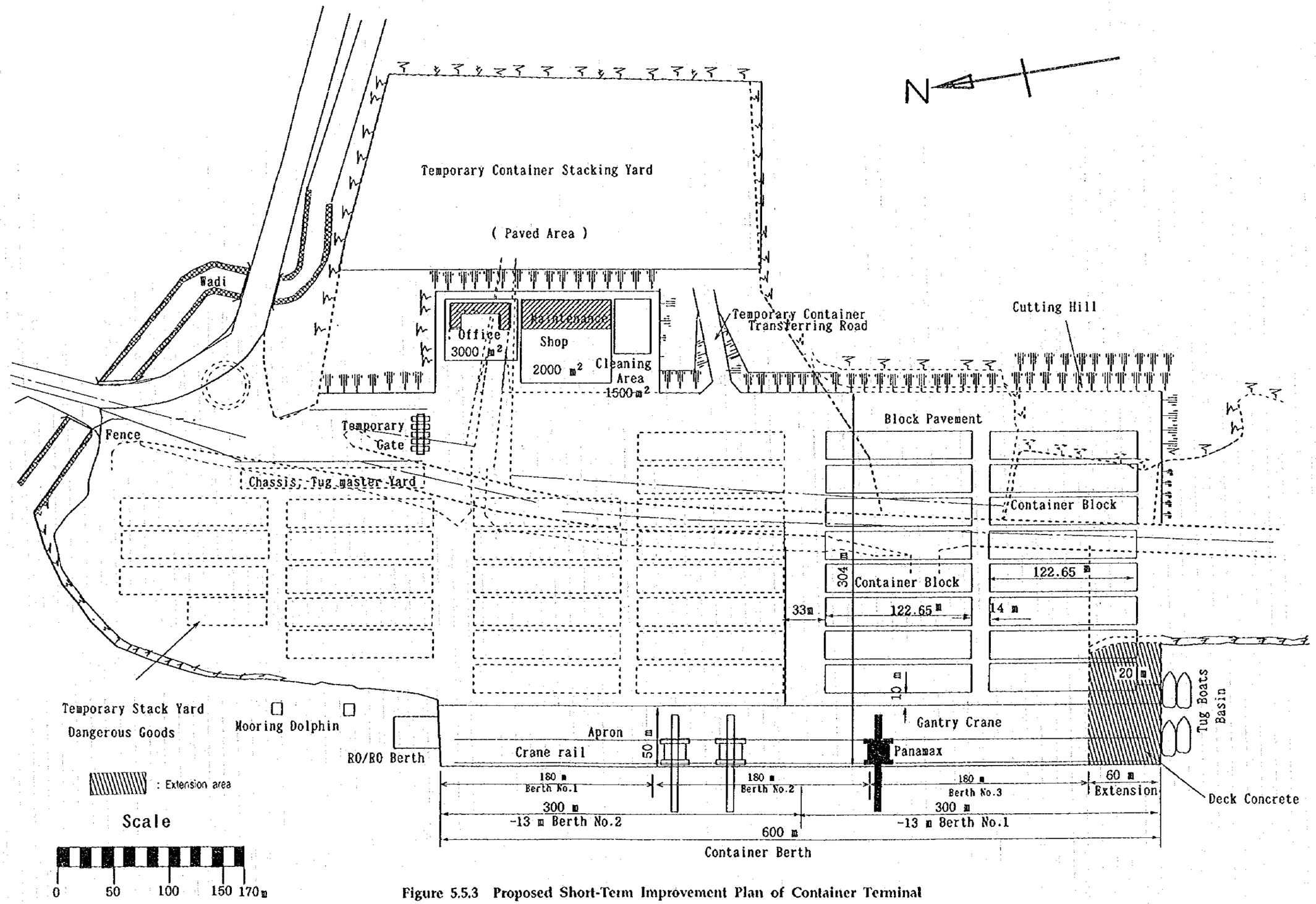


Figure 5.5.3 Proposed Short-Term Improvement Plan of Container Terminal

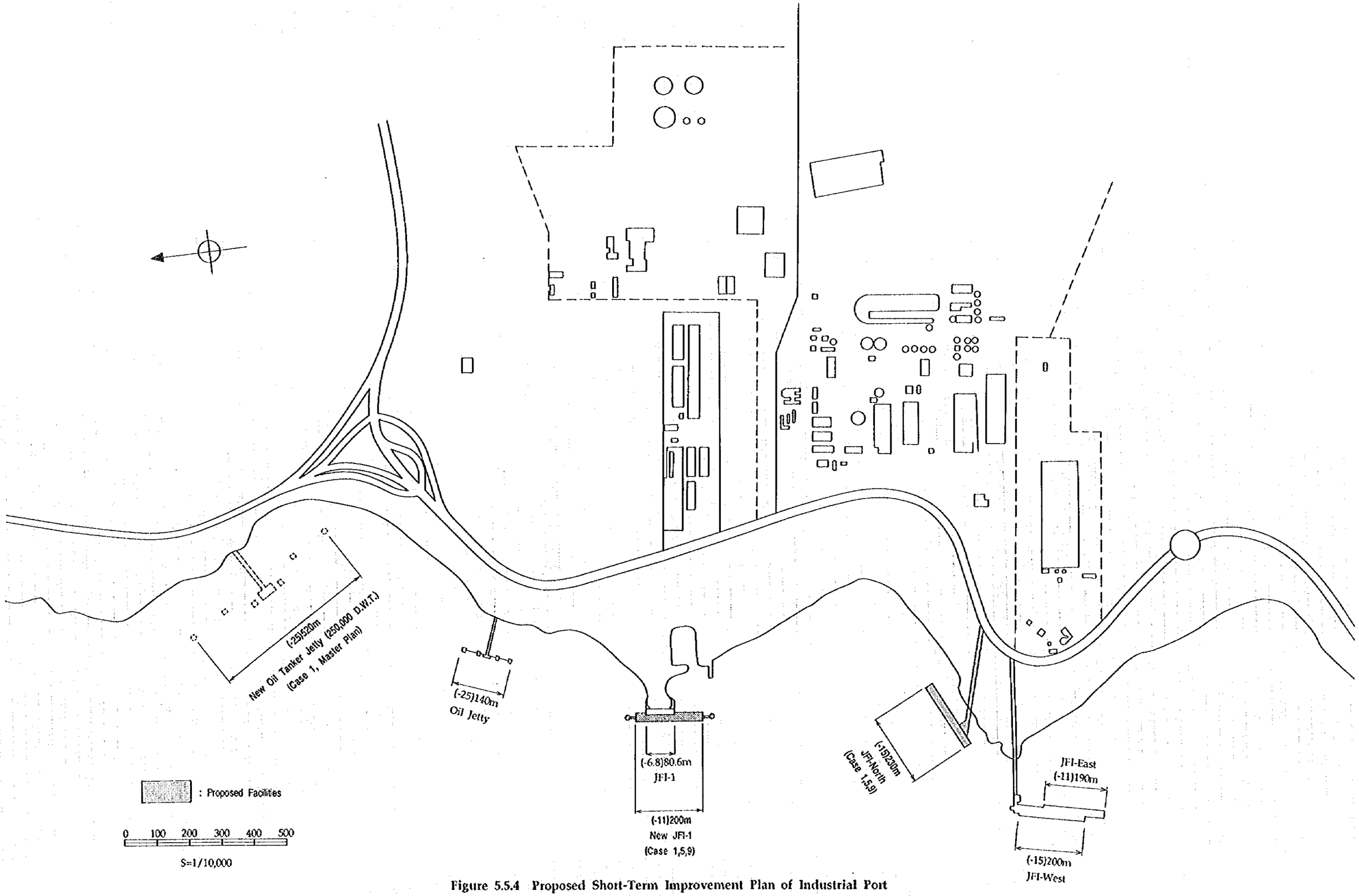


Figure 5.5.4 Proposed Short-Term Improvement Plan of Industrial Port

5.6 Information System for the Short-Term Improvement Plan

5.6.1 Computer System for the Target Year

(1) Pre-Study for Computerization

To make a total computer network of PC in future, it is necessary to establish the project team for computerization prior to the year 2000. The project team will be comprised of representatives of each department including computer specialists, who will formulate policy for computerization and execute actual designs.

The project team firstly analyzes the routine tasks of each department, and collects all documents which are circulated among the departments. The same data and items are duplicated or triplicated on different documents. The most important items are to choose and select the data which is required by each department, and to design the system and equipment. So that the data will be printed on a proper format of each department.

PC has just started computerization by each department individually. Marine, Finance, Supplies & Purchases, Technical Department have their own personal computer or mini computer for their works, but these computers do not form a network and are not linked with each other. The model and O/S are different. The project team should take into consideration these differences to make a computer network effectively.

To make a total computer network of PC, the project team should work under the Director General directly. As the tasks of the project team cover a wide range of tasks from each department, it is necessary for the team to communicate with all the departments frankly beyond the wall of each department. The project team, with a secretariat attached, should be one of the direct substructures of the Director General.

(See Appendix 5.6.1)

(2) File Design

After choosing and selecting necessary data, file design will be planned. Under file design procedure, items, records including the order, length and way to access of data are designed. File design shall be one of the major tasks for the project team.

The computerization which is planned or perceived by each department is related to database files, such as vessel's particulars, cost of port charge, cargo handling charge and spare part inventory control. The database is a multipurpose file system of which relative data is unified by a proper rule, so that the data can be served by RDBMS (Relational Data Base Management System) in common.

(3) System Design

For introduction of a computer system, the study about the system design should be concluded prior to decision of the computer model. The procedure of the system design contains two main items, one is the constitution of the main frame and the other is the network. At the first stage of computerization, PC should decide and design the main frame and equipment under supervision of computer consultants.

The basic procedure of the system design is as follows;

① Determination of requirements
The requirements must be determined about the ability of transaction, response time, throughput, reliability of the system, etc.

Outline of transaction
Outline of database
Response time
Throughput
Reliability
Cost of software
Cost of hardware

② Design
The design must be carried out about the model and capability of CPU, size of the main memory, model of disks, printers, displays, etc. The first step of the system design is to build up the concept covering whole of the computer system.

Modelling of transaction
Modeling of database
Estimation of capability of CPU
Estimation of main and magnetic disk memory
Number of units of CPU, main and magnetic disk, printer, display
Back up system and data
Security system to access

③ Evaluation
The most important is to evaluate whether the system is capable of satisfying the requirements and it can be built up within the fixed budget.

Requirements of capability
Requirements of reliability
Requirements of cost

(4) Priority

The computer systems, which have been proposed by each department, but have not been studied and examined by PC, are listed in the master plan. These computer systems should be scrutinized according to priority by the project team.

In the short-term improvement plan, the computerization of the container terminal has the first priority.

(5) Container Terminal

The total volume of container handling will increase up to around 200,000 TEUs per year with two berths at the target year of 2000. As one container berth can handle 60,000 ~ 100,000 TEUs per year without a computer system, Port of Aqaba will need a computer assistance in 2000. Considering the limited volume that can be handled manually, the container terminal should be prepared immediately the computerization of the container

terminal.

(6) Main Port

From the view point of computerization, operations related to conventional cargo handling has higher priority to computerize than those related to bulk cargo.

Break-bulk cargoes, such as bags, cartons, boxes and steel products, are handled at Main Port. These break-bulk cargoes are discharged by the stevedoring section, and transferred and shifted to the warehouses or sheds. To improve cargo handling productivity of break bulk, a determination of storage location and for control and delivery of cargo would be effective on computer system.

At present, to store break-bulk cargoes in suitable and proper warehouses or sheds, an alphabetical index system is adopted at Main Port by manual. The alphabetical index is prepared by shipping agents based on the cargo manifest according to loaded ports B/L No. in the alphabetic order. The alphabetical index is submitted to PC from shipping agent prior to vessel arrival, and Operation department will decide the storage location referring to the index and space availability without aid of computer.

(See Appendix 5.6.2, 5.6.3, 5.6.4)

① Alphabetical Index
Procedure of the alphabetical index by computer is as follows;

Input the data of cargo manifest, such as;
Name of vessel, Arrival date, Shipping agent, Customs clearing agent,
Shipper, Consignee,
B/L No., Loaded port, Commodity, Type and number of package, Weight,

The name of consignees will be sorted and arranged in the alphabetical order, and the storage locations and address will be decided in a proper suitable space by computer.

The storage location and address will be allocated by block wise. The detailed addressed allocation system is not practical to control and manage the storage space, and the block addressed system which has a certain area is more practical.

The decided storage address will be input by the planning section, and those information will be connected and liked by the computer system to the office of the sheds.

② Cargo Delivery
Receipt & Delivery section control and manage cargo receipt and delivery. Procedure of alphabetical index by computer is as follows;

The name of consignees will be input by keyboard, and the storage address and locations will be seeked for reference. The section informs a truck driver of the data, and transfers to a shed master.

After a cargo is loaded onto a truck, the data of the cargo will be eliminated.

5.6.2 Container Terminal

(1) Computer System

Operation Department has a main computer which was installed in their office at 1991 and "ORACLE" was installed in the computer. The department is trying to make some formats and use the computer to their daily works at both Main Port and Container Port.

The specifications of the main computer are as follows;

Hewlett Packard HP-9000 Series 800/827

Operating system	: HP-UX 9.0 UNIX Operating
Circuit technology	: 32 Bit machine
Speed CMOS	: 53 Mips
Clock speed	: 48 MHZ
Main memory	: 32 MB
Hard disk	: 1.3 GB

The container terminal has the first priority to be computerized at PC. Operation Department, which is in charge of container terminal, should concentrate all their efforts on computerizing of the container terminal.

(2) Process of Introduction

1) Pre-study

Computers has no capability for logical thought, a computer can only perform tasks it is programmed for. To ensure that results will satisfy, pre-study for programming is important. In the same way, the pre-study is necessary to study and analyze procedures and documents of the container terminal. The project team, involving the terminal staff, should check and analyze the procedures, documents and functions of each section of the container terminal.

Generally, it is said that it will take about 1.5 - 2.0 years to establish a new computer system from scratch. The typical time schedule for the computerized container terminal is shown in Table 5.6.1.

(See Table 5.6.1, Appendix 5.6.5)

Typical documents are as follows;

Customs Declaration Sheet
Container Cargo Manifest
Copy of B/L
Container Delivery Order
Container Delivery Sheet
"BON"
Stowage Plan
Bay Plan
Container Export Request
Weighbridge Card

2) File Design

After choosing and selecting necessary data, the project team will proceed with the file design will be planmd. Items of data, records including the order of data, the length of data and the way to access to data are to be designed and decided. Generally, 200~250 byte are required per one container for recording the container number, date, size, vessel name, and etc.

3) Document

Documents for the container terminal are being processed at several offices such as No.8 waiting area, No.1 gate office, No.2 storage yard and No.3 gate office. Between these offices, documents and information are processed and handed over manually or by radio.

At present, container receiving and delivery information and documents are circulated among shipping agents, customs clearing companies and the container terminal. But shipping documents, such as the stowage plan, bay plan and container loading/discharging list are not delivered to the container terminal from shipping agents.

These documents are important as the input data for computerization. In other words, the container terminal can not be operated by computer without this data. The project team and the manager of the container terminal should establish a rule to get these documents prior to vessel arrival otherwise there is no data to input into the computer.

All the necessary forms and documents should be studied and analyzed by each section, and current documents and forms should be modified and changed to suit computer outputs themself.

Container Receiving List
Container Delivery List
Stowage Plan
Bay Plan
Storage Yard Plan
Discharging/Loading Container List
Customs Clearance Information

4) System Design

The specifications of the computers must be decided after a sufficient pre-study on the computer system. The system design also must be studied on the pre-study stage, and peripherals are to be designed and arranged to match the main computer.

At present, PC has the main computer, three printers and ten keyboards and displays in which the specification are described above. From the view point of effective use of these existing computer, printers and displays, it seems the most effective and practical use for PC to introduce these equipment in their container terminal up to the year 2000 for the reasons bellow:

① Handling Capacity

Container handling by manual means has almost reached the maximum which can be handled without computer assistance. The introduction of a computer system is urgent.

② Specifications

The capacity of the current hard disk and CPU are not sufficient to handle the volume of containers and their documents. But being used with magnetic tape, they can be used sufficiently for control the whole container terminal. Additional hard disk(s) should be added according to the increase of containers.

③ Model

The computer was purchased in 1991. Therefore, it may be replaced with a new one before the year 2000 because of wear and tear.

④ Additional Equipment and Peripherals

From the view point of specifications and remaining year of the existing equipment for use, the cost of additional equipment and peripherals should be minimized. The existing computer should be basically used and operated with minimum additions.

Existing printers and keyboards, those are three printers and ten keyboards, are not sufficient to operate the terminal. Some printers and keyboards will be added to provide at the terminal gate, document section and operation section.

(See Table 5.6.4)

⑤ Computer Room

The main computer is installed in a computer room at Main Port. The container terminal is about eight km far away from Main Port, and printers, keyboards and displays are connected by telephone line with modem and communication bridge. Eight km is slightly distant. However, PC should maintain the main computer in the current computer room until a replacement of a new terminal building.

⑥ Down Sizing

Because of "Down Sizing", PC is recommended to use and operate small several size computers as "Client server system". For the future computer network of PC, the existing main computer would be used as server of the network.

(3) Operation

1) Organization

The layout of the current container terminal is not designed to fit a typical computer control system. Several gates, offices and weighbridges are processing container documents. To introduce a computer system into the current container terminal, following sections and offices should be precise about their jobs and duties, and will be provided with keyboards and displays for data processing.

① Terminal Gate
No.1, No.3 and Yarmouk gate

Gate in slip/Delivery order
EIR (OUT/IN)
Changing point and place of a responsibility of container
Check point of condition and status of outside of container

② Document Section
No.8 waiting area
No.1 gate office/Weighbridge
No.1 yard office
No.2 yard office
No.3 gate office/Weighbridge
Main terminal office

Container cargo manifest
Container delivery/receiving list
Container loading/discharging list
Bay plan/Schematic plan
Customs declaration sheet
Container delivery order

③ Operation Section
No.1 yard office
No.2 yard office
Main terminal office

Container delivery/receiving list
Container loading/discharging list
Bay plan/Schematic plan
Cargo work sequence plan
Yard storage plan

2) Training

Almost all the terminal staff are not familiar with computerized container terminal. Prior to starting actual operation by computer, they should be trained to operate their computers. They should know about general flow of documents and containers for smooth operation.

(See Table 5.6.2)

3) Operation

For introducing the computerization into the existing container terminal, the basic concept of the terminal operation are as follows;

① Current procedure for document flow will be maintained as much as possible.

② Basic arrangement of the gates and offices will be maintained as they are.

③ Data will be input into computer at the office where the documents are handled and dealt with. Other office will use the input data for reference.

④ The container cargo manifest, container loading/discharging list, container receiving/delivery list, bay plan/schematic plan are input at the document section.

⑤ The container cargo manifest, container loading/discharging list, container receiving/delivery list, bay plan/schematic plan are also input at the operation section. These data between the document and operation section will be checked and matched by computer.

⑥ The computer system will not be directly connected to any outside organizations or office.

⑦ When the data are delivered by a floppy disk from outside, the data will be read by a personal computer and be transferred to the main computer.

⑧ During the improvement of the container terminal, a straddle carrier system and transfer crane system will be employed areawise. The address of container storage would change from time to time, and the storage address of computer will be also amended.

Likely procedures and document flows for the existing container terminal by computer control are as follows.

(See Appendix 5.6.6, 5.6.7)

Table 5.6.1 Time Schedule for Computr System of Container Terminal

	Items	96.3 — 96.9 — 97.3 — 97.9 — 98.3
System design	Analysis of current procedure	
	System design (Outline)	
	System design (Detail)	
	Specification of system	
Programing	Specification of program	
	Programing	
	Test data	
	Program test	
Operation	Operation guide	
	Arrangement of master plan	
	Registration of master file	
	Plan for practice	
	Test run	
	Test run back up	
	Operation	

Table 5.6.2 Plan for Practice of Computerized Container Terminal

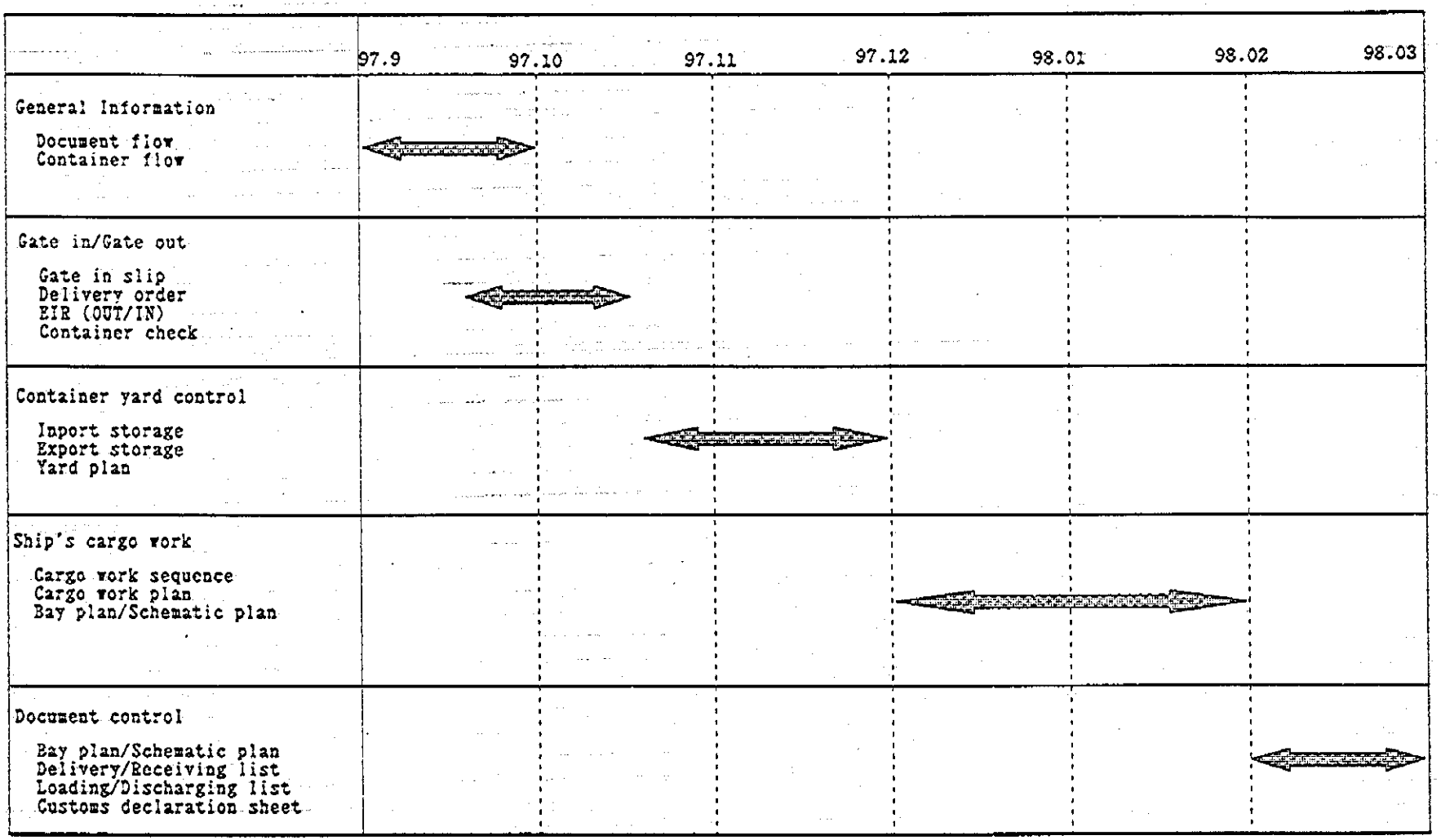


Table 5.6.3 Input & Output Data List

	Delivery Container		Receiving Container	
	Input Data	Output Data	Input Data	Output Data
No.8 Waiting area	Container number Truck number	Shipping agent Customs - clearing co. Vessel name Voy. No./Date Shipper Consignee Commodity Weight (Customs declaration sheet)	Container number Truck number Shipping agent Customs- clearing co. Vessel name Voy. No./Date Shipper Consignee Commodity Weight (Customs declaration sheet)	
No.1 Gate	Container number Truck number Weight data		Container number Truck number Weight data	
No.1 Yard office (Operation)	Container number Truck number	Storage location	Container number Truck number Storage location	
No.2 Yard office (Operation)	Container number Truck number	Storage location	Container number Truck number Storage location	
No.3 Gate	Container number Truck number Weight data		Container number Truck number Weight data	
No.3 Yard office	Container number Truck number	Shipping agent Customs- clearing co. Vessel name Voy. No./Date Shipper Consignee Commodity Weight (Customs declaration sheet)	Container number Truck number	Container stowage plan Bay plan Schematic plan

Table 5.6.3 Input & Output Data List (Continued)

	Delivery Container		Receiving Container	
	Input Data	Output Data	Input Data	Output Data
Main terminal office (Document)	Container number Vessel name Voy. No./Date Shipping agent Customs clearing co. Shipper Consignee Commodity Weight	Container delivery list Container discharging list	Container number Vessel name Voy. No./Date Shipping agent Customs clearing co. Shipper Consignee Commodity Weight	Container receiving list Container loading list
Main terminal office (Operation)	Container number Vessel name Voy. No./Date Shipping agent Customs clearing co. Shipper Consignee Commodity Weight Storage Location		Container number Vessel name Voy. No./Date Shipping agent Customs clearing co. Shipper Consignee Commodity Weight Storage Location	

Table 5.6.4 Arrangement of Peripheral

	Main Computer	Keyboard & Display	Printer
Computer room (Main Port)	HP-9000 1Unit	1 Unit	1 Unit
No.8 Waiting area		2	2
No.1 Gate (Weighbridge)		1	0
No.1 yard office		2	2
No.2 yard office		2	2
No.3 yard office		2	2
No.3 Gate (Weighbridge)		1	0
Main terminal office (Document section)		3	2
Main terminal office (Operation section)		3	2
		17	13

(4) New Container Terminal in Future

1) New Container Terminal

The container terminal of Port of Aqaba will take an initiative to operate the computer system in PC of which the target year is 2000. At the first stage of computer system, the container terminal will start a system with maintaining the layout of offices and the main computer. PC can obtain and get many good results for a computer system during their operation of container terminal.

The container terminal will be developed to one flat storage yard, equipped with transfer crane and four gantry cranes by 2010. The terminal gate, terminal building, maintenance shop and container storage yard will be arranged to an efficient layout. At the renovated new container terminal, a new computer is to be installed as a part of computer network of PC to control all the works and jobs of the container terminal.

2) Terminal Gate

The terminal gate will be constructed to control all traffics of the yard at the entrance of the terminal, and container trailor-chassis and trucks must pass through the gate. The gate should be positioned as the changing point of responsibilities from a consignee to a terminal and vice-verse.

The terminal gate is equipped with keyboards and displays. When container trailor-chassis comes to the gate with "gate in slip" or "delivery order", a gate staff input the container number on a keyboard to register, the document data will be read by a scanner with a bar code, and EIR (OUT/IN) (Equipment Interchange Receipt) will be exchanged between gate staff and driver to clarify the responsibilities. A gate staff will check the condition and status external the container, and make remarks on the EIR, if necessary. The terminal gate control system can control all receiving and delivery containers by computer.

3) Terminal Building

A main office building will be constructed in the container terminal as its control center. The operation section, document section and computer section have their offices in the building and cooperate with each other by exchanging documents and information by computer. All offices inside the building will be wired for LAN system.

Owing concentration of concerned sections and parties into the same building, each section and parties can communicate and exchange the information effectively. The customs office, shipping agents and customs clearing companies should be located in the building for smooth document procedures.

4) Document Section

The document section handles and controls all the shipping documents that come from shipping agents, customs clearing companies and customs office. This section is only one gateway for receiving or delivery all the shipping documents. These data will be stored and transferred by floppy disk, and will be input into computer.

5) Operation Section

The operation section receives necessary documents and information from the document section with floppy disks or through the a computer of network, and makes the yard plan and ship's stowage plan by computer.

The section operates a yard control system and ship's loading/discharging system. Container storage yard is divided in to two areas, export and import container areas. Storage yard is addressed for four blocks of digit for a transfer crane system, such as lane, bay, row and tier. Container storage address will be decided by computer to a proper and suitable location.

The yard plan will be drawn by computer. The computer seeks the most suitable location of a container for storage and display the position. A yard planner informs the terminal gate of the storage location.

The ship's loading/discharging plan will be also drawn by computer. A ship's planner will input the bay plan, loading and discharging list destination-wise. The computer seeks the most suitable location for loading position taking consideration of the destination, commodity, size, weight, ship's condition etc. The data will be stored and transferred by floppy disk.

6) Computer Section

The server, which is linked to the local area network (LAN) with other departments, will be installed in the container terminal to control the terminal operation. Staff of computer section maintain hardwares and improve and modify the programs to make it more compatible with daily works.

(See Appendix 5.6.8 ~ 5.6.15)

5.6.3 Training of Computer Operation

(1) Main Computer

One computer engineer of Development & Training Department is studying the port operation, documentation flow and gathering the information of computer system.

For computerization of PC, however, only one engineer is not enough. More computer engineers and programmers should be employed as the staff of the computer section to keep smooth computer operation and maintenance. When the container terminal is computerized, more computer engineers and programmers are required.

(2) Personal Computer

The introduction of personal computers is most important and basic as the first step for the computerization. The recent new computer network system is constituted by servers, work stations, personal computers and other peripherals. In this system, personal computers have been more important and essential. To know how to use personal computer is one of the most important requirements for operating the future computer network.

(3) Instructor of Personal Computer

An instructor in the training center is engaged in the training course of personal computer. The instructor trains the trainees by using three personal computers. For the computerization, it is important for many staff and workers to put personal computer to practical use.

PC should educate more instructors of personal computers by self-training in the training center or by dispatching them to a technical school.

(4) Trainee of Personal Computer

The computer network system, concerned sections and departments are connected and linked with each other by computer. The peripherals, especially personal computers with keyboards and displays, will be installed in their offices.

The staff of each section should be able to use personal computers which will be a part of the system for their daily works. From this point of view, trainees of the personal computer course should be chosen from all the concerned departments, and they should take the training course prior to the completion of the introduction of the computer network. Especially, as it is planned to introduce computer system into the container terminal by 2000, the operation staff of the terminal must be trained prior to that time.

(5) Training Course of Personal Computer

At present, the training center of PC has a computer training course. In the last two years, 30 groups have participated in this program with 6 ~ 12 persons per each course, and a term of the course is two weeks. To introduce computer system into PC's daily routine works, more advanced courses and frequent sessions are needed.

As professional knowledge for hardware and software are not necessary to the user, the program of the training course should be mainly aimed at practical use of an application software instead of technical and theoretical matters. Once becoming familiar to it, the trainees will easily use and operate other kinds of software.

Recently, there are many kinds of application software on the market such as word processors and spreadsheet programs. It would be very useful for the trainees to introduce these application software into their training course.

The basic items of the personal computer training course are as follows;

1) General Information of Hardware and Software

① Binary scale and decimal system
② Bit and byte
③ Mechanism of CPU
④ ROM and RAM
⑤ File: Unit of data
⑥ Flexible disk (Floppy disk)
⑦ Hard disk

2) Operating System (O/S)

① Operating System
"DOS", "Windows" and "Mac O/S"
② Basic commands and files of "DOS"
③ Operation and functions of "Windows"
④ Operation and functions of "Mac O/S"
⑤ O/S and GUI (Graphical User Interface)

3) Personal Computer and Peripherals

① Performance of personal computer
② CPU and CPU accelerator
③ Memory and hard disk
④ SCSI (Small Computer Systems Interface) and
ID (Integrated Device Electronics) standard
⑤ CD-ROM and drive
⑥ MO (Magneto-Optical) disk
⑦ Display: Normal mode and Multi-scan

4) Application Software

① General information of application software
② Version and compatibility
③ Word processor, spreadsheet, database and graphic software
④ How to use application software

Table 5.6.5 Curriculum of Computer Training

Subject	Items	Time(hr)	Details of Course
General Information of Hardware and Software	Expression of data Binary scale and decimal system	8	Binary scale, Decimal system. Conversion of binary scale to decimal system. Conversion of decimal system to binary scale.
	Bit and byte	4	Mininum unit of information. 16 bit and 32 bit. 8 bit and 1 byte.
	Mechanism of CPU	4	Function of CPU. Receipt and dispatch of order and task. Control of processing of order and task, and peripheral.
	ROM and RAM	4	ROM:Read Only Memory RAM:Random Access Memory Function of ROM and RAM.
	File	4	Function of File. Directory and file. Minimum unit of data for saving.
	Flexible disk (Floppy disk)	4	Capacity, access speed and seek time. Structure of floppy disk; sector and truck. Size: 3.5" (MF), 5" (MD). Density of memory;2DD and 2HD.
	Hard disk	4	Capacity, access speed and seek time. Structure of hard disk.
Operation System (O/S)	"DOS", "Windows", "Mac O/S"	8	Basic O/S;Operating system.
	Basic commands of "DOS"	16	PC-DOS and MS-DOS. Function of commands, Tree directory and file. Device driver and peripheral. Extension;Executive,System,Batch file. Binary file and Text file.
	Operation of "Windows"	8	"DOS" and "Windows". Characteristic of "Windows"; Visual and intuitive. GUI (Graphical User Interface) and Icon. Unity of operational way of application soft. Semi-multi task function.
	Operation of "Mac O/S"	8	Characteristic of "Mac O/S". GUI and Icon, Multi windows and Multi task. WYSIWYG (What You See Is What You Get).
	O/S and GUI	8	GUI function of each O/S.
Personal Computer and Peripherals	Performance of personal computer	4	Mother board; CPU and RAM. Processor, Co-processor, Cache memory, Capacity of memory. FPU; Floating-Point Processing Unit. ODP; Over-Drive Processor.
	CPU	4	Function of CPU. Input/Output to/in peripheral. Model of CPU and clock time.
	Memory and hard disk	8	Function of RAM and ROM. Required capacity of memory for "Windows". SIMM; (Single-Inline Memory Module). EMS ; (Expanded Memory Specification).
	SCSI and ID	4	SCSI; (Small Computer System Interface). ID ; (Integrated Device Electronics).
	CD-ROM and Drive	4	Capacity and Format. Memory for music, picture and animation.
	MO disk	4	MO disk; (Magneto-Optical). Reading and writing.

Table 5.6.5 Curriculum of Computer Training (Continued)

Subject	Items	Time(hr)	Details of Course
Personal Computer and Peripheral	Display and keyboard	8	CRT Display and Liquid crystal Display. Normal mode ; 640 x 480 dot. High resolution mode ; 1,024 x 768 dot. Character key and Function key. Combination of character and function key.
	Printer	4	Laser printer, Ink jet printer, Dot impact printer, Thermal transfer printer. Clearness of type, Printing speed.
	Mouse	8	Operation; "Drag" and "Click"
Application Software	General information of application software	8	Kind of application software. Keyboard and display screen. Font and style of type. "Bit map font" and "Outline font".
	Version and compatibility	4	Version up of application soft.
	Word processor, Spread sheet, Data base, Graphic software	4	Typical sample of application software.
	How to use application software	40	Word processor, Spread sheet, Data base, Graphic software.
Client Server System	Server, Personal Computer	4	Function and relation of server and personal computer
	Down sizing	4	Main frame, server and work station
	O/S for network system	8	UNIX, Netware, Windows NT
	Protocol	8	TCP/IP
	RDBMS	32	Relational Data Base Management System. Oracle, Sybase, Informix, Open Ingres, SQL
		240	

5.7 Preliminary Design of Port Facilities

5.7.1 Main Port

(1) Comparative Design of Alternative 1 and 2 for the Location of New Grain Berth

(a) Basic concept to arrange New Grain Berth at the best place

An idea that recommendable arrangement of a marginal wharf shall be right steps in the water depth of basin may be applicable in Alternative 1. The idea may be applied for the turning basin by man-made that has been dredged. However, there is no dredging activity in the basin of General Cargo Berth No.1 to No.6 and outward of the basin is very deep due to the very steep seabed.

From the point of the view, it is no problem to align the Grain Berth elsewhere General Cargo Berths exist on the marginal wharf. Therefore the alignment of the Grain Berth in the berth arrangement plan shall be determined in comparison with the construction cost based on the comparative design after considering depth and existing facility conditions.

(b) Current situation of General Cargo Berth No.1 and No.2

At present, cargo handling equipment are put on the Berth No.1. The crane rail of grain unloaders and a belt conveyor line are laid in the parallel of quay face-line of the berth. Though the plan on the Berth No.1 will alter the position of crane rail and belt conveyor line according to the change of quay face-line, the plan at Berth No.1 is still prevail against it of Berth No.3.

On the other hand, when the Grain Berth is constructed at Berth No.3, a conveyor line has to cross Berth No.2 to connect it to the existing conveyor line. As the result of site survey, the clearance in height of conveyor line is approximate 15 meters and the length of span between conveyor foundations is 32 meters each. At present, the conveyor line is laid alongside Transit shed No.1 by 110 meters in length and at open storage by 28 meters. The position of the conveyor line is higher than it at the top of doors(gates) where 5 doors are available in seaward of transit shed. There are 4 conveyor foundations in front of Transit shed No.1 and no foundation interrupts the doors.

It is possible to design an adequate span of conveyor foundations which they don't prevent cargo trucks to pass from and/or to the berths at open area and block the doors of No.2 and No.3 transit sheds.

When the General Cargo Berth No.1 was constructed in 1960, water depth of the mooring basin was 7 meters below Chart Datum at the shallowest place. In 1980, mooring basin of the Berth No.1 and the vicinity was dredged up to -11.0 m. for deepening purpose. After that, two times (1985 and 1989) maintenance dredging at the southern corner of Berth No.1 has been carried out so far.

At the Berth No.1, structural design calculation has been taken under the conditions of 11.0 m water depth and 3.25 tons/sq.m for surcharge on deck in 1960. In 1978, the structural design was reviewed to reinforce the deck for the wheel loads of unloaders that were equipped in 1979.

On the other hand, Berth No.3 to Berth No.6 has been designed as -14 m water depth and slope of one by two (1:2) gradient under the deck at the critical case of design calculation.

Table 5.7.1 shows current situation of GC Berth No.1 and No.3

Table 5.7.1 Current Situation of GC Berth No.1 and No.3

	Berth No.1	Berth No.3
1. Time of construction	1960	1980
2. Structural type Foundation structure Super structure	Open type piers Krupp KP 34 steel box pile In-situ concrete deck	Open type piers 610 dia steel pipe pile Precast Beam & Slab
3. Design conditions Design load Surcharge Wheel load consideration Design depth at mooring basin	 3.25 tons/sq.m for portable silo(5.5m span) -11 m(after 1980)	 3.25 tons/sq.m for portable silo(5.5m span) -14 m(slope 1:2)
4. Current water depth	More than CD -11.2 m.	More than CD - 13.4 m
5. Berth & Apron Length Width of apron Width between front and shed Cargo handling equipment	160 m 18.05 m(deck) 30 m(paved by concrete) 3 grain unloaders 150 m belt conveyor line	180 m 26.50 m(deck) 30 m(paved by concrete) None None
6. Conditions of basin Depth at 5m far from faceline Gradient of seabed Seabed soil	 Varies, -11.2 to -12.8 m very steep Coral or very dense sand	 Varies, -13.4 to -14.7 m very steep Coral or very dense sand

Note : Face line of Berth No.2 to No.6 is straight. Face line of Berth No.1 is inclined by 2 degree to East against the extension line of No.2 - No.6 at the crossing point of Berth No.1 and No.2

Figure 5.7.1(1) shows facility layout of New Grain Berth (Alternative 1) where is located at General Cargo Berth No.1 and a part of No.2.

Figure 5.7.1(2) shows facility layout of New Grain Berth (Alternative 2) where is located at General Cargo Berth No.3 and a part of No.3.

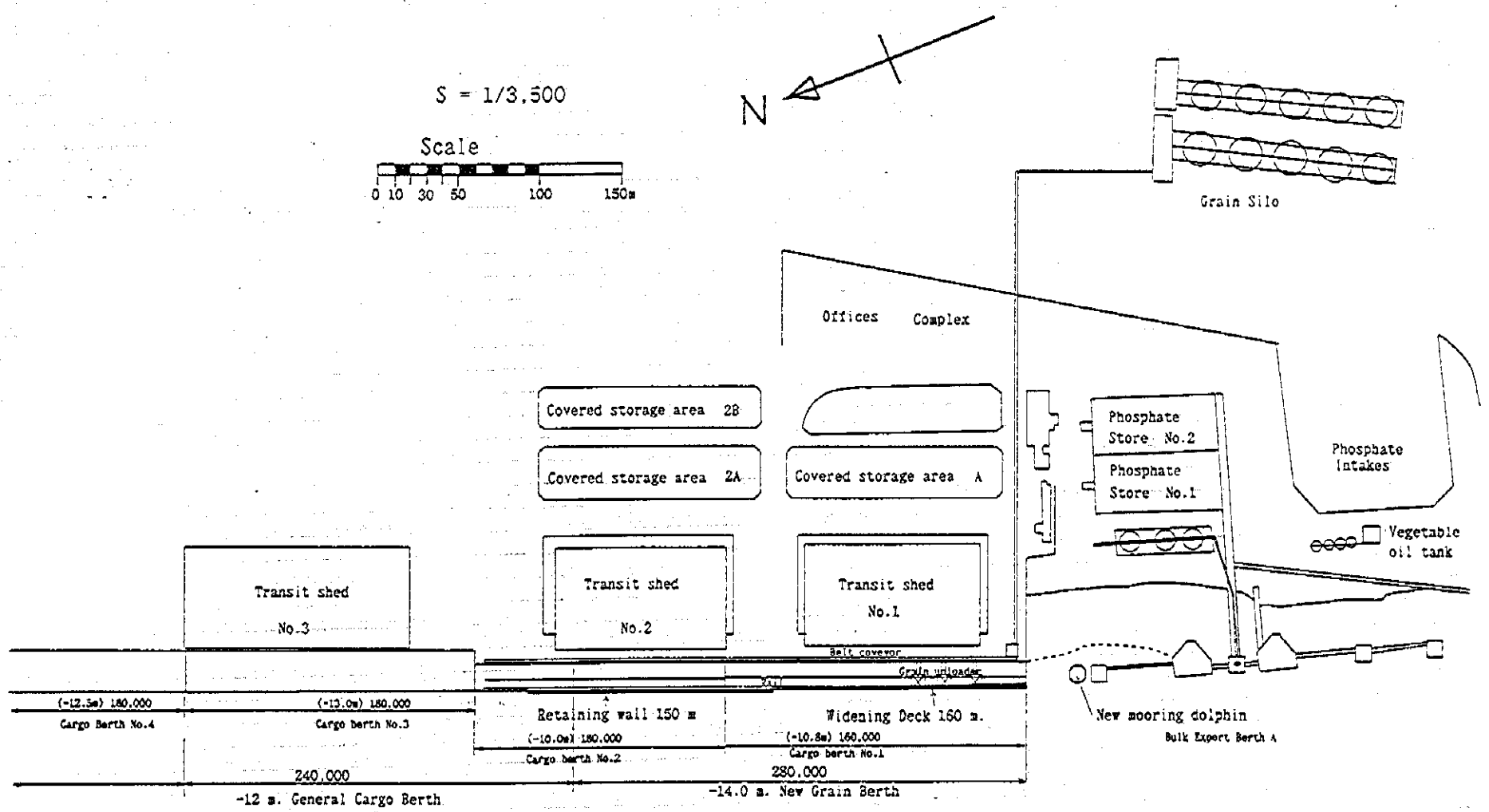


Figure 5.7.1 (1) Facility Layout of New Grain Berth (Alternative 1)

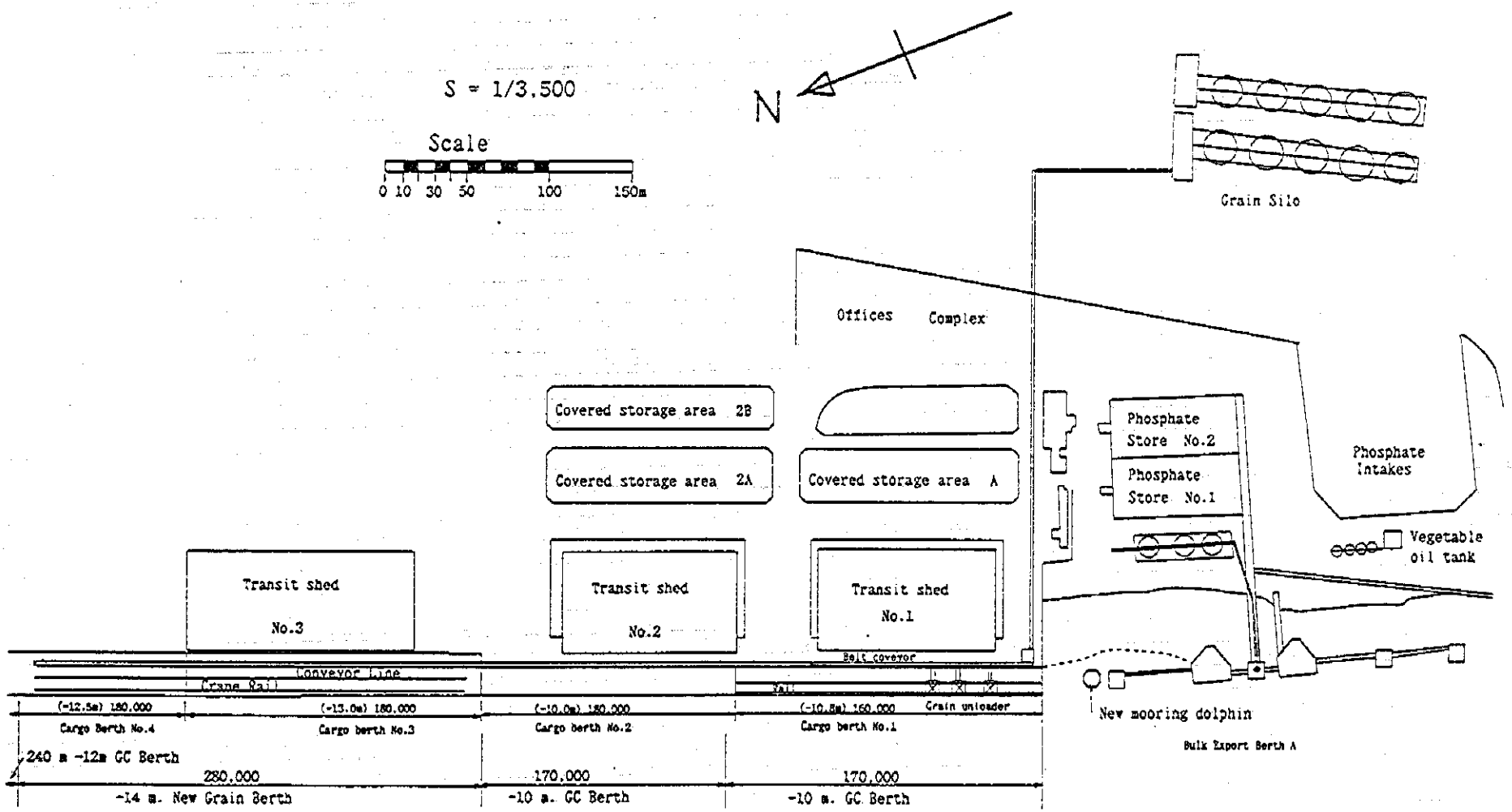


Figure 5.7.1 (2) Facility Layout of New Grain Berth (Alternative 2)

(c) Preliminary design for the comparison of Alternatives

In order to decide the most suitable location where an exclusive grain berth to be constructed in a marginal quaywall of General Cargo Berth No.1 to No.6, two alternatives of the layout plan are proposed. Both alternatives proposed at Berth No.1 and Berth No.3 are currently used for grain unloading. The grain berth is planned as 280 meters in length and 14 meters below Chart Datum in depth to accommodate 50,000 DWT grain carrier. In case of Alternative 1 proposed at Berth No.1 (160 m in length), the grain berth is extended by 120 m. to Berth No.2. In Alternative 2 proposed at Berth No.3 (180 m), the berth is extended by 100 m to Berth No.4.

Figure 5.7.1 to 5.7.3 show Facility layout and the details of New Grain Berth at General Cargo Berth No.1 (Alternative 1).

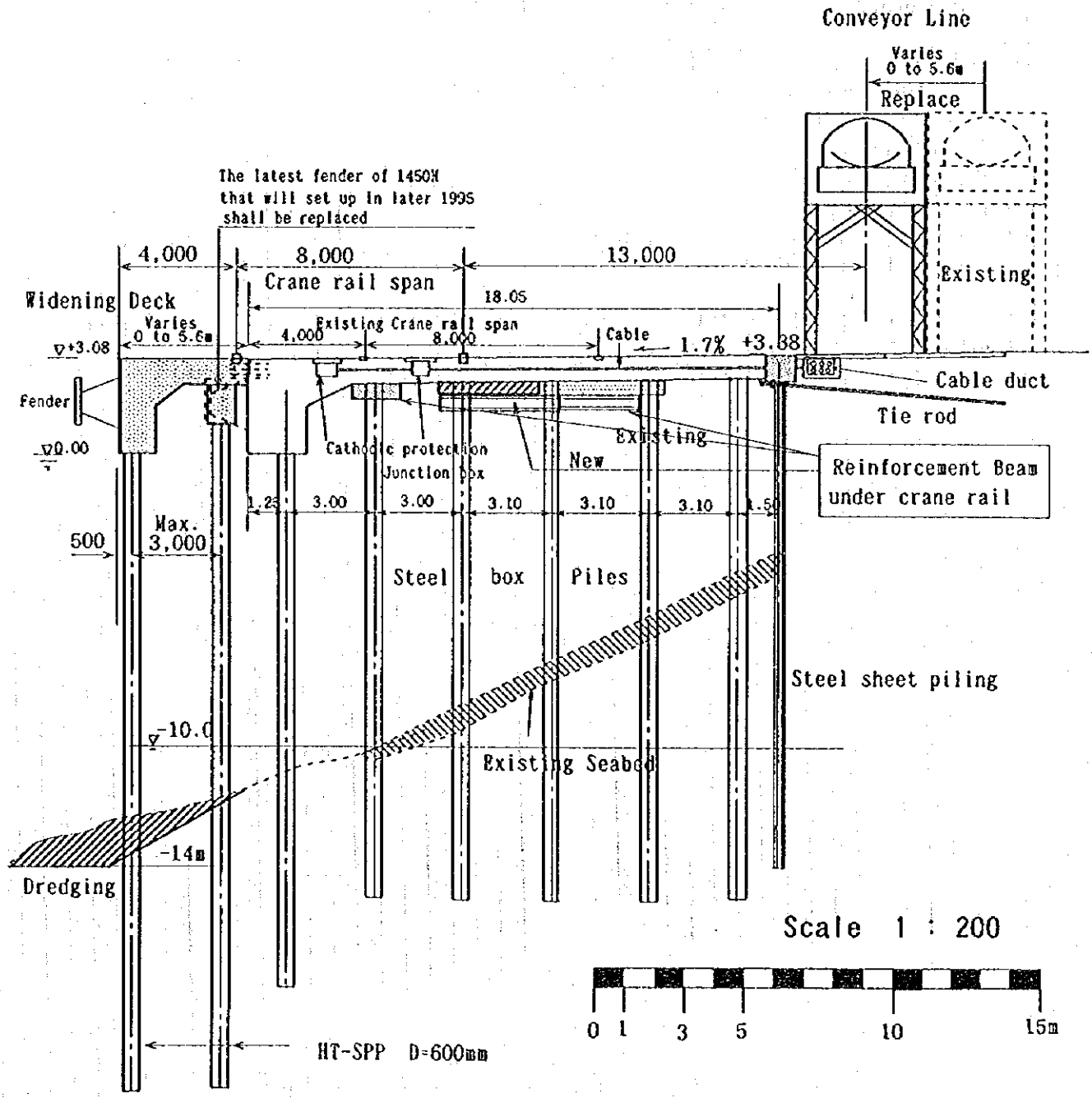


Figure 5.7.2 (1) Typical Section of New Grain Berth at GC Berth No.1

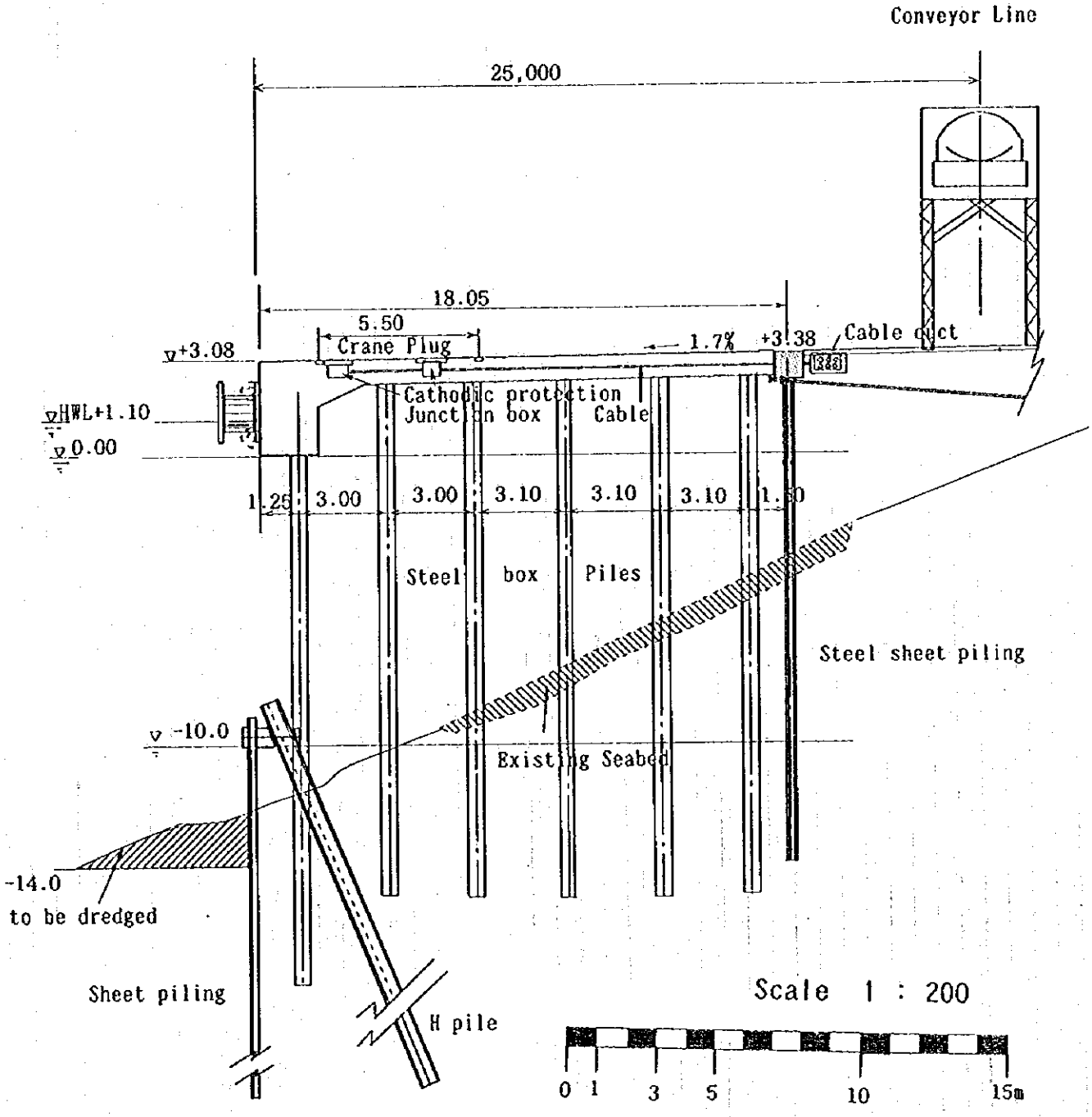


Figure 5.7.2 (2) Typical Section of New Grain Berth at GC Berth No.2

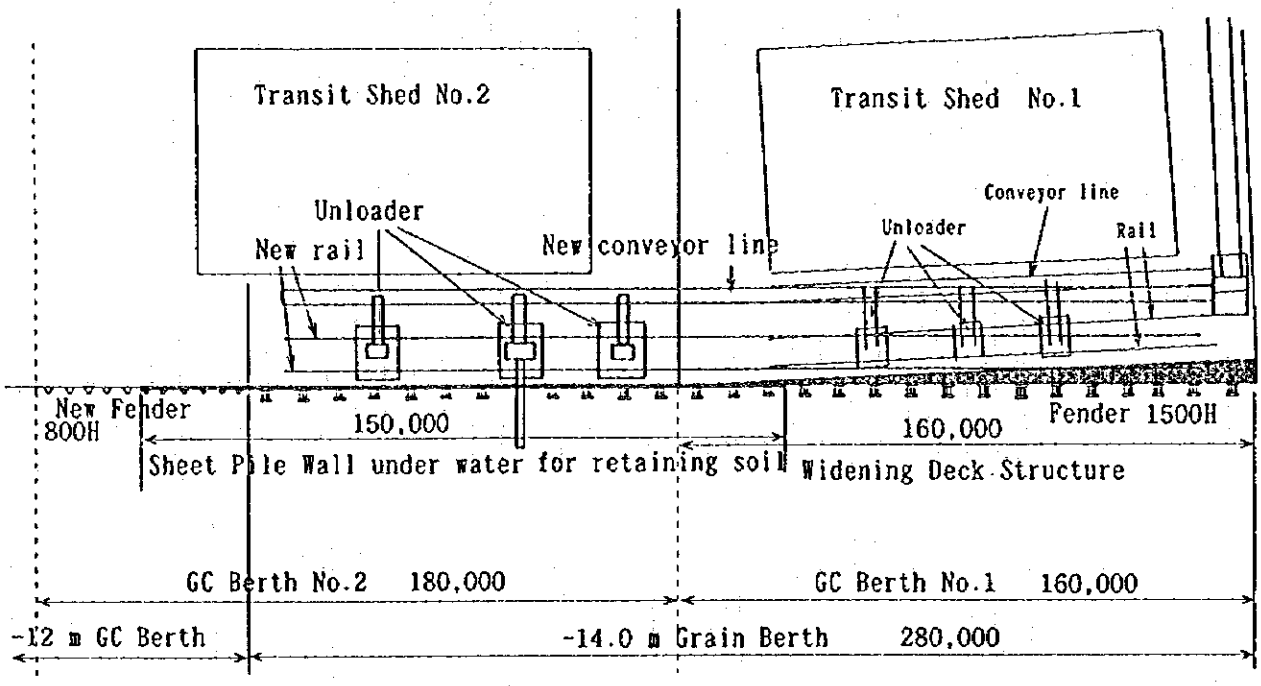


Figure 5.7.3 Facility Layout of New Grain Berth at GC Berth No.1

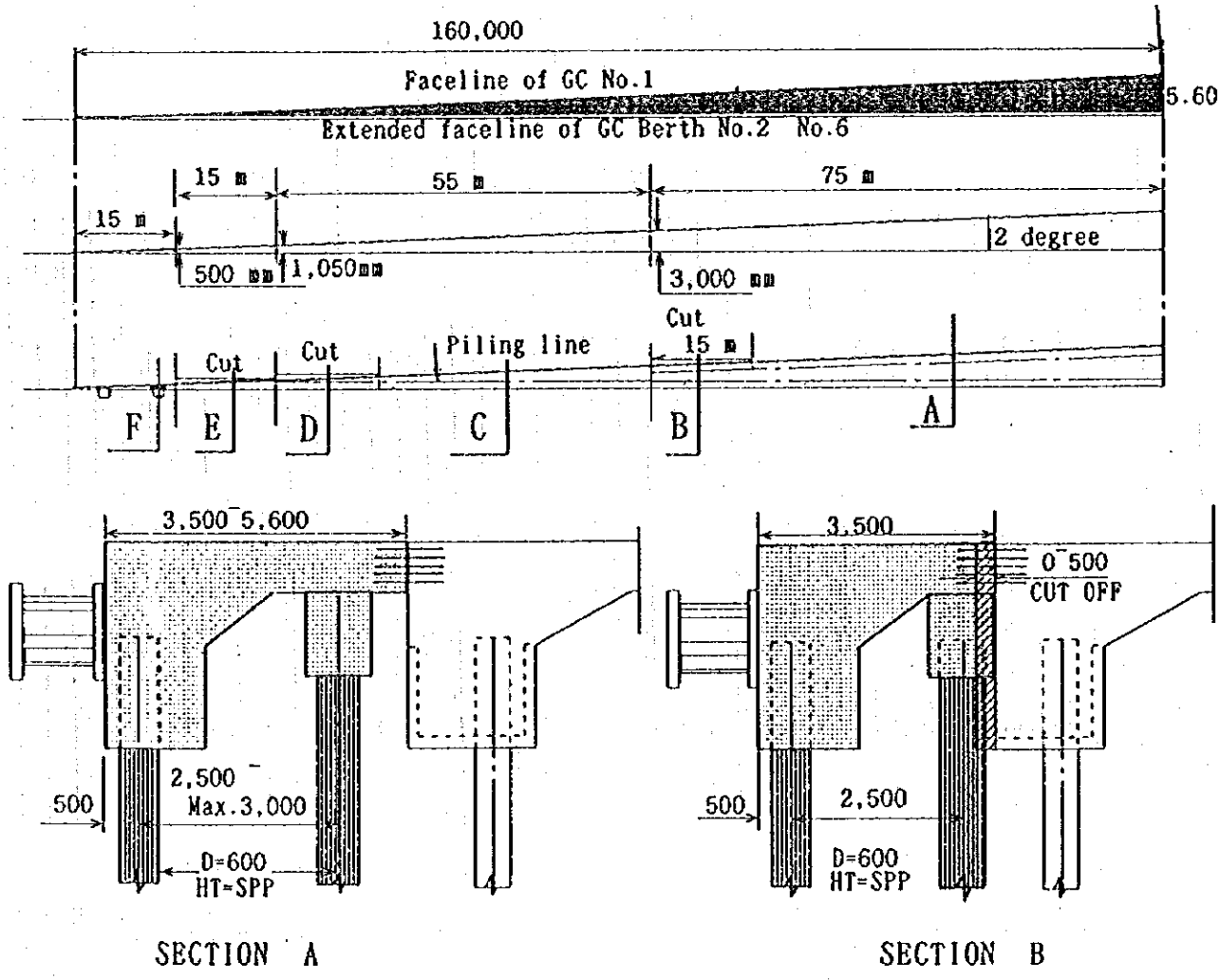


Figure 5.7.4 (1) Widening Deck Structure (1)

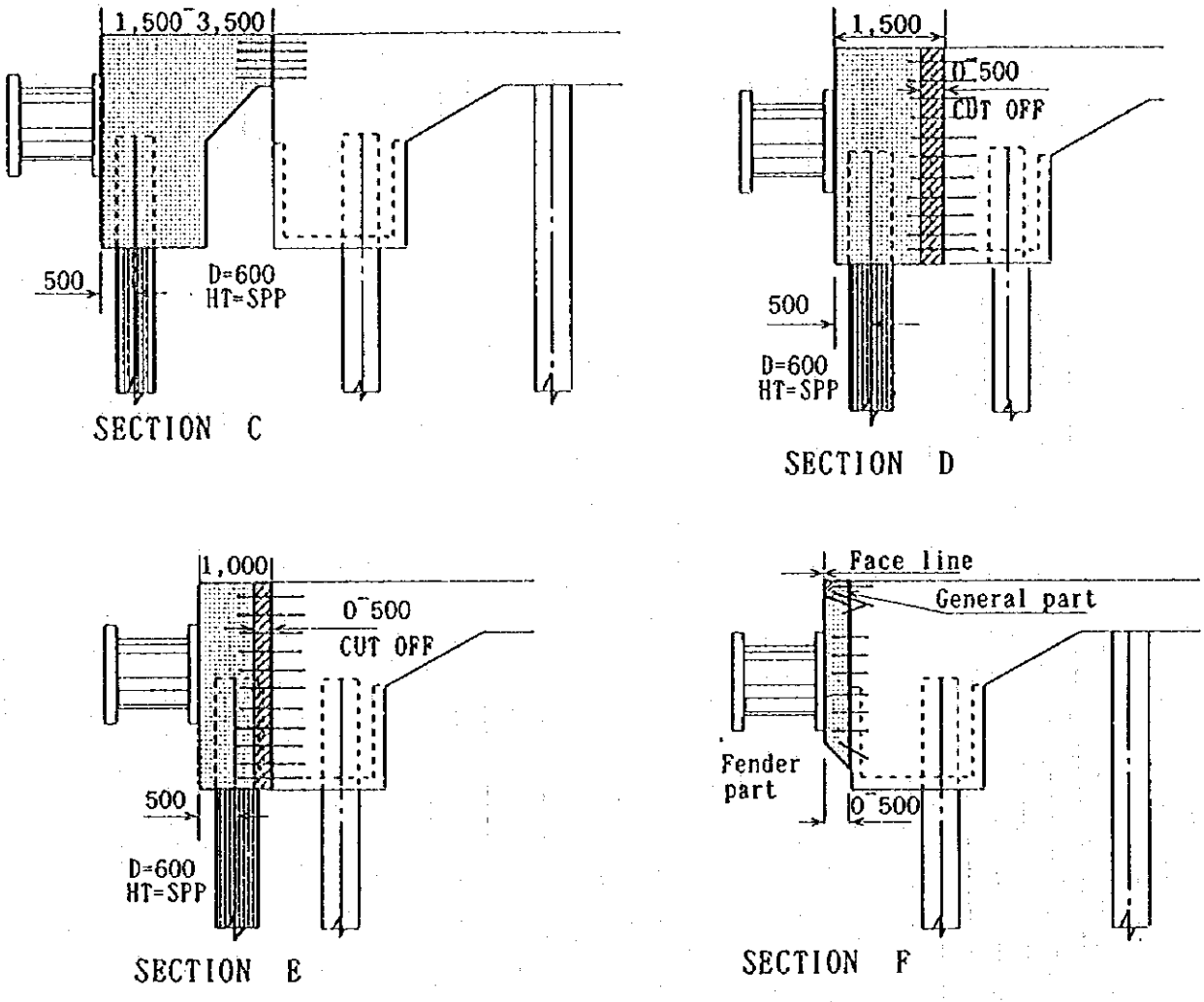


Figure 5.7.4 (2) Widening Deck Structure (2)

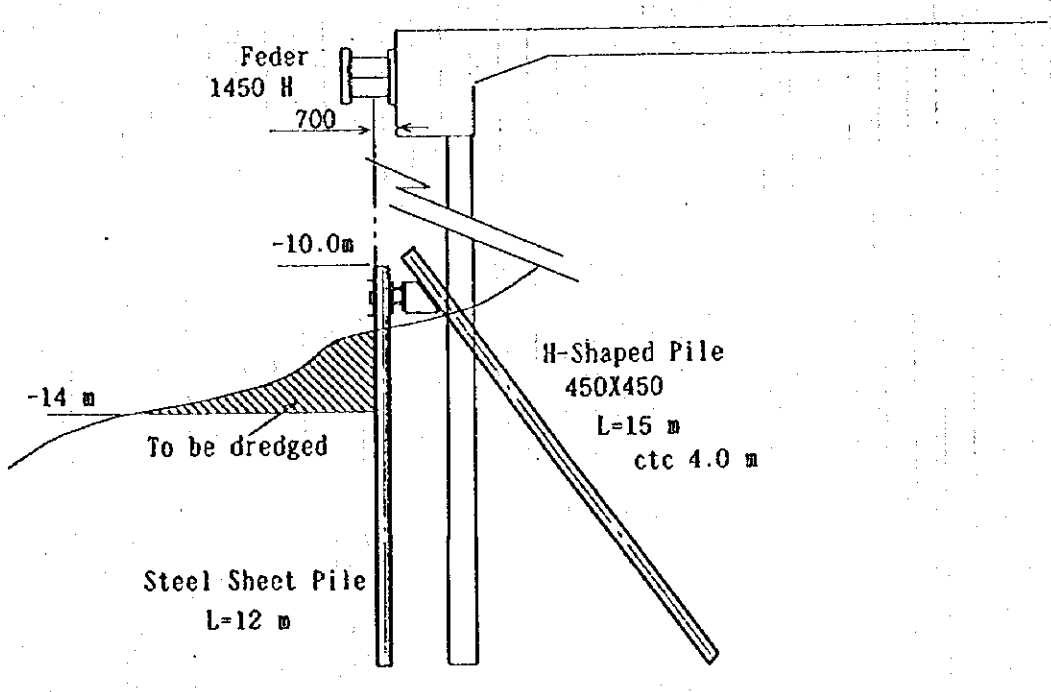


Figure 5.7.4 (3) Deeping Structure (SSP Wall)

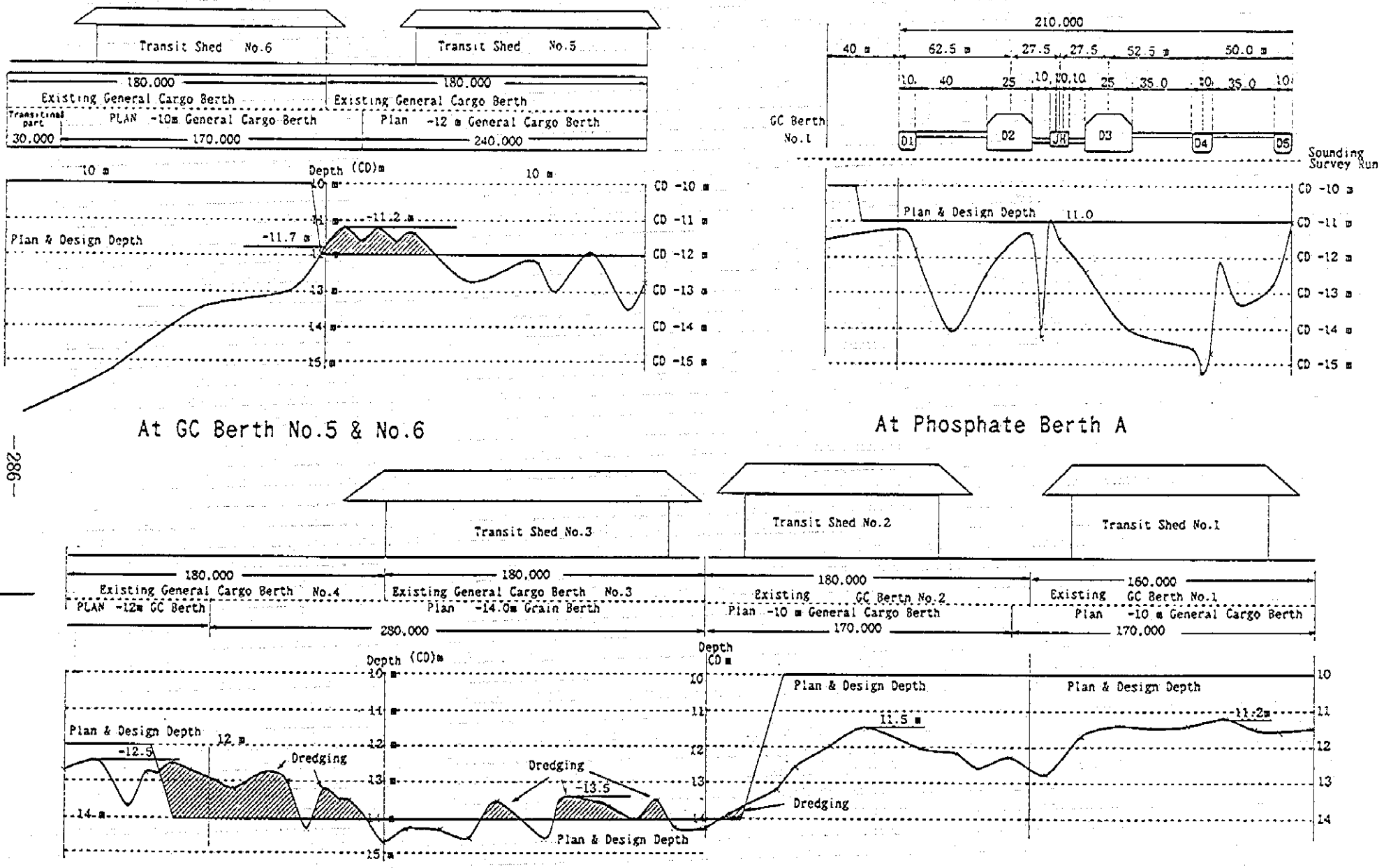


Figure 5.7.5 (1) Water Depth and Dredging Plan (Alternative 2)

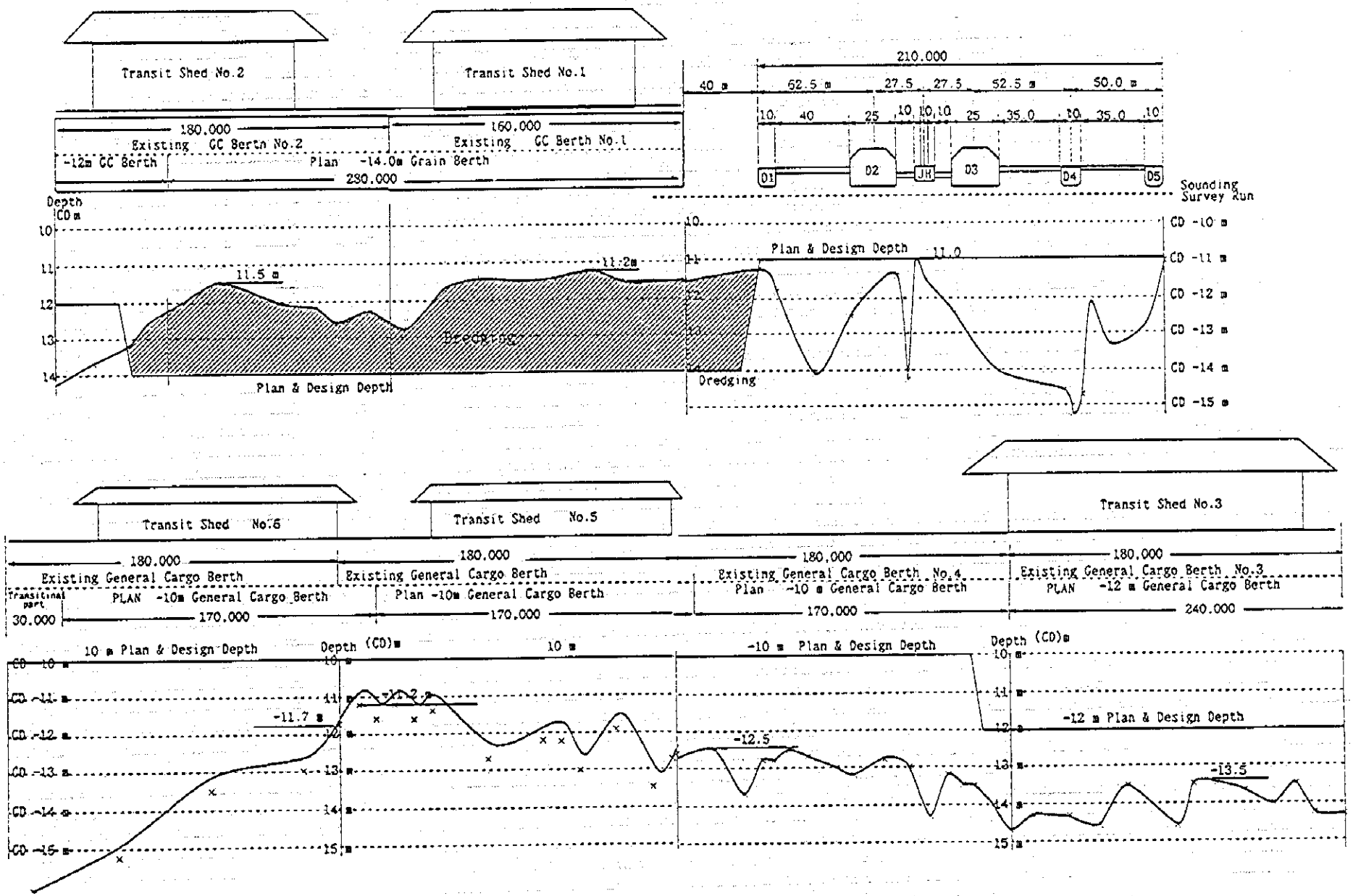


Figure 5.7.5 (2) Water Depth and Dredging Plan (Alternative 1)

(d) Comparison cost for Alternative 1 and 2

Table 5.7.2 Cost Comparison for Grain Berth by Location

'000 JD

Description (Cost Item)			Alt. 1(GCB1)	Alt.2(GCB3)
A	DIRECT COST	Alt.1/Alt.2	4,554	1,689
1.	Replace / demolish		240	150
1).	Foundation of Conveyor	5 / 0 unit	33	-
2).	Conveyor Line	150 / 0 Lin.m	63	-
3).	Angle Tower	1 / 0 unit	24	-
4).	Unloaders	3 / 3 units	120	150
2.	Unloader/Conveyor		1,255	1,521
1).	Foundation of Conveyor	10 / 16 units	120	192
2).	Conveyor Line	110 / 450 Lin.m	231	945
3).	Reinforcement of Deck	200 / 280 Lin.m	800	280
4).	Crane Rail	260 Lin.m(W)	104	104
3.	Widening Deck		1,067	-
1).	Steel Pipe Piling	1,100 / 0 Lin.m	616	-
2).	Concrete including steel bars	960 / 0 cu.m	394	-
3).	Cut off concrete/Joint bars	25 / 0 tons	57	-
4.	Deepening Mooring Basin		1,992	18
1).	Dredging	6,400 / 600 cu.m	192	18
2).	Retaining Wall	150 / 0 m	1,800	-
B	INDIRECT COST	30% of Direct Cost	1,366	506
	GRAND TOTAL		5,920	2,195

Cost of Alternative 1 is 2.7 times higher than Alternative 2, and the difference is about 3.7 Million JD.

The table above does not include the cost of fender, bollard, utilities concern and so on since their cost is completely same between both Alternatives.

In case of Alternative 1, maintenance cost will include dredging of General Cargo Berth No.1 and the surrounding area every several years.

(2) Preliminary Design for the improvement of the New Grain Berth

(a) General

After comparing Alternative 1 and 2, Alternative 2 was selected. Water depth of mooring basin at 5 m. far from the face-line of quaywall is shown in Figure 5.7.5. The sounding for measuring the water depth was carried out by JICA Study Team in July, 1995.

(b) Facility component to be improved

According to the required port improvement plan and facility layout plan of New Grain Berth for Short Term Improvement Plan, the objective port facilities shall be improved. Table 5.7.3 shows facility component of New Grain Berth to be improved.

Table 5.7.3 Facility Component of the New Grain Berth

Facility Component Location	Description		
	Facilities	Specification	Quantity
Quaywall	New Fender for 50,000 DWT	H > 1400 mm	21 units
(Location; GC No.3	New bollard / bitt	100 / 70 tf	16 units
GC No.4 100m)	RC Pile Cap(reinforcement)	1.5 × 1.5 × 1.0 m.	58 nos.
	Longitudinal RC Beam(ditto)	d=1.0 × h=0.8	260 m
- 14.0 m Basin	Deepening(Dredging)	Design depth -14.5m	600 m^3
Cargo Handling	New crane rail	Rail gauge 8.0 m.	260 m
Equipment	New conveyor line	600 ton/hrs	450 m
	New conveyor foundation	Span 30 -35 m.	16 units
	Grain unloaders	Replace	3 units
	Power supply	Cable duct	260 m

(c) Preliminary design of New Grain Berth

Figure 5.7.6 shows Facility Layout of New Grain Berth. Figure 5.7.7 shows Typical Section of New Grain Berth.

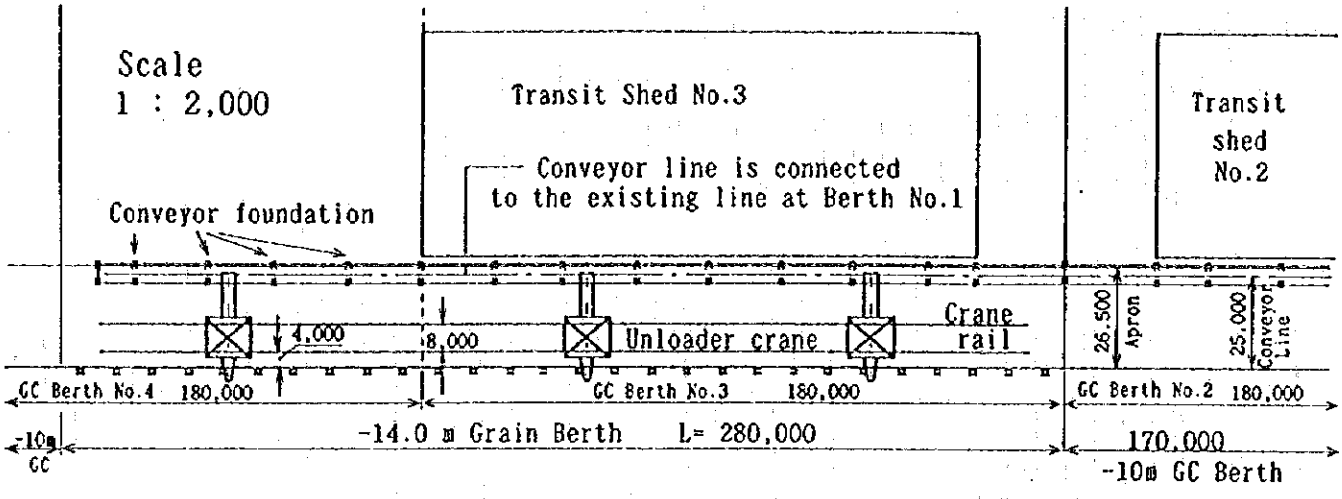


Figure 5.7.6 Facility Layout of New Grain Berth at GC Berth No.3

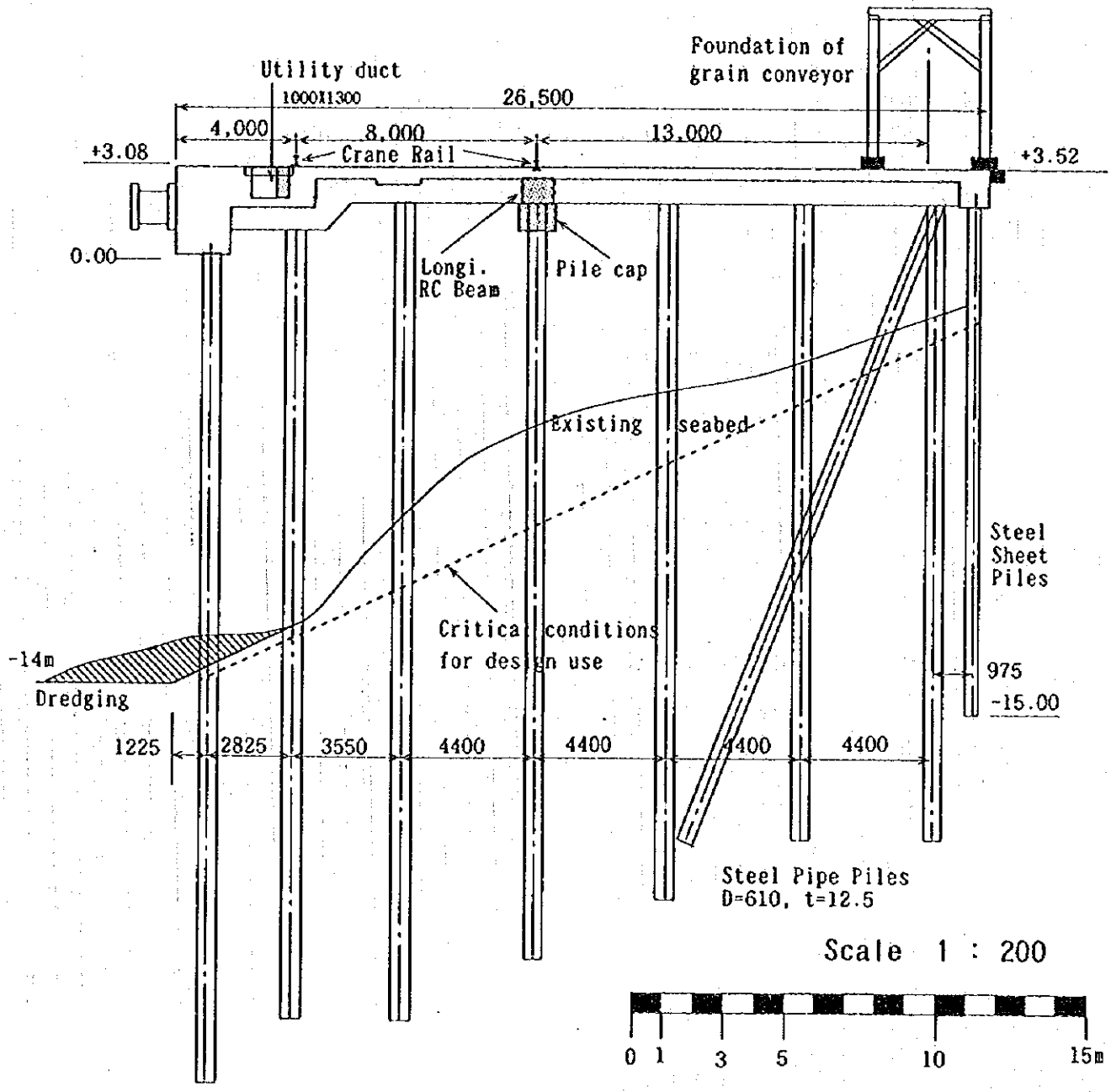
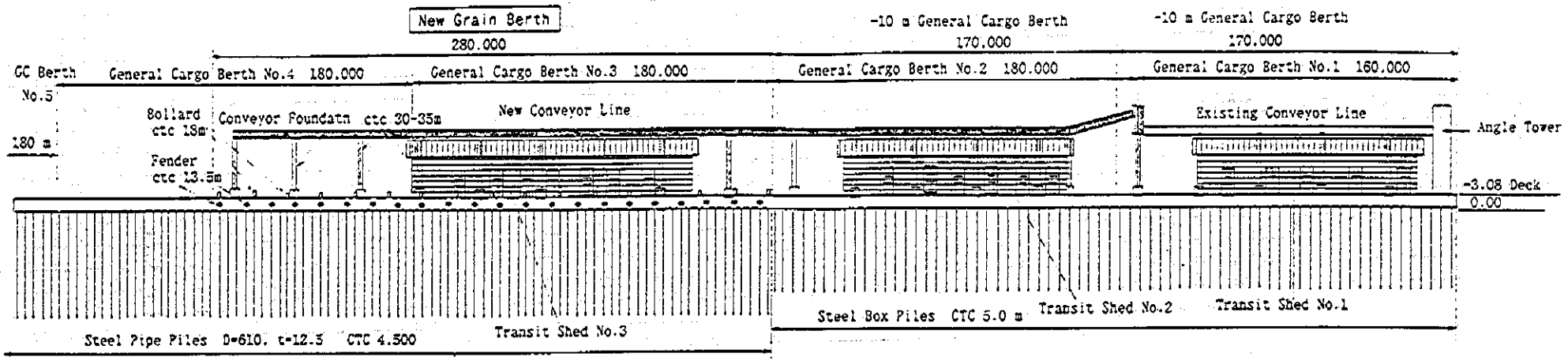


Figure 5.7.7 Typical Section of New Grain Berth at GC Berth No.3



Front View of New Grain Berth

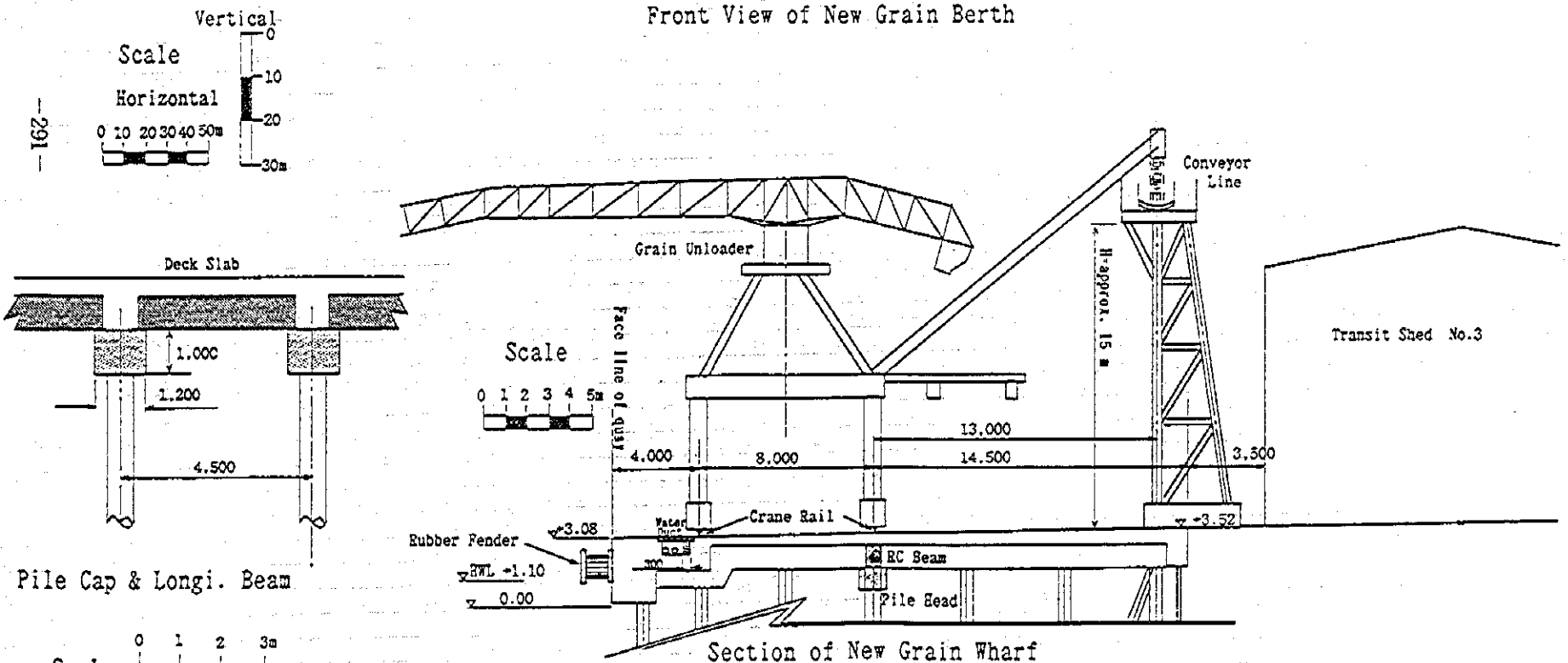


Figure 5.7.8 Preliminary Design of New Grain Berth

(3) Rehabilitation of New Oil Berth

New Oil Berth, formerly known as Phosphate Exporting Berth A, is planned to accommodate both various oil tankers and phosphate bulk carriers as at present. Though the panned life span of the berth is estimated as 50 years, 35 years have already passed through. The berth consists of a jetty head and 6 mooring dolphins. Concrete surface of their dolphins is damaged at many places. At some places, steel bars are exposed, specially, at upper parts of side walls. Those parts shall be urgently repaired. Deterioration of concrete and corrosion of steel box piles is most progressed at mooring dolphin No.1(north end). The bollard is used for mooring both ships of berthing phosphate A and general cargo berth No.1. It is recommended to prohibit two ships from simultaneously mooring at the bollard. After the year 2000, and additional mooring dolphin shall be constructed beside the existing dolphin.

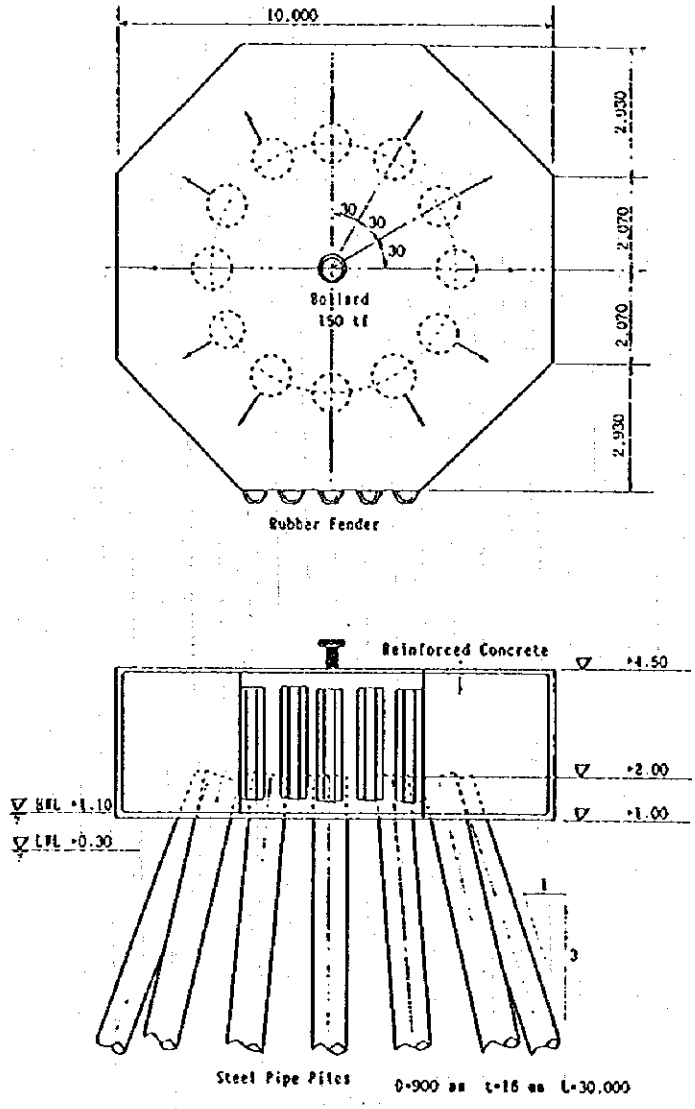


Figure 5.7.9 New Mooring Dolphin Beside MD No.1

5.7.2 Container Port

(1) Facility Layout of Container Terminal to be improved by 2000

Two (2) blocks of container yard are scheduled to be improved in the Short-Term Improvement Plan. Therefore the extension of container wharf is included in the Short-Term Plan. Office building and the related facilities are planned at northern east area of the terminal.

Figure 5.7.10 shows Facility Layout of Container Terminal.

(2) Facility Component

According to the required port facilities for the Short-Term Improvement Plan, the objective port facilities shall be improved. Table 5.7.4 shows facility component of container terminal.

Table 5.7.4 Facility Component of Container Terminal

Facility Component	Facilities	Specification	Quantity
Container Berth	Foundation piles	SPP D=762-914	169 nos
	RC deck	RC flat slab deck	4,692 m^2
	Rubber Fender	Rubber tubular dock	5 units
	Bollard	150 tf	3 units
	Retaining wall	Steel Sheet Piling	60 lin.m
Revetment	Steel Sheet Piling / Coping	Z-40 type	30 lin.m
Berth Equipment	Container crane	Crane rail/Power	60 lin.m
Building	Port office	2 floors	3,000 m^2
	Maintenance shop	Land ; 2,000 sq.m	750 m^2
Container Yard	Pavement	Interblock surface	70,600 m^2
Road / Pavement	Roads & pavement	Permanent/Temporary	17,000 m^2
Site preparation	Excavating/grading	preparation sub-base	95,000 m^2
	Reclamation	behind extent. berth	20,000 m^2
	Cut & format slopes	setting berm,drainage	700 lin.m

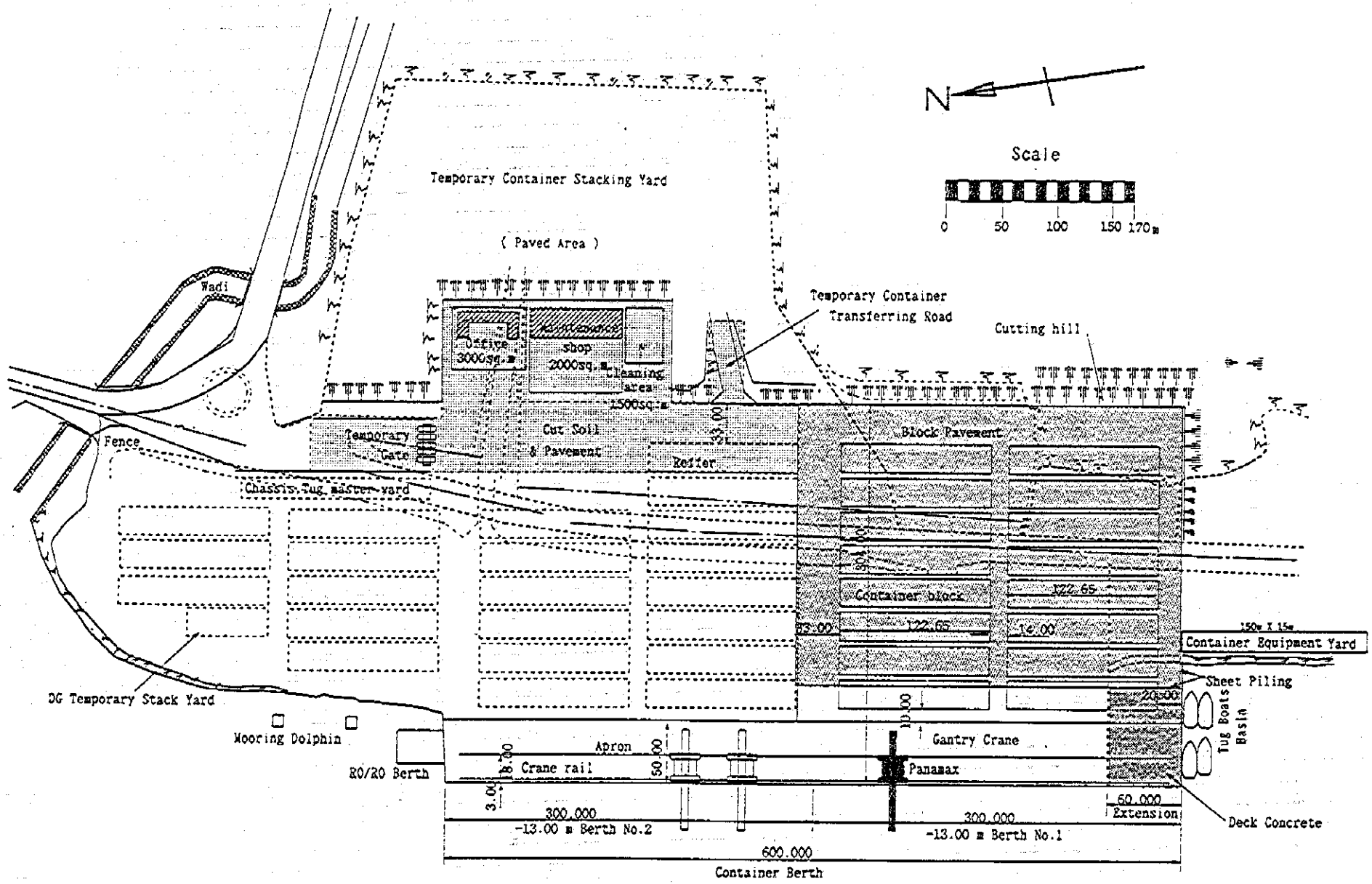


Figure 5.7.10 Facility Layout of Container Terminal

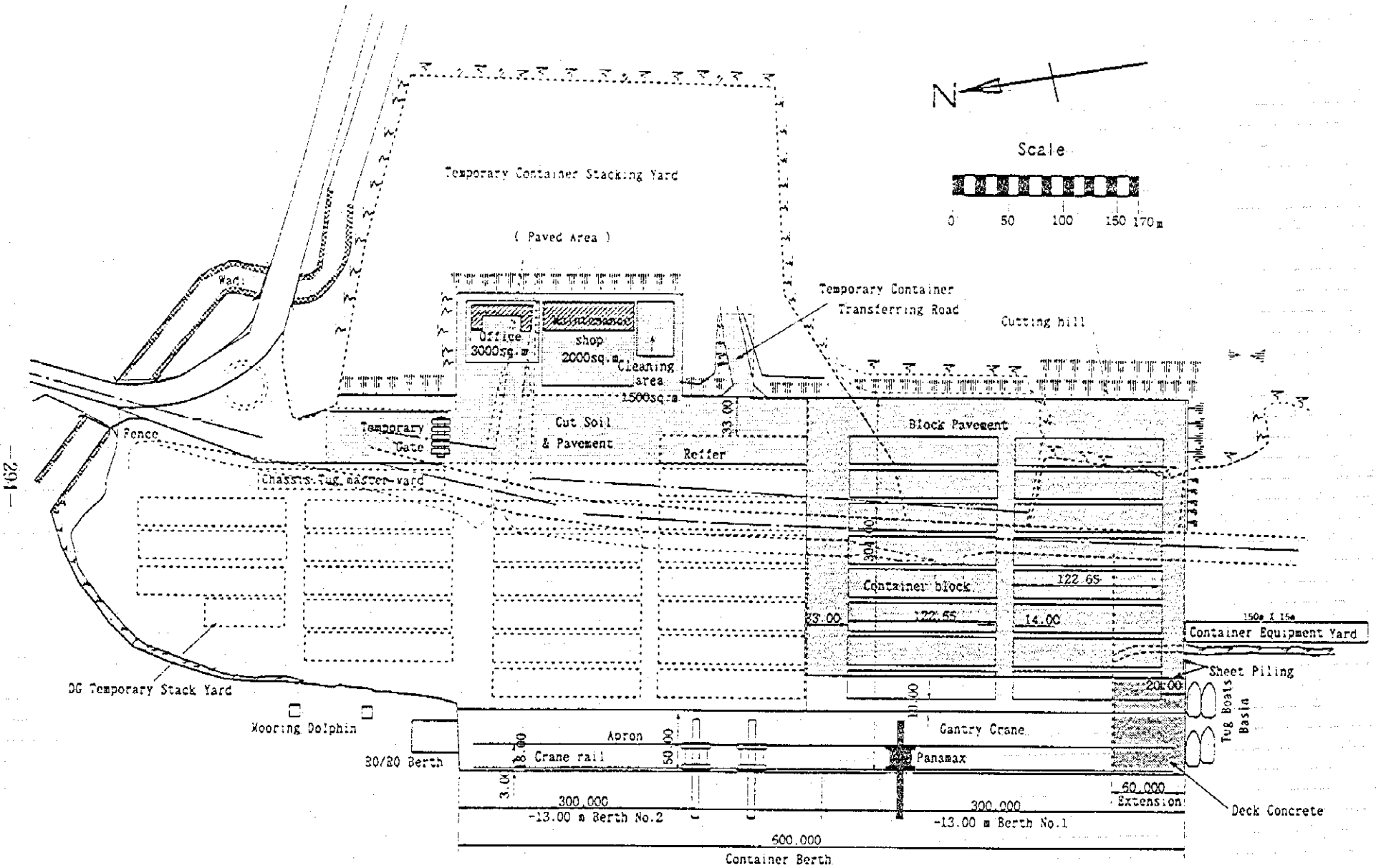


Figure 5.7.10 Facility Layout of Container Terminal

(3) Preliminary Design for Extension of Container Wharf

(a) Design Conditions

i) Soil conditions

A soil boring was carried out at the extremity of proposed extension berth. The results are as follows.

- Stratum from seabed to 20 meters depth is uniform soil which is whitish, creamish and grayish, fine to coarse loose to very dense coral sand with some shells.
- Classification of soils

Depth	Specific Gravity	Clay	Silt	Sand	Gravel
- 9.5 - -12.5	2.649	0	7.6%	92.4%	
-12.5 - -15.5	2.631	0	6.9%	93.1%	0
-15.5 - -19.0	2.642	0	6.2%	93.8%	0
-19.0 - -25.0	2.645	0	7.7%	92.3%	0
-25.0 - -28.0	2.639	0	7.1%	92.9%	0
-28.0 - -29.5	2.628	0	8.2%	91.8%	0

-N-Value	N-Value	angle of Internal Friction
From -9.5 to -13.0	7	27
From-13 to -15.5	30	35
From-15.5 to -20.0	50	40
From-20 to -26.0	45	40
From-26.0 to -30.0	55	42

ii) Bathymetric conditions

Figure 5.7.11 shows bathymetric conditions of extension wharf area

iii) Other natural conditions

Other natural conditions for design use are described in Chapter 4.9.1.

iv) Load conditions

-Ship's conditions (60,000DWT = 32,000GT = 72,000 Displacement Tonnage)

Berthing velocity :	0.15 m./sec.
Berthing energy	60 ton.-m.
Tractive Force on Bollard	150 tf

-Load conditions

Surcharge	4.0 ton./sq.m
Wheel condition uniform	35 ton./wheel
(2 times at abnormal)	70 ton./wheel

(b) Preliminary Design of the Container Wharf

Figure 5.7.12 shows preliminary design of the container wharf.

(4) Preliminary Design of Container Yard

(a) Design Conditions

i) Soil conditions

A soil boring was carried out in a area of proposed container yard to be improved in the Short-Term Plan. The result are as follows.

- Stratum from ground to 20 meters depth is uniform soil which is medium to coarse, dense to very dense granitic sand with some fine gravels.

- Classification of soils

Depth	Specific Gravity	Clay	Silt	Sand	Gravel
+4.0 - +2.5	2.633	0	9.8%	90.2%	0
+2.5 - -0.5	2.640	0	0.5%	80.1%	19.4
-0.5 - -2.0	2.650	0	1.1%	71.1%	27.8
-2.0 - -6.5	2.631	0	4.1%	86.9%	9.0
-6.5 - -11.0	2.637	0	5.9%	82.8%	11.3
-11.0 - -16.0	2.637	0	2.0%	86.6%	11.4

-N-Value

	N-Value	angle of Internal Friction
From +4.0 to 0	50	40
From 0 to -5.0	70	42
From -5.0 to -10.0	45	40
From -10 to -13.0	40	40
From -13.0 to -16.0	55	42

ii) Topographic conditions

Westward slopes of a small hill will be cut for preparing new container yard. The stratum of soil is medium to coarse,dense to very denser granitic sand with some gravels as well as near flat land. However some stones, very highly weathered, are available in the soils.

(b) Preliminary Design of the Container Yard

Regarding the container box handling equipment in the container terminal by 2000, container stacking and discharging system changes from straddle carrier method to transfer crane, and stacking system alters from 3 steps stack to 4 steps stack. Therefore the design of pavement shall be changed. There are, in principal, two designs for the pavement of container yard. As a design, section of pavement is determined by the purpose such as transfer crane lane, trailer lane, container stock yard and the stacking point according to the differences of load conditions. In the other, section of pavement is taken as an uniform section in all areas of container yard. The design of the Study applies to the latter one, and the section of pavement is shown in Figure 5.7.13.

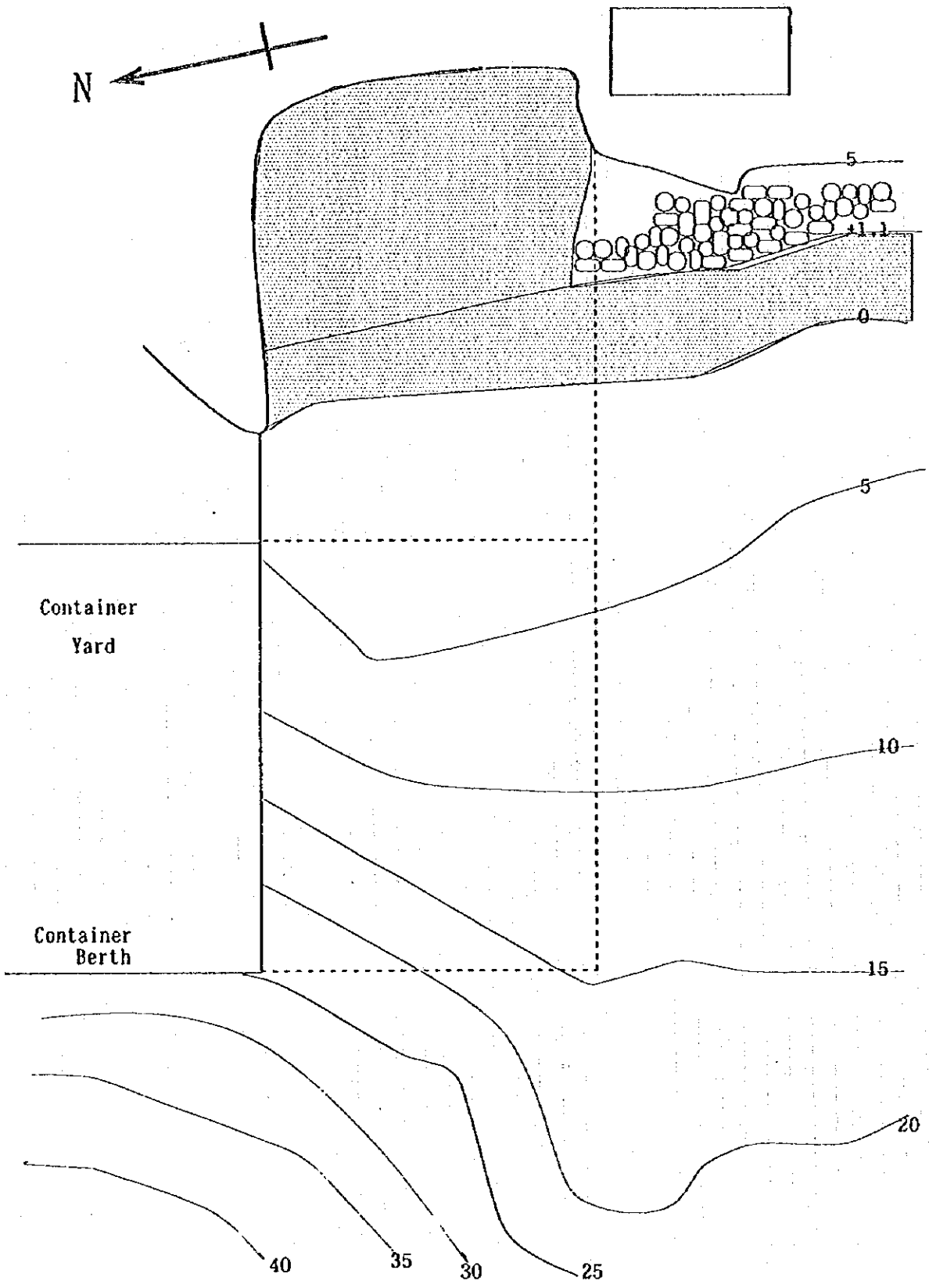


Figure 5.7.11 Bathymetric Conditions of New Wharf

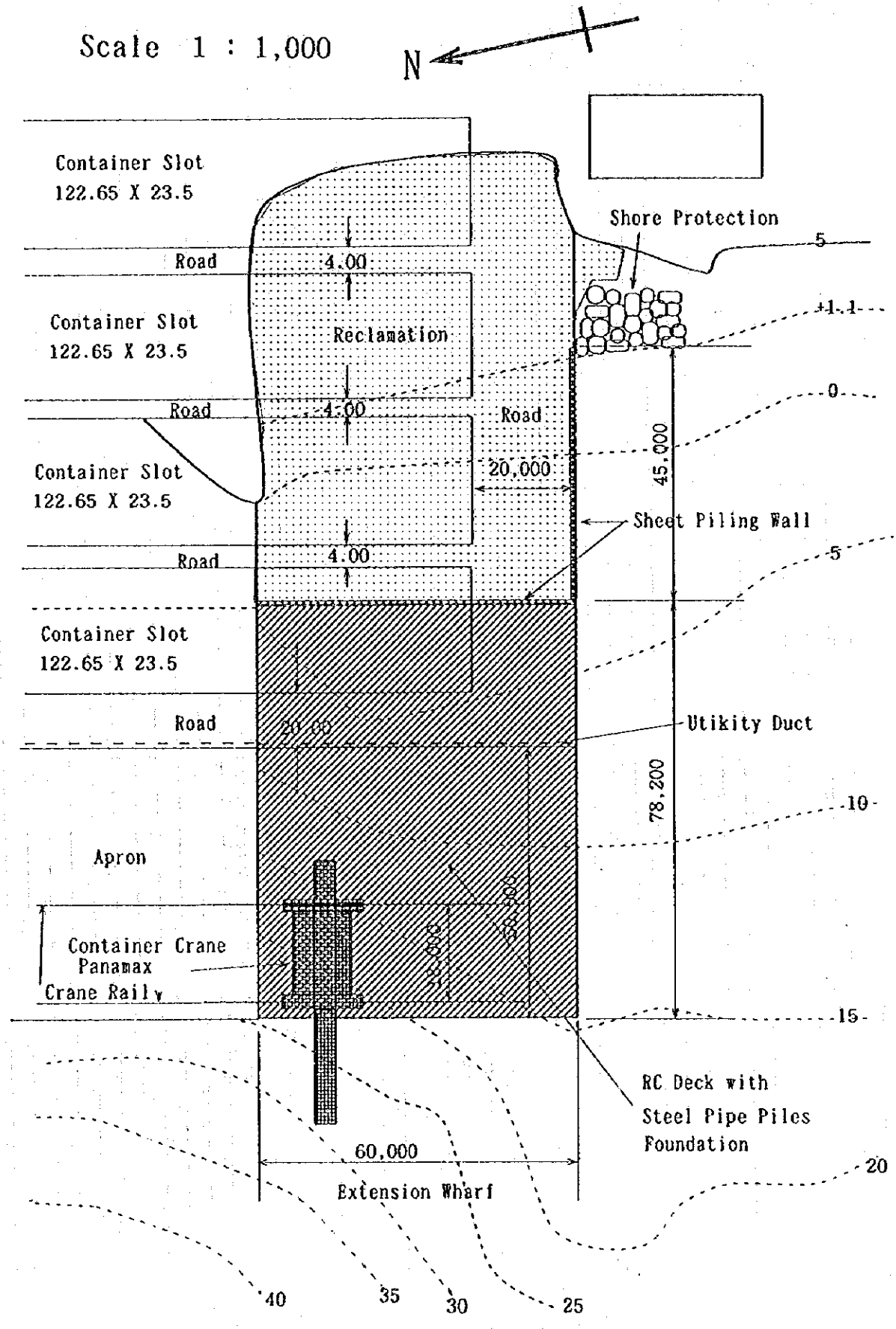


Figure 5.7.12 Preliminary Design of Contalner Wharf

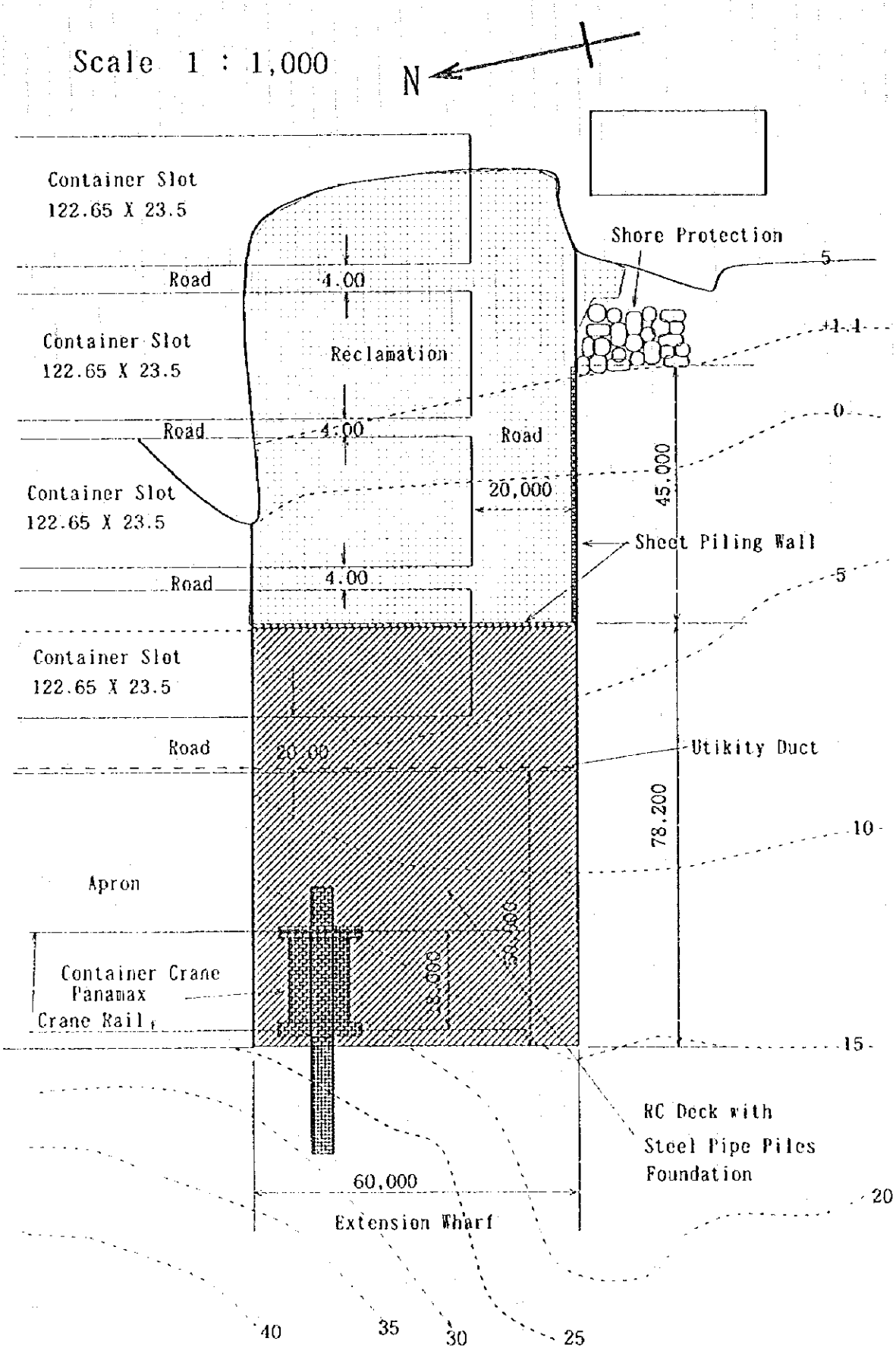
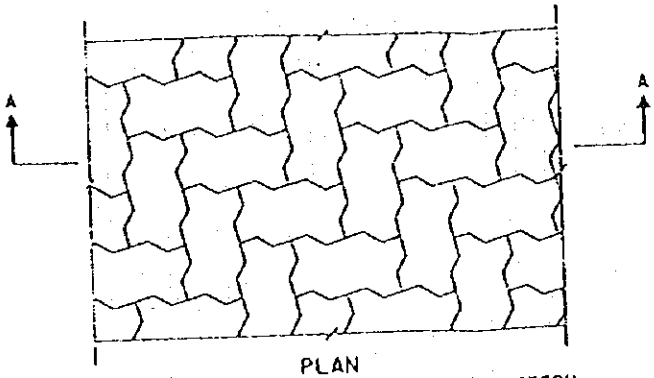
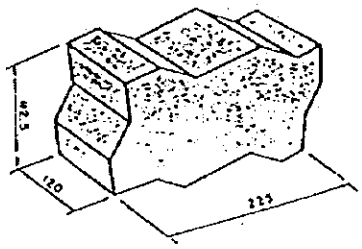
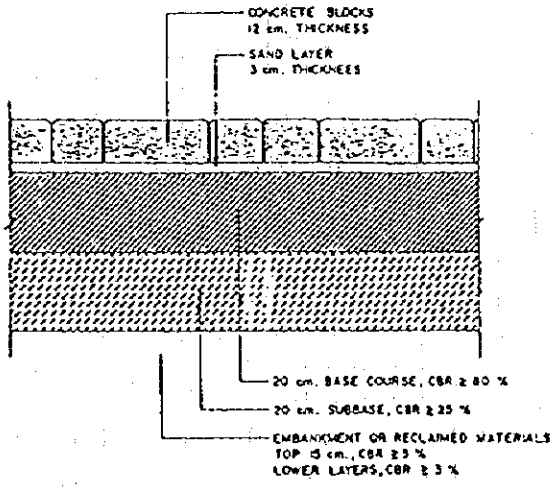


Figure 5.7.12 Preliminary Design of Container Wharf



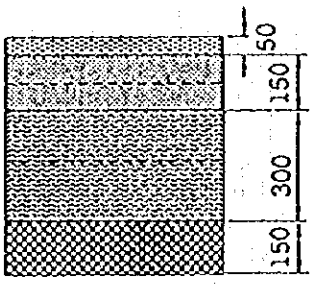


INTERLOCKING CONCRETE BLOCK SHAPE AND DIMENSION



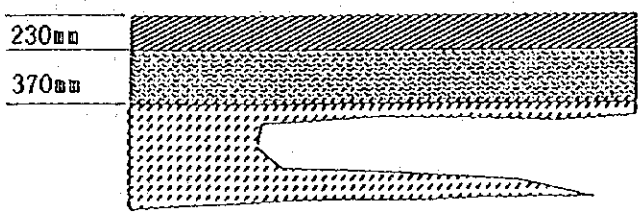
SECTION A–A
INTERLOCKING CONCRETE BLOCK PAVEMENT FOR APRON SLAB

Section of Pavement for Container Yard



Asphaltic concrete wearing course
Asphaltic concrete base course (2 layers)
Crushed stone road base (2 layers)
Granular sub-base

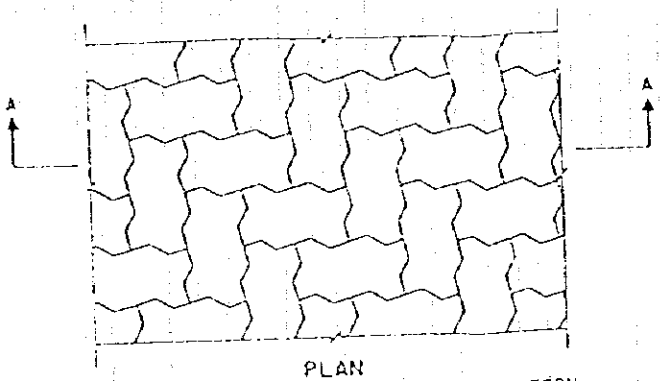
Section of Trunk Roads inside Ports

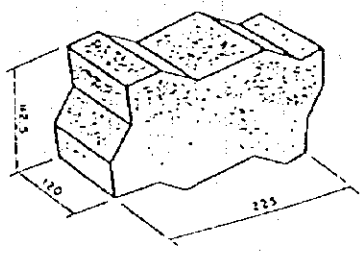


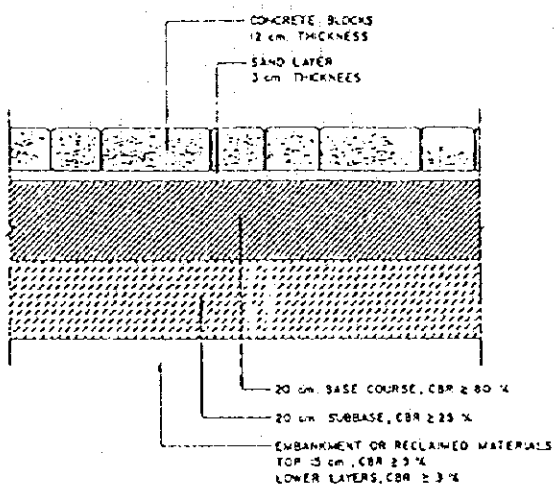
Concrete pavement
Crushed stone
Filling

Section of concrete pavement

Figure 5.7.13 Section of Pavement of Container Yard

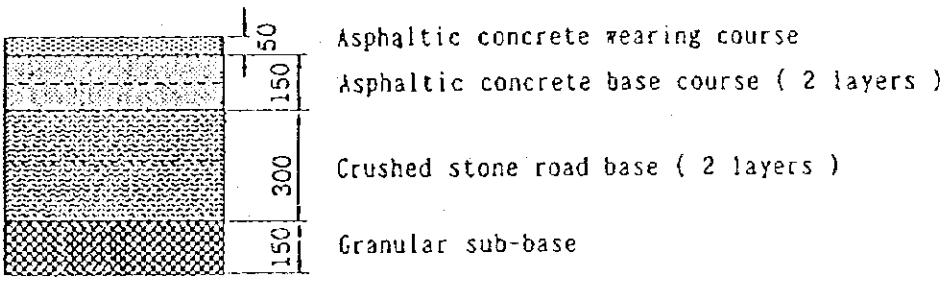




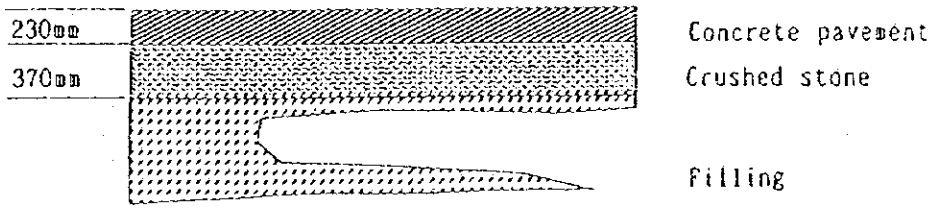


SECTION A–A
INTERLOCKING CONCRETE BLOCK PAVEMENT FOR APRON SLAB

Section of Pavement for Container Yard



Section of Trunk Roads inside Ports



Section of concrete pavement

Figure 5.7.13 Section of Pavement of Container Yard

5.7.3 Industrial Port

A live-stock import berth utilizing the existing timber jetty is improved in the Short-Term Improvement Plan. Design berth length is 200 m. The face-line of the berth is planned at 15 meters seaward parallel to the existing timber berth. Design depth is set as 11.0 meters below Chart Datum. An open type pier with steel pipe piles foundation is applied in design. Maximum ship size to be accommodated by the berth is planned as 20,000 Gross Tonnage, live-stock carrier overall length of 200 meters. To accommodate such size of ships, two mooring dolphins are planned at both extremities.

A loading pier for exporting fertilizer products is designed at the north of existing Industrial Berths. Since two berths will be required after the year 2010, the face-line of the proposed berth is determined considering an additional berth in future and the following conditions;

- Two berths shall be straight, and the design water depth at the face-line of the berths shall be more than 15 meters due to avoiding dredging works.
- Also it shall be less than 25 meters due to the economical reasons.
- Design berths length is 440 meters (220 m. X 2 berths) and the proposed berth length is set as 230 meters considering the location of control tower which is placed at the boundary of both berths.
- Conveyor line from the control tower to angle tower No.3 shall be straight and it shall be laid out of the salt storage company area.
- The extended line of the face-line shall be crossed nearby the north extremity of JFI-West Berth to secure a good ship maneuvering.

Furthermore, the reason why the north berth of which two berths are planned in future is selected in the Short-Term Improvement Plan is ;
- Arrested Iraqi ships are moored at the area of proposed south berth, and it takes much cost to shift the ships and to prepare new anchorage for them.

An open type pier with steel pipe piles foundation is applied in design. Maximum ship size to be accommodated by the berth is planned as 50,000 Dead Weight Tonnage and berth length of 220 meters is planned considering the existing JFI-West Berth. A loader of 1,500 tons per hour capacity is planned to equip on the berth. A belt conveyor line and angle tower with control room at the corner are equipped. A bridge connected to the pier and land is planned alongside a new conveyor line to the existing angle tower No.3 which will be constructed by the fertilizer companies.

No facility is improved at JFI-West & East by year 2000.

(1) JFI-1 Berth

(a) Design Conditions of JFI-1 Berth

1) Soil conditions

No soil boring was carried out near existing timber jetty by the JICA Study Team. However there are many boring data near the site. The boring were carried out by Canadian Consultant in a study on multi purpose jetty wadi 2 industrial area. According to the boring data, the stratum from seabed to 10 meters depth consists of medium to dense,

fine to coarse coral sand with shell fragment and the SPT N-Value shows 30 to 50. The stratum from 10 m. to 20 m. consists of dense to very dense, fine to coarse coral sand, fine gravel and shells with N-Value of over 50.

2) Other natural conditions

Other natural conditions for design use are described in Chapter 4.9.1.

3) Load conditions

- Ships conditions (20,000 GT = 27,000 Displacement Tonnage)
  - Berthing velocity 0.15 m./sec.
  - Berthing energy 25 ton./m.
  - Tractive force on bollard 100 tf
- Load conditions
  - Surcharge 4.0 ton./sq.m.
  - Wheel condition uniform 35 ton. / wheel
  - (2 times at abnormal) 70 ton. / wheel

No loader nor unloader is planned in the Short-Term Plan by year 2,000. However, in future, they may be required according to the increase of industrial products or law materials import. It is applied in design to be able to equip quay cranes with rail gauge between 10 m and 12 m.

(b) Preliminary Design of Port Facilities

A structural type of open type pier with steel pipe piles foundation is designed. A couple of raker piles is set at the center of jetty section. Foundation piles are arranged 2.0 m., 5 m. each from front by transberth section at the center area, and 2.0 m., 5.0 m., 5.0 m., 5.5 m., 5.5 m. at the both sides. At the center area, precast PC panels are bridged to connect new berth and old jetty.

Figure 5.7.14 shows facility layout of JFI-1 berth.
Figure 5.7.15 shows section of JFI-1 berth.
Figure 5.7.16 shows layout of mooring dolphin.

(2) JFI-North Berth

1) Soil conditions

A soil boring was carried out near the proposed JFI-North berth. The results are as follows.

Stratum from seabed to -22 m depth is uniform soil which is whitish and greyish fine branched coral filled with fine to medium grained coral sand and shells, weak to very weak branches.

Stratum from -22 m to -33 m depth is uniform soil which is greyish, very dense, fine to medium grained beach sand with some shells.

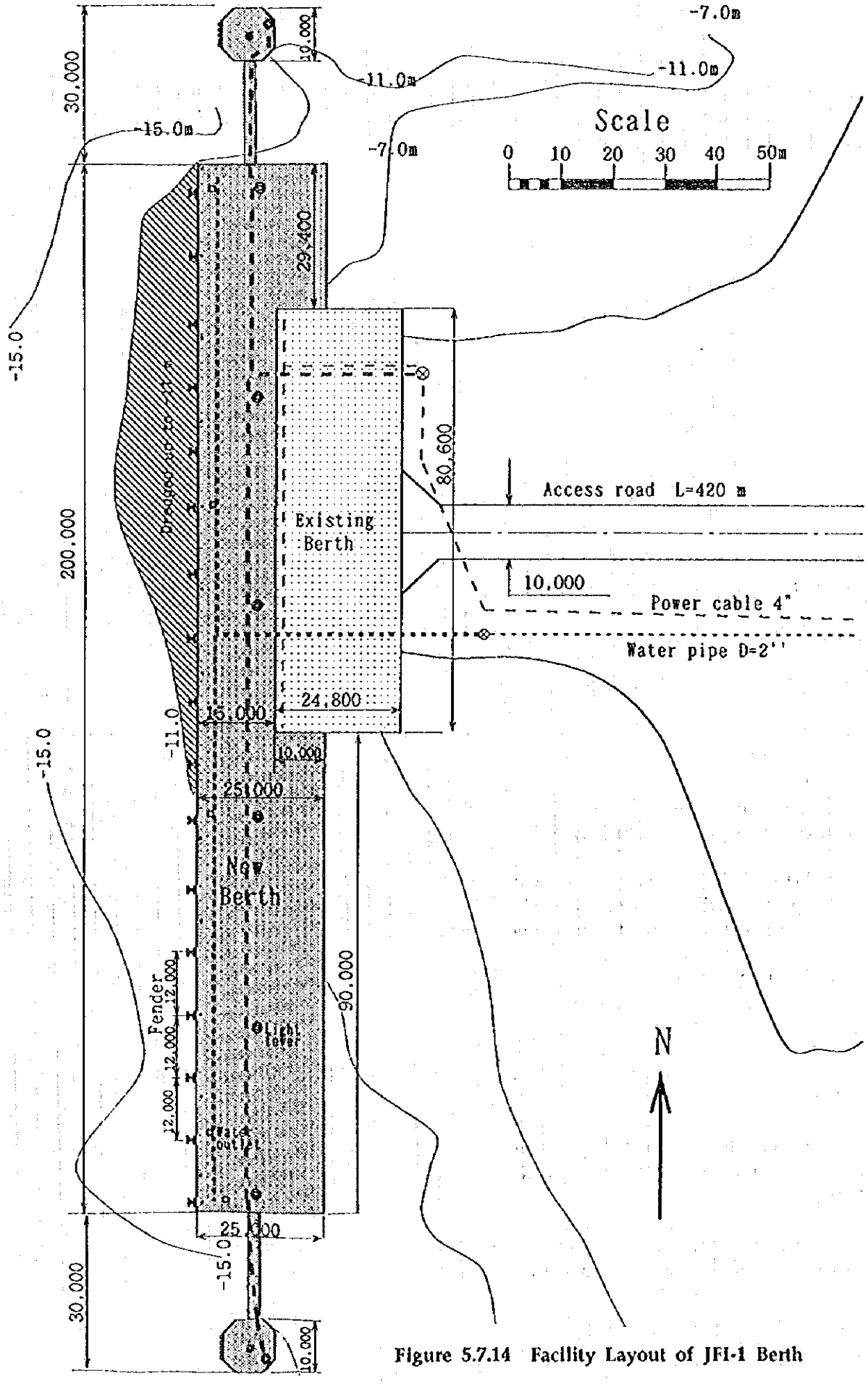


Figure 5.7.14 Facility Layout of JFI-1 Berth

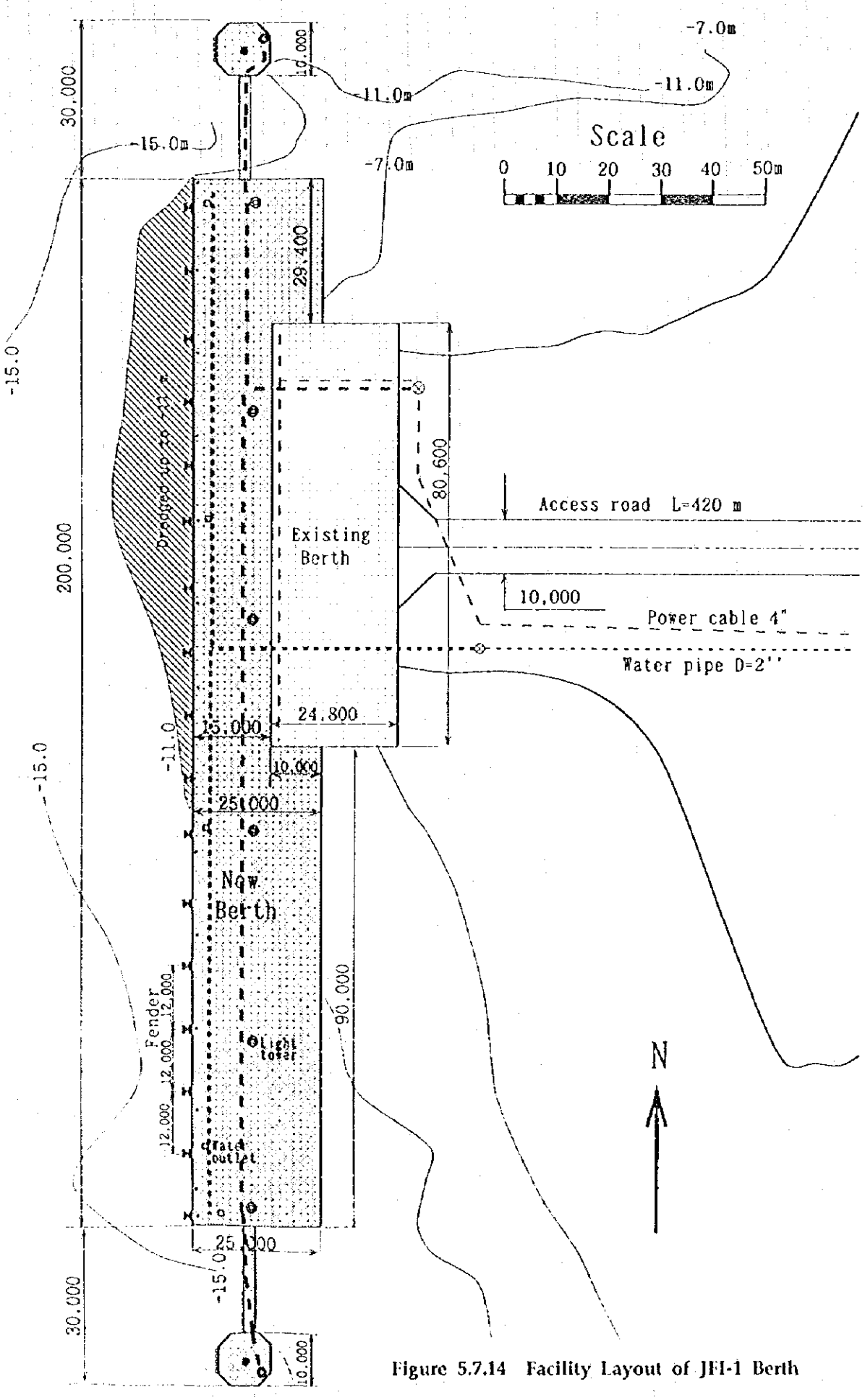
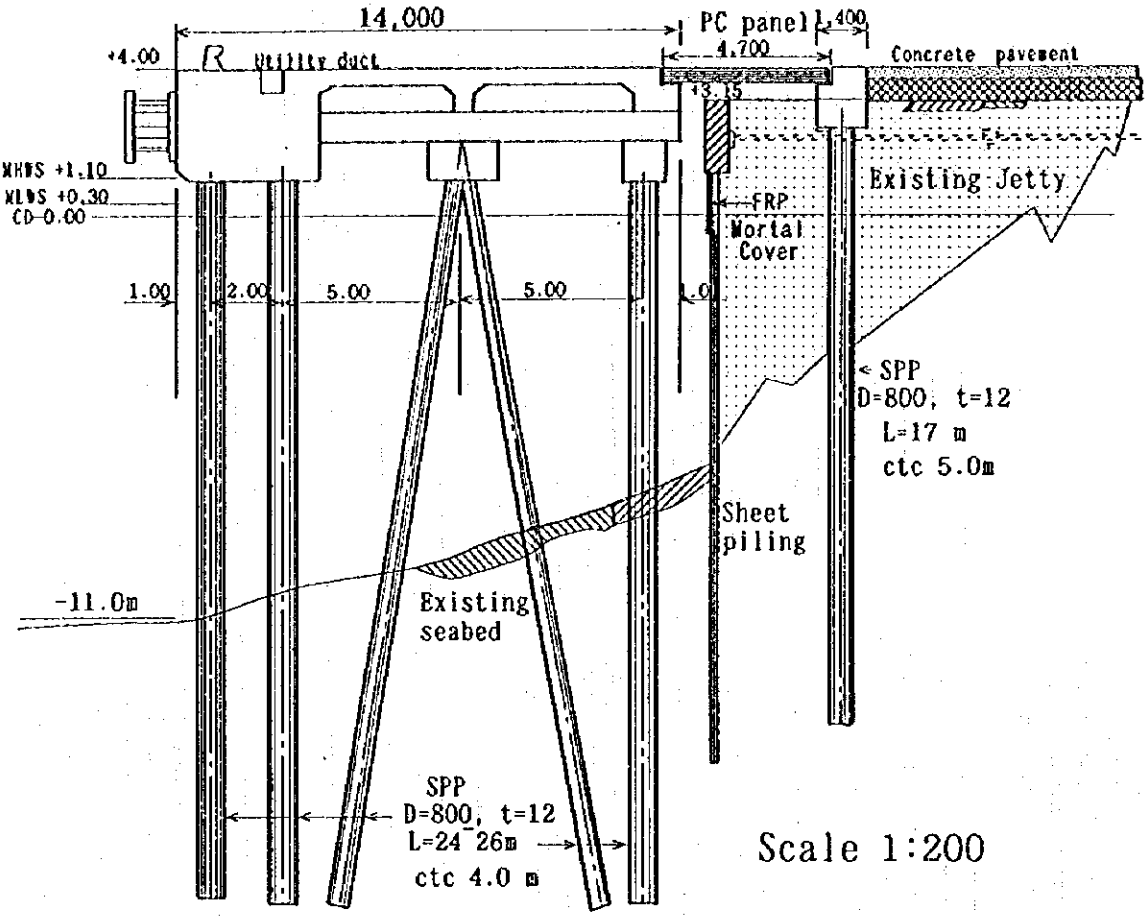


Figure 5.7.14 Facility Layout of JFI-1 Berth



Typical Secshon of Live-stock Berth (Middle)

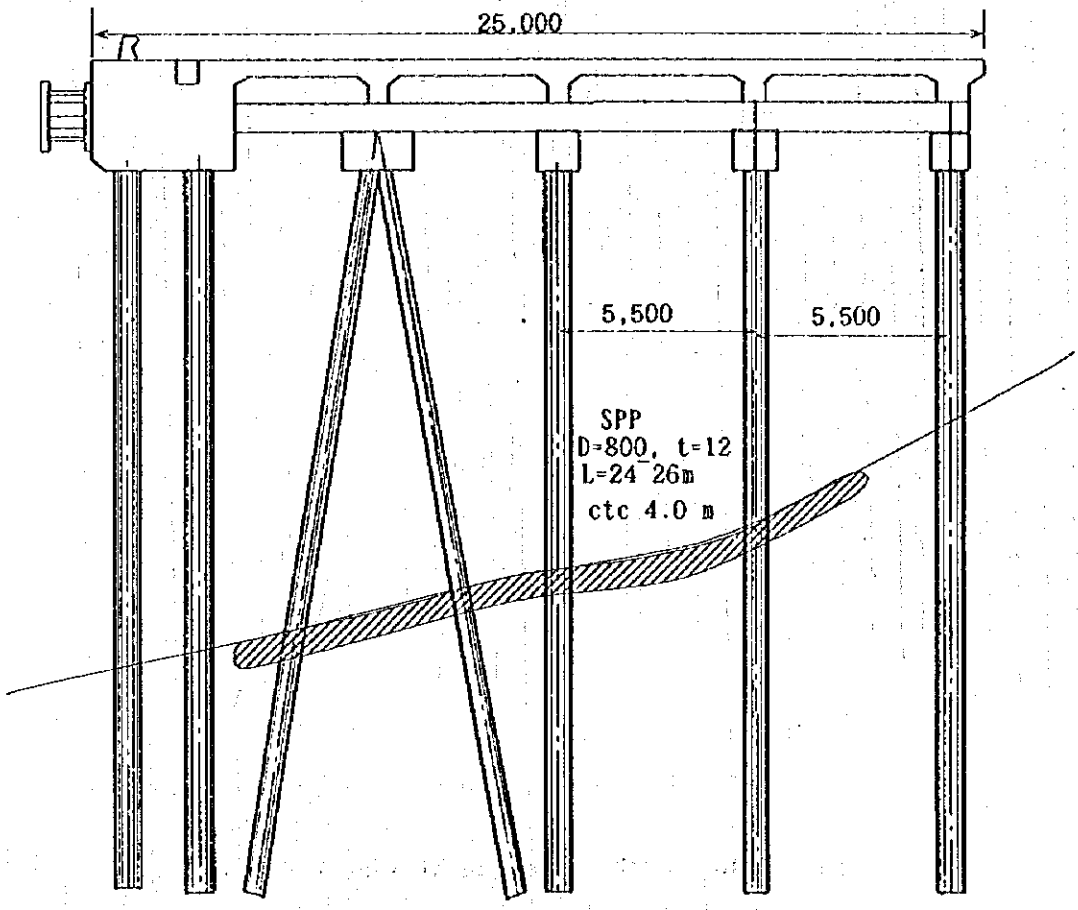
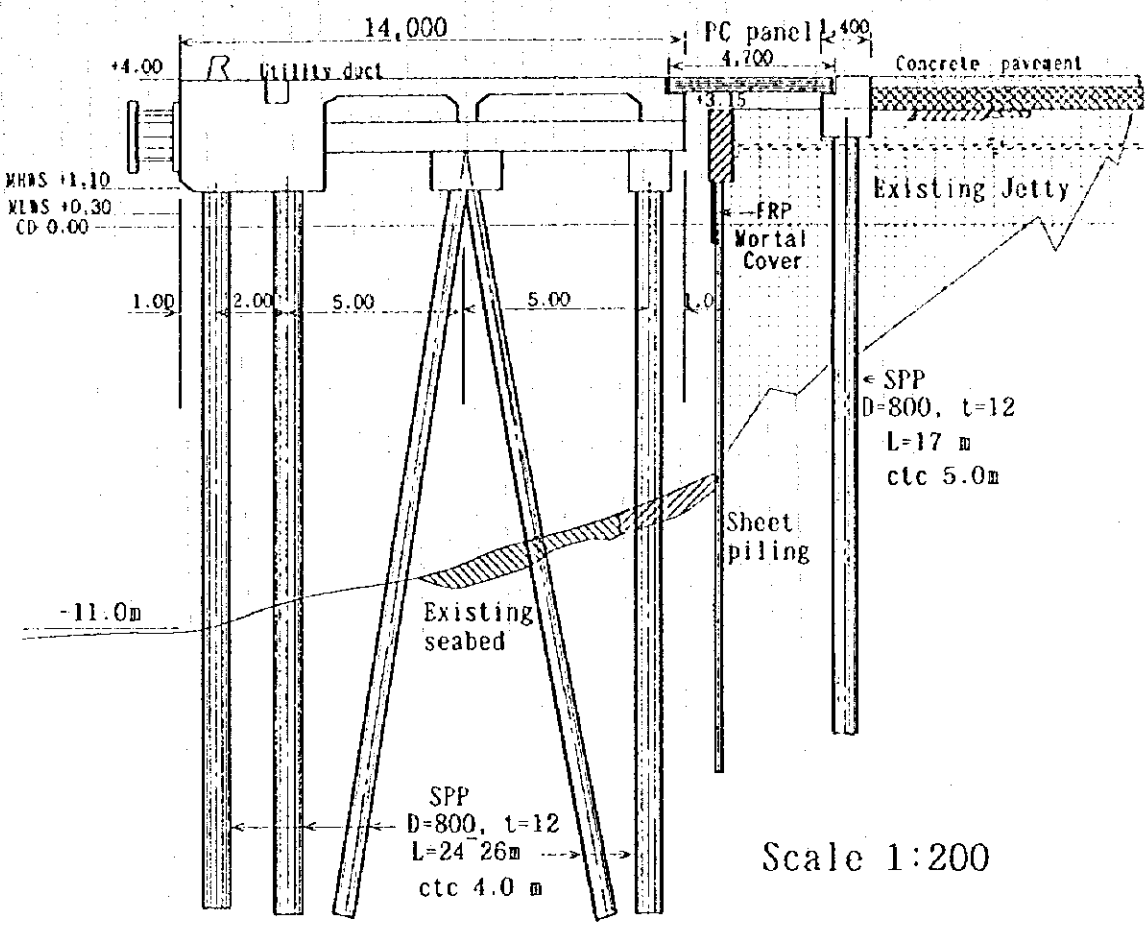


Figure 5.7.15 Section of JFI-1 Berth



Typical Secshon of Live-stock Berth (Middle)

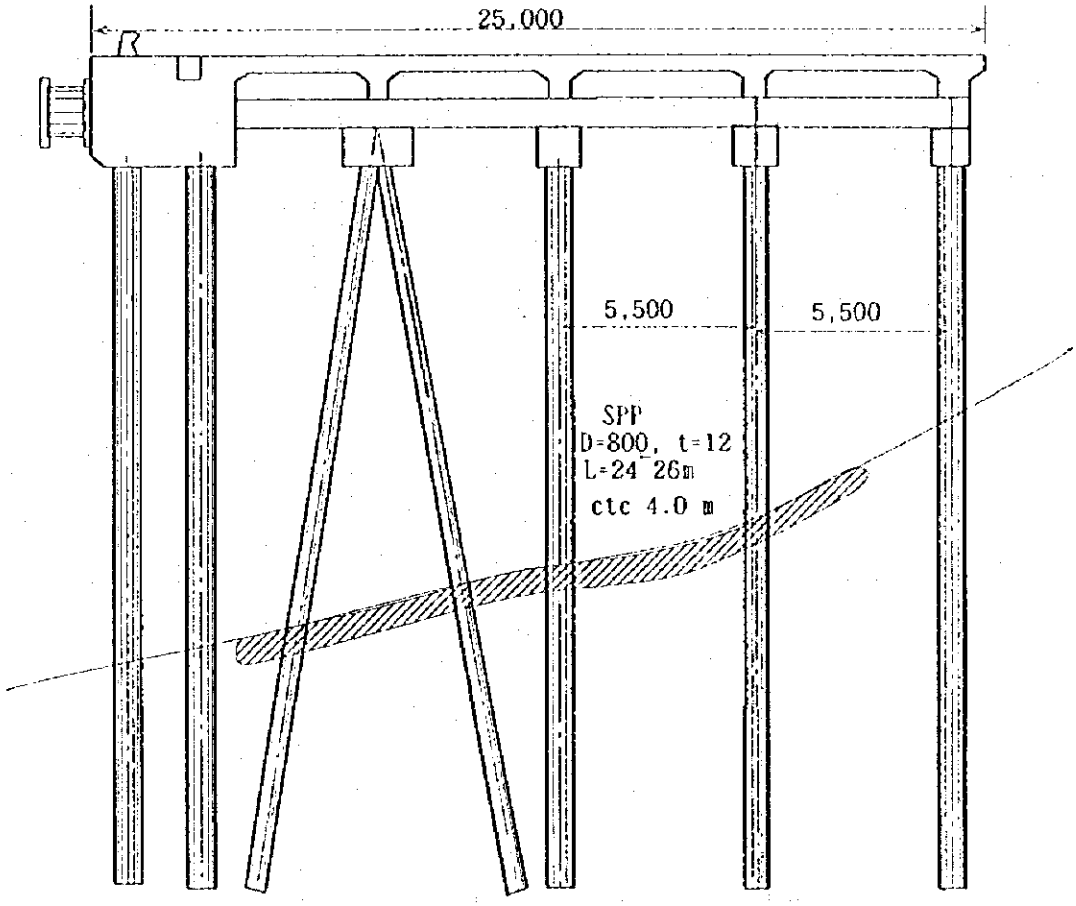


Figure 5.7.15 Section of JFI-1 Berth

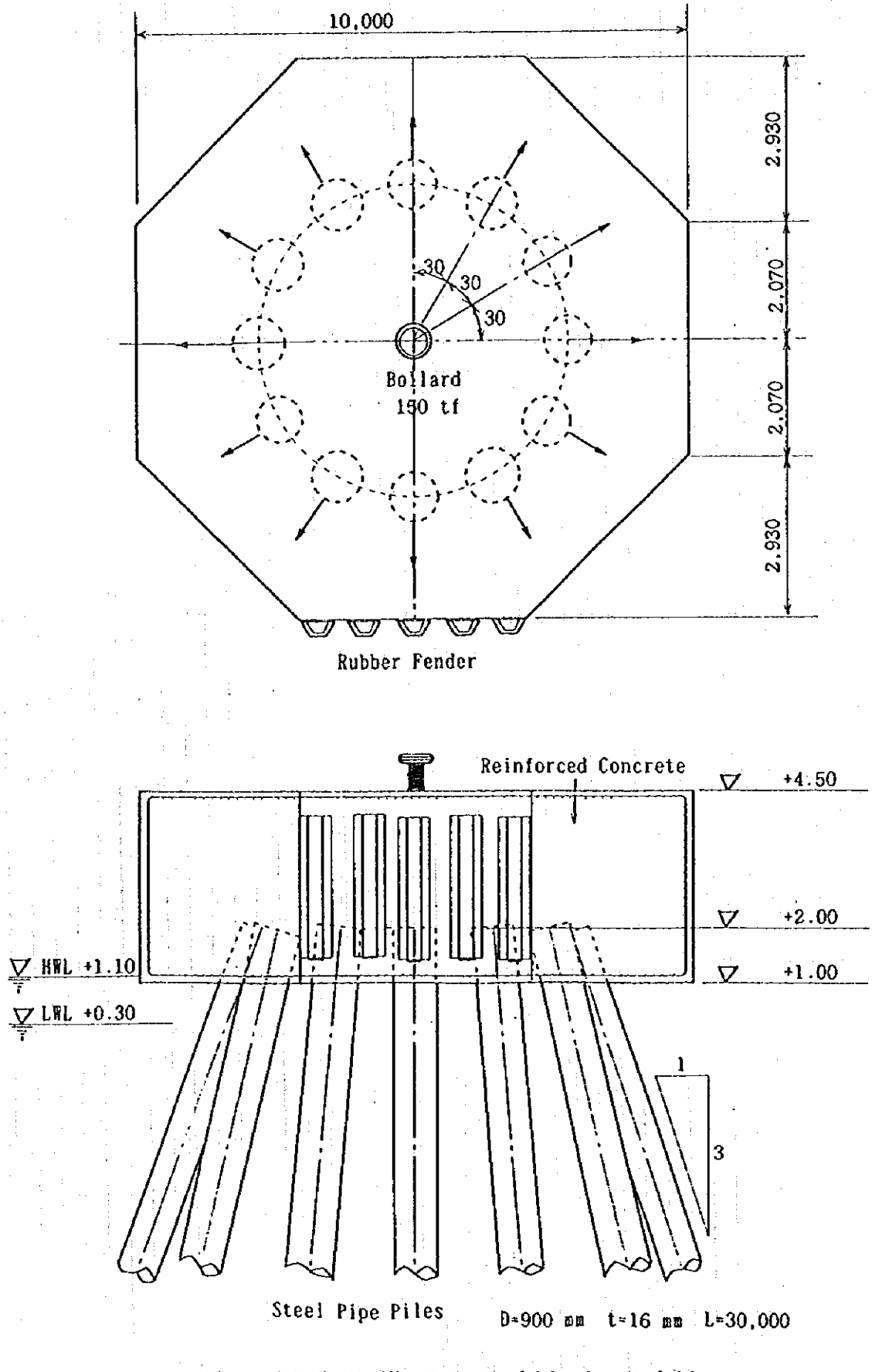


Figure 5.7.16 Facility Layout of Mooring Dolphin

Classification of soils

Depth	Specific Gravity	Clay	Silt	Sand	Gravel
10 - 13.0	2.656	0.0	3.6%	67.4%	29.0%
13.0 - 16.0	2.618	0.0	1.4%	54.4%	44.2%
16.0 - 17.5	2.629	0.0	4.5%	74.0%	21.5%
17.5 - 19.0	2.633	0.0	4.0%	65.5%	30.5%
19.0 - 20.5	2.693	0.0	3.4%	69.2%	27.4%
20.5 - 22.0	2.648	0.0	5.2%	78.2%	16.6%
22.0 - 28.0	2.626	0.0	3.6%	96.4%	0.0
28.0 - 33.0	2.603	0.0	1.7%	98.3%	0.0

N-Value

Depth	N-Value	Angle of Internal Friction
10.0 - 15.0	46	40 degree
15.0 - 20.0	65 (Max 72)	42
20.0 - 24.0	52	40
24.0 - 28.0	58	42

2) Bathymetric conditions

Figure 4.9.17(1) shows bathymetric conditions of Industrial Port area including the proposed JFI-North Berth. The contours of water depth are almost paralleled to the coast line. The gradient of seabed is very steep, nearly 1 by 4 from coast to -50 meters of depth.

3) Other natural conditions

Other natural conditions for design use are described in Chapter 4.9.1.

4) Load conditions

Dimensions of ships

Type of ships	Bulk cargo ship(Maximum)	Bulk cargo ship(minimum)
Tonnage	50,000 DWT	5,000 DWT
Overall length	216 m	109 m
Moulded breadth	31.5 m	16.4 m
Moulded depth	17.5 m	9.0 m
Full load draft	12.4 m	6.8 m
Free board at full load	5.1 m	2.2 m

Berthing conditions

Berthing velocity	0.15	m/sec.
Berthing method	point berthing	
Berthing energy	66	ton-m
Tractive force on bollard	150	tf

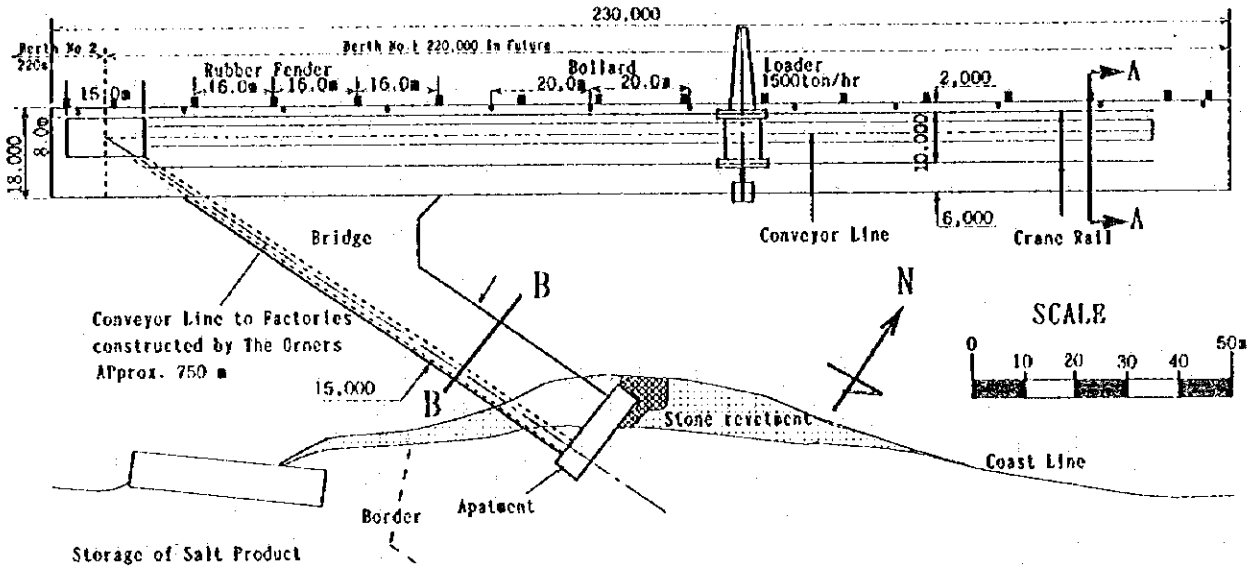
Load conditions

Surcharge		4.0	ton / sq.m
Wheel load	uniform	35	ton / wheel
(at abnormal)	both sides	70	ton / wheel

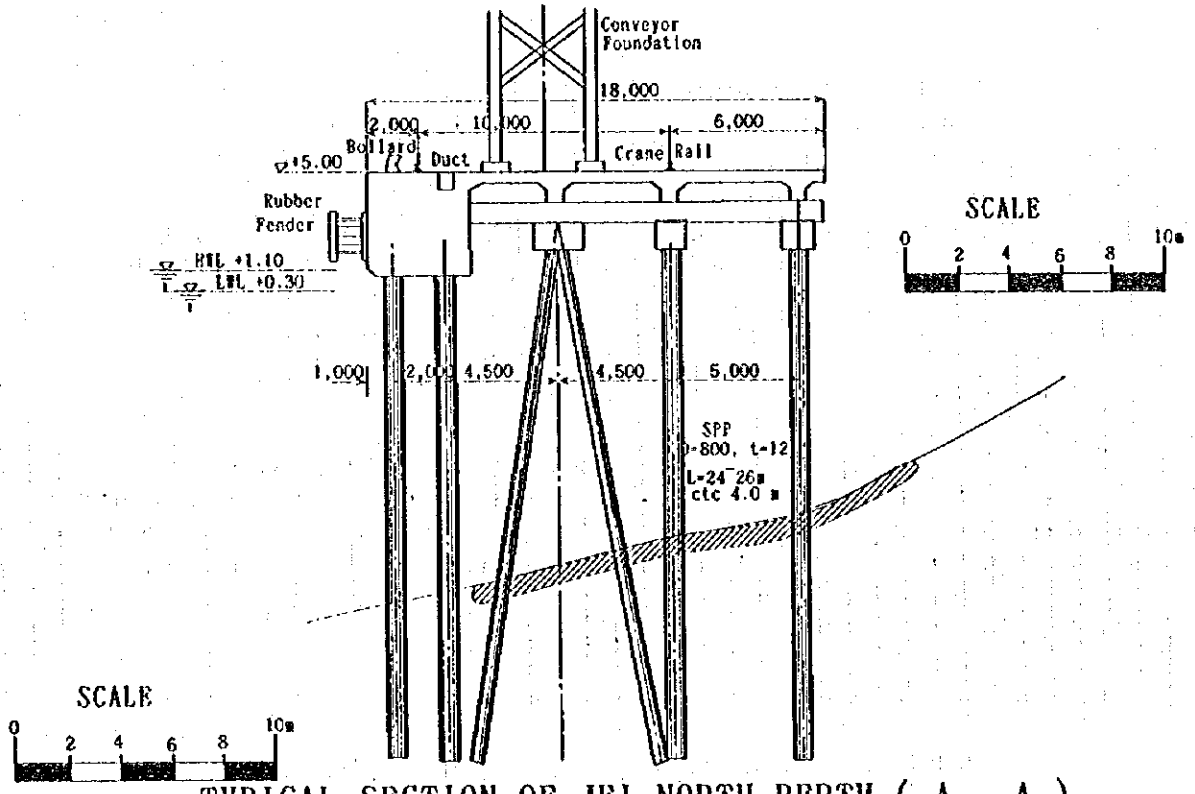
(b) Preliminary Design of Port Facilities

It isdesigned for a structural type of open type pier with steel pipe piles foundation. A couple of raker piles is set at the center of jetty section. Deck width is designed as 18 meters, 12 m from front for bulk head, bollards, utility duct and conveyor foundation, and 6 m at rear side for traffic zone. Foundation piles are arranged 2.0 m, 4.50 m, 4.50 m, 5.0 m each from front by transberth section. Transberth pile head beams are set every 4 m interval. Bollards for 150 ton tractive force are set on the bulk head every 20 meters interval. Rubber fenders are arranged every 16 meters interval.

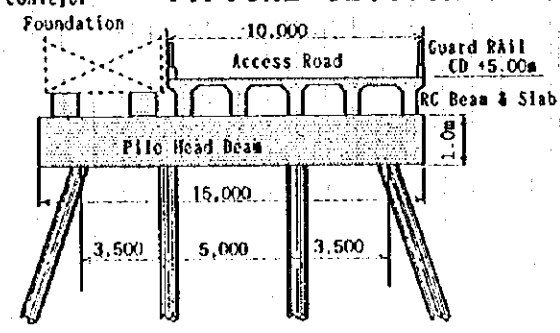
Figure 5.7.17 shows location, facility layout, typical section of berth and section of bridge of JFI-North Berth.



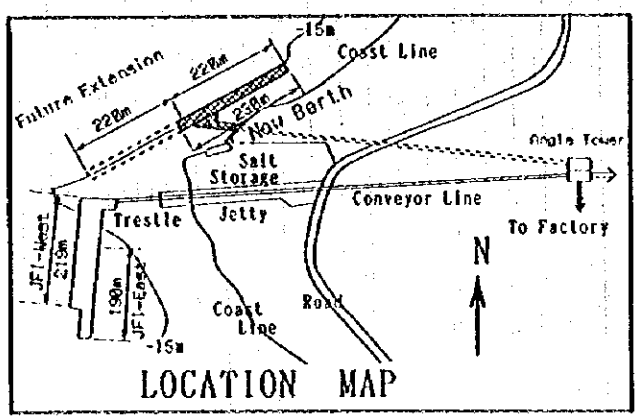
FACILITY LAYOUT OF JFI-NORTH BERTH



TYPICAL SECTION OF JFI-NORTH BERTH (A - A)



SECTION OF BRIDGE (B-B)



LOCATION MAP

Figure 5.7.17 Preliminary Design of JFI-North Berth

5.8 Project Implementation Program

In working out the preliminary plan for implementing the facilities construction and equipment procurement and installation of the short-term development, the JICA Study Team assumes the following preconditions :

(1) General

a) Except for JFI-North Berth, the financial sources are finalized before the middle of 1996 and selection of a consulting firm is to commence in July, 1996.
b) The design is to commence in the middle of October, 1997.
c) Contractor(s) for civil works and supplier(s) for equipment procurement are to be selected through international competitive bidding according to guidelines of respective financial sources.
d) The procurement of the equipment and the construction of civil works are to be completed before they are required according to the cargo demand forecast.
e) Contract packages are to be as follows:
   i) Waterborne works (berth) construction
   ii) On-land civil works (cut and fill, pavement, buildings, utilities)
   iii) Procurement of a container quay-side gantry crane (panamax)
   iv) Procurement of transfer cranes
f) Construction of facilities, procurement of equipment, training of employees, etc., identified under Urgent Improvement Plan and Improvement Measures of Environment, are excluded from the planning.
g) Repair works of damaged/deteriorated facilities are excluded from the planning.

(2) Main Port

a) Phosphate Berth A is to be kept as it is except minor repair works.
b) Deepening of the grain berth will be carried out by a waterborne work contractor.
c) Deepening of General Cargo Berth No. 4 will be carried out in the short-time development since the dredging quantity is minimal.

(3) Container Port

a) All the functions of the terminal are to be maintained at an acceptable service level during the implementation. To this end, 2-transfer cranes will be introduced to the northern-half of the container yard in the early part of 1998 to cope with the cargo increase despite the construction work of the southern half container yard.
b) The remaining 3-transfer cranes will be ready for use when the southern half of the container yard is completed.

(4) Industrial Port

a) JFI-North berth is to be operated at the beginning of 1999.

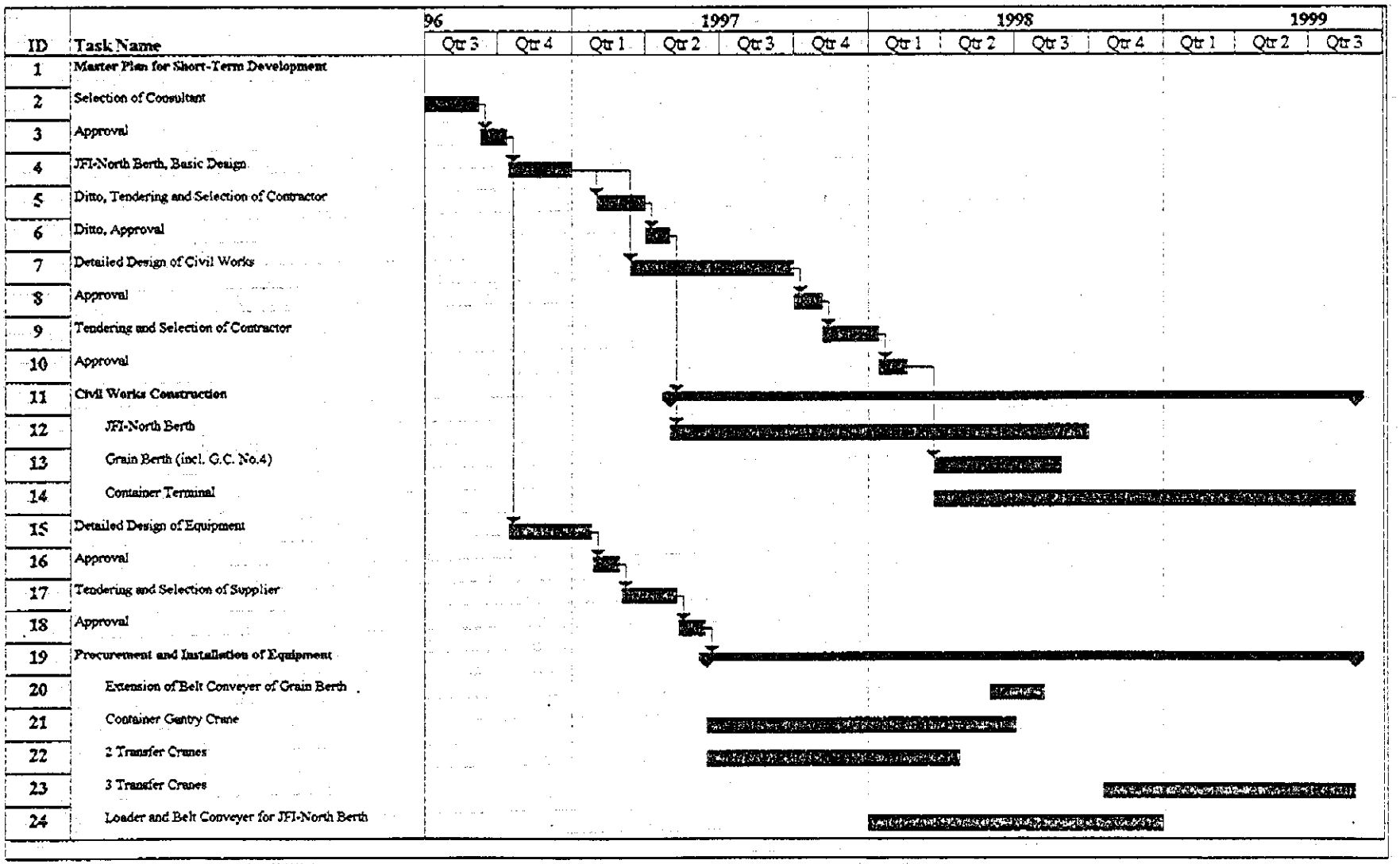


Figure 5.8.1 Implementation Program of the Short-Term Improvement Plan

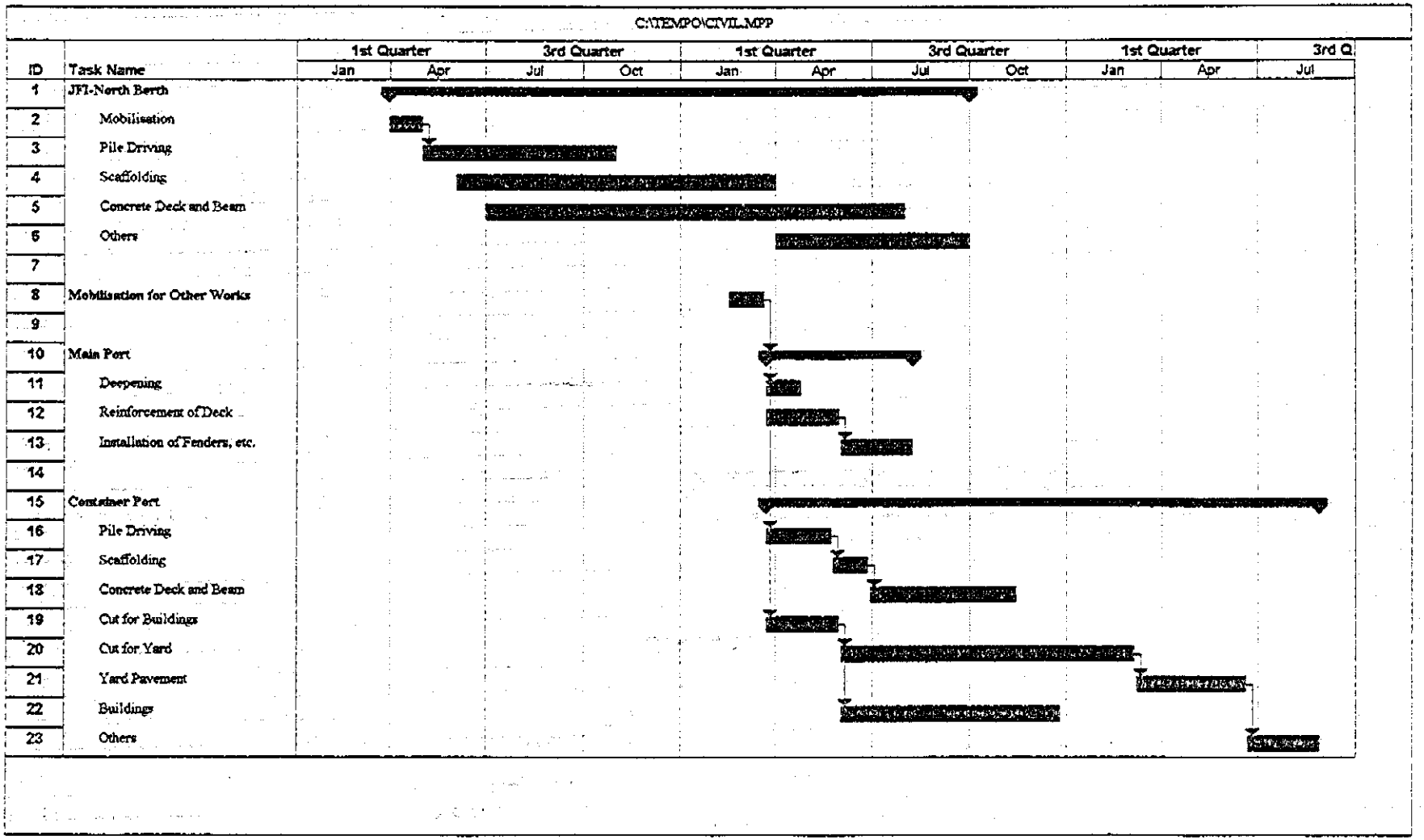


Figure 5.8.2 Construction Schedule of Civil Works

5.9 Cost Estimation

The JICA Study Team estimated the cost for the facilities construction and equipment procurement and installation of the short-term development as follows:

a) Quantities of the main civil works are based on the preliminary designs of typical cross sections. Therefore, they are approximations rather than exact figures.

b) Unit rates of the on-land works generally follow those which were collected during the site surveys. Unit rates of the waterborne works, such as concrete beams and slabs of the jetties, are obtained by multiplying those of the on-land concrete works with certain factors.

c) Unit rates which cannot be obtained using the collected data were obtained from the actual prices from similar projects.

d) Unit prices of the equipment were quoted by a potential supplier. Therefore, they are higher than would-be actual prices through a competitive bidding.

e) An exchange rate in which 1 J.D. is equal to 130 Japanese Yen and 1.45 US $ is adopted.

Table 5.9.1 Cost Estimate of the Short-Term Improvement Plan

1 J.D. = Yen 130 1 J.D.= $1.451

Item No.	Description of Work	Unit	Quantity	Unit Rates	Total(J.D.)	Currency	
						J/C(J.D)	L/C(J.D)
1	**Main Port**						
1.1	Grain Berth (-14m, 280m)						
1.1.1	Civil Works				679,000	632,000	47,000
1.1.2	Procurement and Installation of Equipment				1,230,000	1,101,000	129,000
1.2	General Cargo Berth No. 4						
1.2.1	Deepening (Civil Works)				15,000	14,000	1,000
	Main Port Total				**1,924,000**	**1,747,000**	**177,000**
2	**Container Port**						
2.1	Container Terminal						
2.1.1	Civil Works						
2.1.1.1	Berth Extension				2,816,000	2,465,000	351,000
2.1.1.2	Yard Development				3,672,000	2,516,000	1,156,000
2.1.1.3	Buildings				505,000	253,000	252,000
	Sub-Total of Civil Works				6,993,000	5,234,000	1,760,000
2.1.2	Procurement and Installation of Equipment						
2.1.2.1	Container Quay-Side Crane (Panamax)				5,540,000	5,263,000	277,000
2.1.2.2	Container Transfer Crane (RTG, 4 tire-stacking)				7,200,000	7,200,000	0
	Sub-Total of Equipment				12,740,000	12,463,000	277,000
	Container Port Total				**19,733,000**	**17,697,000**	**2,036,000**
3	**Industrial Port**						
3.1	JFI-1 Berths				5,221,400	4,639,000	582,400
3.1.1	Civil Works				5,221,400	4,989,476	532,164

Table 5.9.1 Cost Estimate of the Short-Term Improvement Plan (Continued)

Item No.	Description of Work	Unit	Quantity	Unit Rates	Total(J.D.)	Currency	
						J/C(J.D)	L/C(J.D)
3.2	JFI-North Berth				10,249,640	9,130,000	819,400
3.2.1	Civil Works				5,521,640	4,639,000	582,400
3.2.2	Procurement and Installation of Equipment				4,728,000	4,491,000	237,000
3.2.2.1	Loader of Fertilizer Products	unit	1	3,480,000	3,480,000	3,375,000	105,000
3.2.2.2	Belt Conveyor Line	m	210	4,800	1,008,000	918,000	60,000
3.2.2.3	Operation & Angle Tower				240,000	168,000	72,000
	Industrial Port Total				**15,471,040**	**14,119,476**	**1,351,564**
	Direct Cost Total				**37,128,040**	**33,563,476**	**3,564,564**
	Consulting Services of Civil Works	%	18,430,040	8	1,474,408	737,204	737,204
	Ditto, Equipment	%	18,698,000	3	560,940	448,752	112,188
	Administration Cost for PC Cost)	%	37,128,040	2	742,560	0	742,560
	Physical Contingency of Civil Works	%	18,430,040	10	1,843,004	1,455,973	387,031
	Ditto, Equipment	%	18,698,000	5	934,900	906,853	28,047
	Ditto, Consulting Services	%	2,035,343	5	101,767	62,078	39,689
	Ditto, Administration Cost	%	742,560	5	37,128	0	37,128
	Physical Contingency Total				2,916,799	2,424,904	491,895
	Cost Total				**42,822,742**	**37,174,336**	**5,648,406**
						(86.8%)	(13.2%)
	Tax (18% of Total)				7,708,093	0	7,708,093
	Project Cost Total				**50,530,835**	**37,174,336**	**13,356,499**
						(73.6%)	(26.4%)

Table 5.9.2 Cost Estimate (Direct Cost Breakdown)

Item No.	Description of Works	Unit	Quantity	Unit Price	Amount (JD)
1	**Main Port**				
1.1	Grain Berth (-14m, 280m)				
1.1.1	Civil Works				
1.1.1.1	Deepening of Berth	cu.m	800	77	62,000
1.1.1.2	Rubber Fenders (c.t.c. 20 m)	each	21	23,000	483,000
1.1.1.3	Bollard (c.t.c. 30 m)	each	16	3,100	50,000
1.1.1.4	Reinforcement of Concrete Deck	l.m.	260	180	47,000
1.1.1.5	Crane Rail	l.m.	520	60	31,000
1.1.1.6	Foundation of Conveyer	each	16	120	2,000
1.1.1.7	Cable Duct. etc.	L.S.	1	3,800	4,000
	Sub-Total of Civil Works				679,000
1.1.2	Procurement and Installation of Equipment				
1.1.2.1	Extension of Conveyer	l.m.	450	2,400	1,080,000
1.1.2.2	Relocation of Unloaders	each	3	50,000	150,000
	Sub-total of Procurement and Equipment				1,230,000
	Total of Grain Berth				1,909,000
1.2	General Cargo Berth No. 4 (-12m, 240m)				
1.2.1	Deepening	cu.m	200	77	15,000
	Main Port Total				1,924,000
2	**Container Port**				
2.1	Container Terminal				
2.1.1	Civil Works				
2.1.1.1	Berth Extension				
1)	Steel Pipe Pile Foundation 762mm dia. 9.5mm-t, 30m long	each	110	8,700	957,000
2)	Ditto, (914mm dia. 12.7mm thick, 30m long)	each	33	11,700	386,000
3)	Steel Sheet Piles (FSP III Type, 26m long)	each	225	1,500	338,000
4)	Tie-rod, Whaling and Anchor	each	57	1,100	63,000
5)	Corrosion Protection of Steel Piles	L.S.	1		12,000
6)	Concrete Pile Cap	each	143	330	47,000
7)	Concrete Beam and Slab	cu.m	3,750	190	713,000
8)	Quay-Side Container Crane Rail (73 kg/m)	l.m.	120	620	74,000
9)	Bollards (c.t.c 30m)	each	4	3,100	12,000
10)	Rubber Fenders (Cylinder-type)	each	20	7,700	154,000
11)	Filling	cu.m	12,000	5	60,000
	Sub-Total of Berth Extension				2,816,000
2.1.1.2	Yard Development				
1)	Cut	cu.m	365,000	6	2,190,000
2)	Yard Pavement	sq.m.	84,500	12.07	1,020,000
3)	Utilities	L.S.	1		154,000
4)	Power Supply and Lighting	L.S.	1		308,000
	Sub-Total of Yard Development				3,672,000

Table 5.9.2 Cost Estimate (Direct Cost Breakdown) (Continued)

Item No.	Description of Works	Unit	Quantity	Unit Price	Amount (JD)
2.1.1.3	Buildings				
1)	Terminal Office Building (3,000 sq.m.)	sq.m.	3,000	120	360,000
2)	Maintenance/Workshop (2,000 sq.m.)	sq.m.	2,000	67	134,000
3)	Fence	l.m.	531	21	11,000
	Sub-Total of Buildings				505,000
2.1.2	Procurement and Installation of Equipment				
2.1.2.1	Container Quay-Side Crane (Panamax)	unit	1	5,540,000	5,540,000
2.1.2.2	Container Transfer Crane (RTG, 4 tire stacking)	unit	5	1,440,000	7,200,000
	Sub-Total				12,740,000
3	**Industrial Port**				
3.1	JFI-1 Berth				5,221,400
3.1.1	Civil Works				5,221,400
3.1.1.1	Quay				
1)	Dredging	cu.m.	8,500	31	264,000
2)	Steel Pipe Pile Foundation (D=800mm, t=12 mm, l=25m)	each	312	9,200	2,870,000
3)	Ditto, (D=800, t=12 mm, 17 m long)	each	21	7,500	158,000
4)	Corrosion Protection of Steel Piles	L.S.	1	25,600	25,600
5)	Pile Capping	each	333	330	110,000
6)	Concrete Beam and Slab	cu.m.	3,360	190	638,000
7)	Concrete Slab on Existing Jetty	cu.m.	189	150	28,000
8)	Concrete Beam on Existing Jetty	cu.m.	97	150	15,000
9)	Installation of Bollards (c.t.c. 20m)	each	10	3,100	31,000
10)	Installation of Bollards (c.t.c. 12m)	each	17	19,000	323,000
11)	Concrete Coping of Existing Steel Sheet Piles	L.S.	1	21,000	21,000
	Sub-Total of Quay				4,483,600
3.1.1.2	Mooring Dolphins				
1)	Steel Pipe Pile Foundation (D=900mm, t=16mm, 30m long)	each	24	13,500	324,000
2)	Top Concrete	cu.m.	700	160	112,000
3)	Bollards	unit	2	4,200	8,400
4)	Fenders	L.S.	1	7,700	7,700
	Sub-Total of Mooring Dolphins				452,100
3.1.1.3	Catwalk to Mooring Dolphins (20 m long)	unit	2	15,400	30,800
3.1.1.4	Access Road and Livestock Yard				
1)	Asphalt Concrete Pavement for Vehicles	sq.m.	4,200	6.65	27,900
2)	Asphalt Concrete Pavement for Livestock Yard	sq.m.	40,000	5.10	204,000
	Sub-Total				231,900
3.1.1.5	Utilities, etc.	L.S.	1	15,000	15,000
3.1.1.6	Power Supply and Lighting	L.S.	1	8,000	8,000

Table 5.9.2 Cost Estimate (Direct Cost Breakdown) (Continued)

Item No.	Description of Works	Unit	Quantity	Unit Price	Amount (JD)
3.2	JFI-North Berth				
3.2.1	Civil Works				5,521,640
3.2.1.1	Quay				
1)	Steel Pipe Pile Foundation	each	348	9,200	3,201,600
2)	Cathodic Protection of Steel Poles	L.S.	1	26,800	26,800
3)	Pile Capping	each	348	330	114,840
4)	Concrete Beam and Slab	cu.m.	5,570	190	501,300
5)	Installation of Bollards	each	12	3,100	37,200
6)	Installation of Rubber Fenders	each	16	19,000	304,000
	Sub-Total of Quay				4,742,740
3.2.1.2	Trestle				
1)	Steel Pipe Pile Foundation	each	60	7,360	441,600
2)	Cathodic Protection of Steel Piles	L.S.	1	9,000	9,000
3)	Pile Beams	cu.m.	390	190	74,100
4)	Concrete Slab	cu.m.	530	150	79,500
5)	Abatement and Revetments	L.S.	1	72,700	72,700
6)	Guard Rail / Road Marker etc.	lin.m.	60	100	6,000
	Sub-Total of Trestle				682,900
3.2.1.3	Utilities etc.	L.S.	1	15,000	15,000
3.2.1.4	Power Supply and Lighting	L.S.	1	80,000	80,000

Table 5.9.3 Annual Disbursement for Construction and Equipment

Unit : J.D.

ITEM Year	Amount	1996	1997	1998	1999	Total
Civil Work						
(1). Grain Berth and G.C. No.4	694,000	0	0	694,000	0	694,000
(2). Container Terminal	6,993,000	0	0	3,885,000	3,108,000	6,993,000
(3). JFI-1 Berth	5,221,400	0	0	2,764,271	2,457,129	5,221,400
(4). JFI-North Berth	5,521,640	0	2,760,820	2,760,820	0	5,521,640
TOTAL	18,430,040	0	2,760,820	10,104,091	5,565,129	18,430,040
Physical Contingency (10%)	1,843,004	0	276,082	1,010,409	556,513	1,843,004
Civil Works TOTAL	20,273,044	0	3,036,902	11,114,500	6,121,642	20,273,044
Equipment						
(1). Extension of Belt Conveyor	1,230,000	0	0	1,230,000	0	1,230,000
(2). Container Quay Crane	5,540,000	0	3,324,000	2,216,000	0	5,540,000
(3). 2-Transfer Cranes	2,880,000	0	1,152,000	1,728,000	0	2,880,000
(4). 3-Transfer Cranes	4,320,000	0	0	1,728,000	2,592,000	4,320,000
(5). Conveyor System (JFI-North)	1,248,000	0	0	1,248,000	0	1,248,000
(6). Loader of Fertilizer	3,480,000	0	2,88,000	1,392,000	0	3,480,000
TOTAL	18,698,000	0	6,564,000	9,542,000	2,592,000	18,698,000
Physical Contingency (5%)	934,900	0	328,200	477,100	129,600	934,900
Equipment TOTAL	19,632,900	0	6,892,200	10,019,100	2,721,600	19,632,900
Consulting Services						
(1). Civil Works	1,414,403	123,850	491,000	491,000	368,553	1,414,403
(2). Equipment	560,940	53,750	214,375	214,375	78,440	560,940
Physical Contingency (5%)	101,767	8,880	35,269	35,269	22,349	101,767
Consulting Services TOTAL	2,137,110	186,480	740,644	740,644	469,342	2,137,110
Administration Cost						
2% of Direct Cost	742,560	62,560	247,000	247,000	186,000	742,560
Contingency (5%)	37,128	3,128	12,000	12,000	10,000	37,128
Administration Cost TOTAL	779,688	65,688	259,000	259,000	196,000	779,688
GRAND TOTAL	42,822,742	252,168	10,928,746	22,133,244	9,508,584	42,822,742
Ratio (%)		0.6 %	25.5 %	51.7 %	22.2 %	
Accumulated Ratio (%)		0.6 %	26.1 %	77.8 %	100 %	

5.10 Management and Operation System for the Short-Term Improvement Plan

Not only proper port planning but also the establishment of an effective port management and operation system is required to carry out port projects. In this chapter, problems in the present system of port management and operation have been examined, and management and operation system for the Short-Term improvement Plan have been drafted.

5.10.1 Introduction of New Sections

As mentioned in the Master Plan, following new sections should be introduced in the stage of the Short-Term Improvement Plan.

(1) Port Planning Section

PC does not have clearly enunciated port development policies and plans. Without these, haphazard construction is likely to take place which may disturb the future development of the port. In order to provide means for orderly development, PC should introduce Port Planning Section which is in charge of preparing port development policy and plan.

PC should appeal to Ministry of Transport to fix above policy and plan as a national policy.

(2) Port Management and Operation Strategy Section

It is required for PC to establish strategies for port management and operation with the target for the organization being to make the role of each section clear. PC should introduce Port Management and Operation Strategy Section which is in charge of preparing the strategies for financial (including tariff), port promotion and personnel affairs in order to ensure financial resources and capable human resources and activate the organization for promoting the Short-Term Improvement Plan.

5.10.2 Financial System

(1) Budgetary System

PC presents the annual budget to the Ministry of Transport for final ratification. At that time, PC has to discuss the budget with the Ministry of Finance.

However, Ministry of Finance does not always recognize PC's budget fully. This has sometimes caused ineffective execution of the budget in the past. In this sense, PC is not fully independent from the Central Government.

This situation should be improved in order to ensure that a sufficient budget is available throughout implementation of the project. PC should make Ministry of Finance and other related organs recognize the necessity of not only the project but also continuous budget and internal finance resources (contribution cutbacks) showing the port development plan and estimated financial statements in order to ensure enough budget for the project. (PC makes a budget for next fiscal year only).