15.8 Multipurpose Terminal Project

15.8.1 Preparing Alternative Terminal Plans

As mentioned in Section 15.4, it is required to build a multipurpose terminal with six (6) 14-meter-deep berths and spacious open yards behind them. According to the future berth assignment for conventional cargo handling presented in Table 15.4.6, two (2) berths are assigned for “timber”, another two (2) berths for “steel products” and the remaining two (2) berths for “miscellaneous conventional cargo”. Consequently, the terminal needs to have spacious land area including berths, open yards and sheds behind them.

Since the land space is severely limited within the Alexandria Harbour, this multipurpose terminal may need to be built on a new land by reclamation where good road connection will be available. The existing channel leading to Alexandria Container Terminal within the Alexandria Harbour is presently maintained at 14.0 meters below CD. Water area between the coal/coke terminal and the grain terminal, of which water depth ranges from 11.0 to 14.0 meters and is expected mostly at 14.0 meters, is usable for ship-maneuvering area for the multipurpose terminal. Additionally, the total dredging volume of seabed in this area is expected relatively small, while the ship-maneuvering area needs to be dredged up to 14.0 meters below CD. Taking account of the above-mentioned viewpoints, the area proposed as the project site is considered to be suitable for the new terminal at the south west of the Center Zone, which includes “hook-shape quay” as indicated in the zoning concept around the existing berths (nos.55 through 61).

While a general cargo vessel is usually equipped with ship-cranes or derick-cranes, her cranes do not necessarily have sufficient lifting capacity for heavy cargoes even if she is laden with heavy cargoes. Hence, in the new multi-purpose terminal, rail-mounted quay-side gantry cranes with the lifting capacity of 40 tons under a hook are planned to be installed. Those cranes are so-called multi-purpose cranes which can lift not only conventional heavy cargoes such as steel products and plant components for factory fabrication but also loaded containers by replacing an ordinary crane hook by a spreader specialized for container-handling. Taking account of incidental breakdown of a crane, two units of multi-purpose QGCs (Quay-side Gantry Cranes) are proposed.

Three different rectangular-shape alternative terminal plans are prepared as below, serving six (6) 14-meter-deep berths of which total length is 1,440 meters, spacious open yards whose total area of approximately170,000 sq.m, and two (2) units of sheds whose total covered area of 12,000 sq.m are to be guaranteed.

15.8.2 Alternative-1

Alternative-1 is a plan to build a rectangular-shape (740m x 400m) terminal area with three (3) 14-meter-deep berths on the longest berth line at the southern end, one (1) 14-meter-deep berth (also available as Ro-Ro berth) at the western end, and two (2) 14-meter-deep berths at the northern end. Figure 15.8.1 shows a layout plan of Alternative-1 in the Alexandria Harbour.

15.8.3 Alternative-2

Alternative-2 is a plan to build a rectangular-shape (980m x 320m) terminal area with four (4) 14-meter-deep berths on the longest berth line at the southern end, one (1) 14-meter-deep berth (also available as Ro-Ro berth) at the western end, and one (1) 14-meter-deep berth at the northern side. Figure 15.8.2 shows a layout plan of Alternative-2 in the Alexandria Harbour.

15.8.4 Alternative-3

Alternative-3 is a plan to build a rectangular-shape (1,270m x 250m) terminal area with five (5) 14-meter-deep berths (one berth at the western end is also available as Ro-Ro berth) on the longest berth line at the southern end and one (1) 14-meter-deep berth at the western end. Figure 15.8.3 shows a layout plan of Alternative-3 in the Alexandria Harbour.

15.8.5 Evaluation of the Alternatives

All three alternative plans whose dimensions of berths, open yards, sheds, multipurpose QGCs and related facilities are the same, are expected to equally function and to ensure the same amount of benefit from the viewpoint of national economy of Egypt. Therefore, when evaluating and choosing the optimum alternative plan among the three, it is only required to compare the project costs of each alternative plan.

Table 15.8.1 Preliminary Cost Estimation Result Comparison among Three Alternatives

(Unit: thousand LE)

Alternative Name	Alternative-1	Alternative-2	Alternative-3
Construction Costs	494,159	586,120	638,405
Maintenance Costs	200,778	222,626	237,266
Total Costs	694,937	808,746	875,671

Preliminary cost estimation results of the three alternative plans are presented in Table 15.8.1 (Detail information is referred in Chapter 16). Aleternative-1 is revealed as most economical and consequently proposed as the multipurpose terminal project.

15.8.6 Proposed Plan (Alternative-1)

(1) Dimensions of the Proposed Plan (Alternative-1)

Major components of the proposed plan are i) six (6) multipurpose berths of which water depth is 14.0 m and total length is 1,440 m, ii) spacious open yards whose total area is 170,000 sq.m, iii) two units of sheds whose total covered area is 12,000 sq.m, iv) two (2) units of multipurpose QGCs, v) dedicated road merging to the existing fly-over, vi) dredging of ship-maneuvering area of which total volume is approximately 70,000 cu.m, and vii) 36 units of forklifts (24 units for lifting capacity of 5 tons and 12 units for 3 tons).

Table 15.8.2 Major Components of the Proposed Multipurpose Terminal Project

Project Component	unit	Infrastructure	Superstructure	Equipment
1. Multipurpose Berths (-14.0m*240m)	(berth)	6	---	---
2. Open Yards	(sq.m)	170,000	---	---
3. Sheds	(sq.m)	12,000	---	---
4. Multipurpose QGC	(unit)	---	2	---
5. Dedicated fly-over road	(m)	360	---	---
6. Dredging of Ship Maneuvering Area	(cu.m)	70,000	---	---
7. Forklifts	(unit)	---	---	36

(2) Open Yards and Sheds

The spacious open yards of which total area is 170,000 sq.m are located behind the berth. Also, two units of the sheds of which total covered area is 12,000 sq.m are located behind the northern end of the reclaimed area.

(3) Dedicated Fly-over Road merging to the Existing Fly-over

The existing fly-over connecting the Alexandria Container Terminal and the port gate (no.27) is presently available only for the traffic to/from the existing container terminal. A new dedicated port road behind the port is mostly available and being partly still developed between the port gate (no.27) and the roundabout located adjacent to the Alexandria airport. This road leads to Cairo through either “the Agricultural Road” or “the Desert Road”, and is expected to smoothly evacuate port traffic to/from the Alexandria Harbour. The final stage of this road development is presently under construction right behind the gate (no.27). The new multipurpose terminal needs good road connection through the existing fly-over between the new terminal and the port gate (no.27). The existing road along the eastern fence of the coal/coke terminal is presently being expanded to four-lane-road. However, one (1) outbound lane by fly-over structure is required to exclusively merge with the existing fly-over so as to smoothly evacuate port traffic to/from the new terminal.

(4) Dredging the Ship-Maneuvering Area up to 14.0 meter below CD.

Two (2) ship-maneuvering basins are planned at the water area between the coal/coke terminal and the grain terminal in Alexandria Harbour. These basins are to be designed for the fully-loaded 65,000 DWT-class dry bulk carriers transporting “coal” and “grain”. Since LOA of this dry bulk carrier is 230 meters, diameter of ship-maneuvering circle is to be determined as 460 meters (twice as long as 230 meter). One of the ship-maneuvering basins, which is expected to be commonly used by both general cargo vessels and dry bulk carriers, is located off the eastern end of the new terminal area (see Figure 15.8.4).

(5) Forklifts

Thirty six (36) units of forklifts (24 units for lifting capacity of 5 tons / 12 units for lifting capacity of 3 tons) are required to be introduced to ensure an efficient conventional cargo

Figure 15.8.1 Layout Plan of Multi-purpose Terminal Master Plan

Figure 15.8.2 Layout Plan of Alternative-2 for Multi-purpose Terminal Master Plan

Figure 15.8.3 Layout Plan of Alternative-3 for Multi-purpose Terminal Master Plan

handling operations. Stevedoring companies are responsible to introduce these forklifts at each terminal.

15.8.7 Conventional Cargo Handling System

(1) Quay-side Loading/Unloading Operations

Concerning the berth assignment for the new multi-purpose terminal, two berths are assigned to sawn timber, another two berths to steel products, and the remaining two berths to miscellaneous cargoes to be stored either in the shed or at the open yard. In case of conventional cargo handling, quay-side loading/unloading operations are generally performed with ship's cranes/derricks or mobile shore cranes. However, two units of multi-purpose QGCs of which under-spreader capacity is 40 tons are planned to be installed to secure an efficient operation for handling extremely heavy cargoes and/or heavy bulky bare cargoes such as plant components, heavy vehicles, etc. Additionally some kinds of attachments are required to enable to lift various kinds and shapes of above-mentioned heavy bulky cargoes. An example profile of the multi-purpose QGC is presented in Figure 15.8.4.

(2) Open Yard Operation between the Quay and the Open Yard.

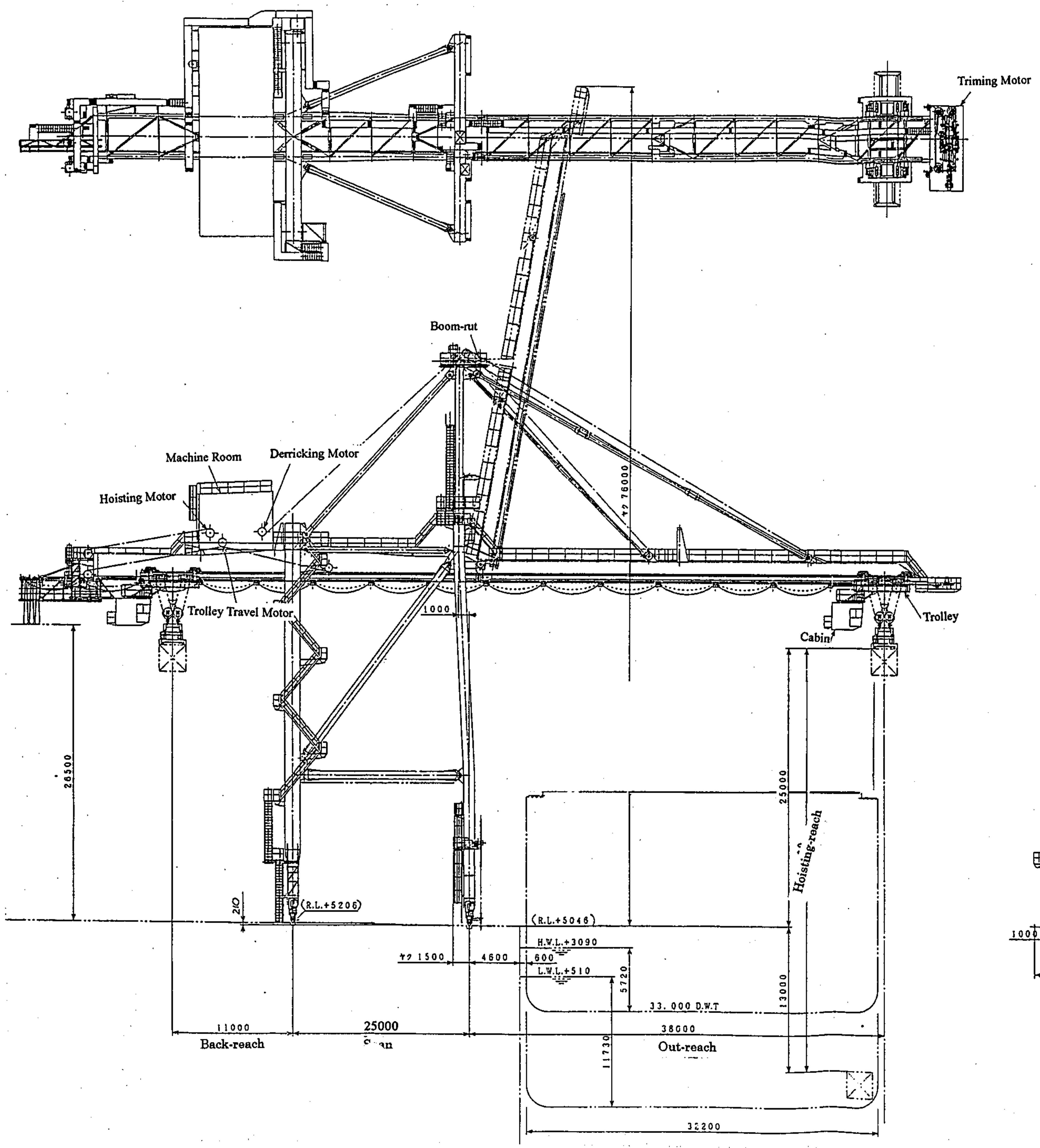
In handling heavy bulky conventional cargo such as sawn timber, steel products, etc., large apron and sorting/storing yards are needed for smooth operation. It is also necessary to use pallets for landing cargoes on the quay so that forklifts could pick up, carry and sort the landed cargoes and store them in the sheds and/or at the spacious open yard behind the quay. In particular, bagged cargo such as fertilizer and sugar, must be handled with pallets to increase the throughput. Therefore, it is recommended that the sufficient number (36 units) of the forklifts should be introduced for this terminal as mentioned in Section 15.4.

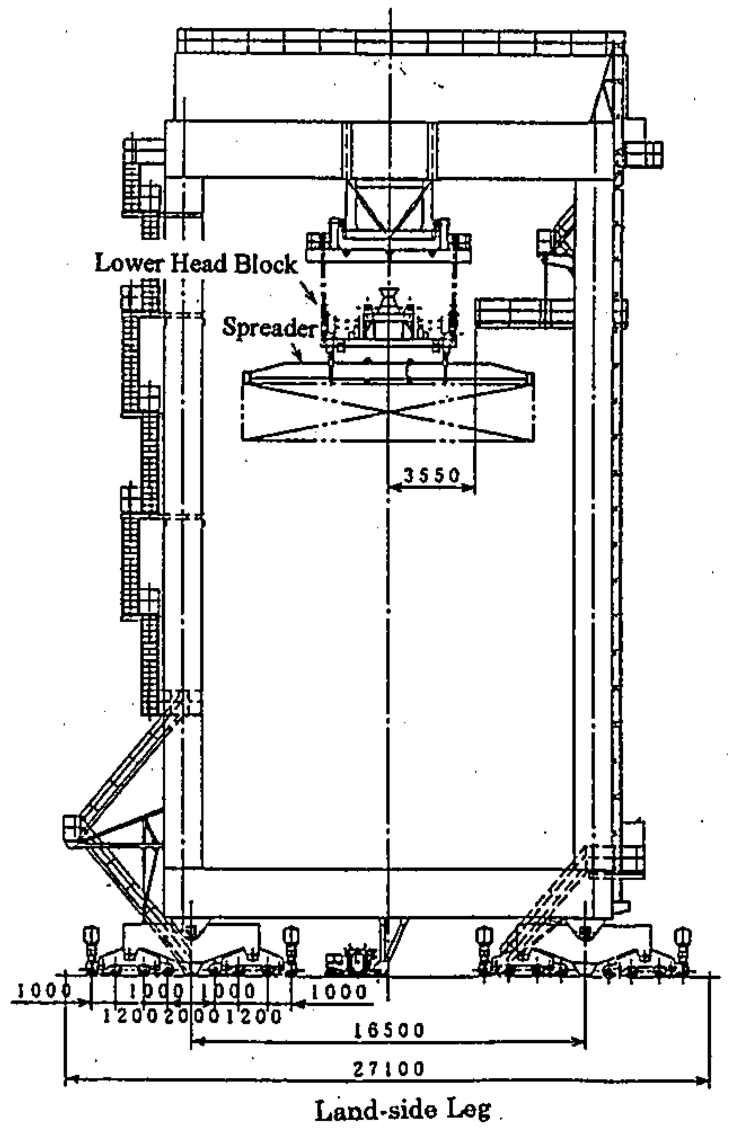
Proper use of the cargo handling equipment such as special attachment is also recommended for handling various cargoes (to be mentioned in Section 18.4).

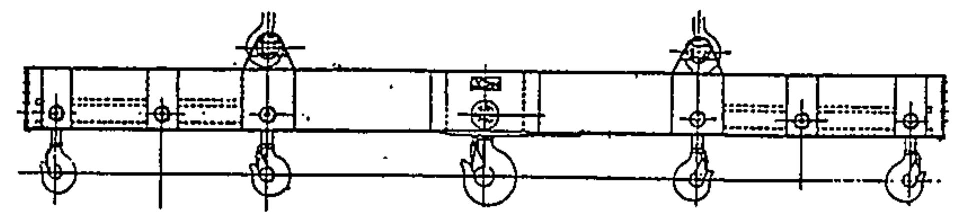
(3) Cargo Flows in and around the Terminal

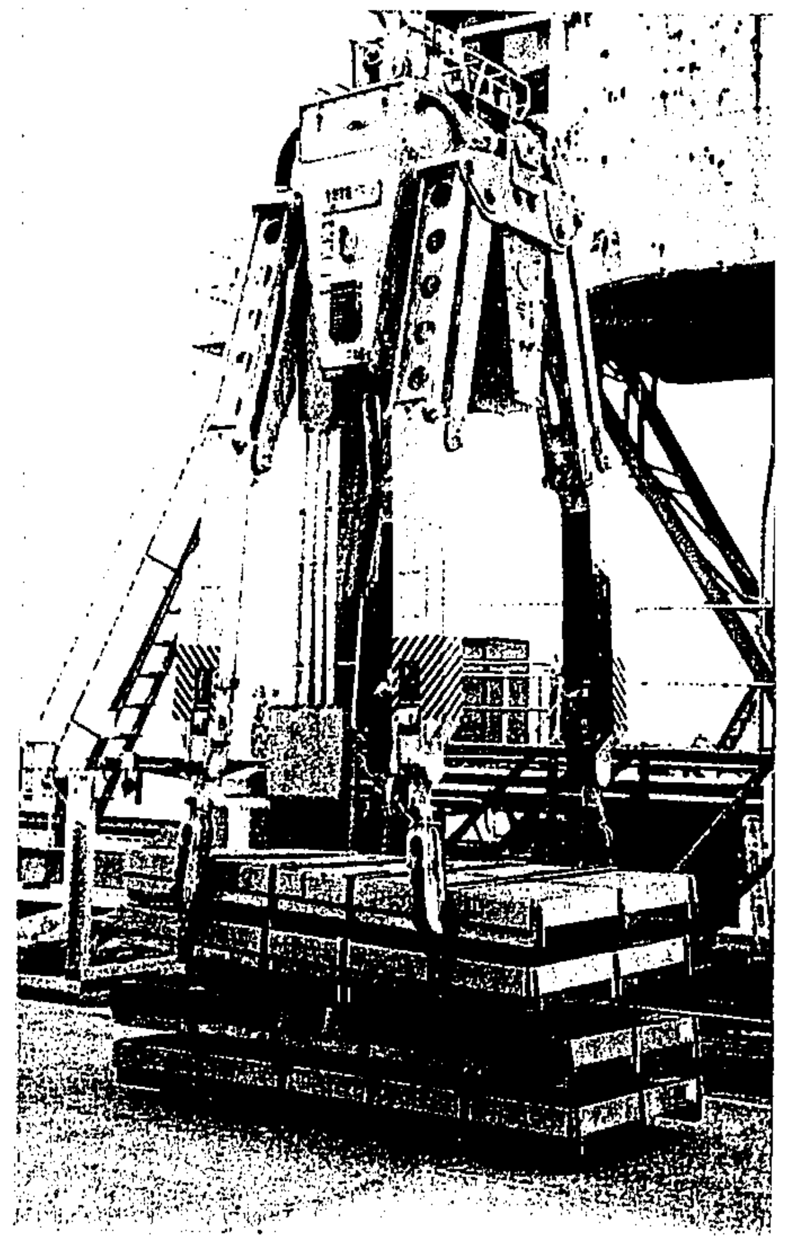
In general, the throughput of cargoes depends on the arrival of trucks and the turn-around on the apron. Smooth truck flow in and around the terminal is essential to secure high productivity of the whole terminal. The open yard is divided into some blocks by removable-type flexible fences, which can be easily re-arranged to meet demand fluctuation among the terminal operators. It is recommended that incoming trucks should be controlled at the terminal gate, and move in one way along the passage within the open yard. This truck flow is presented in Figure 15.8.5. Perspective of the multipurpose terminal is also presented in Figure 15.8.6.

Additionally, the dedicated terminal access road with a fly-over bridge is required to be connected to the existing fly-over bridge in order to secure a smooth evacuation of the cargo traffic from the terminal.






Heavy Cargo Lifting Beam with Hooks


Lifting Attachment for Steel Plates

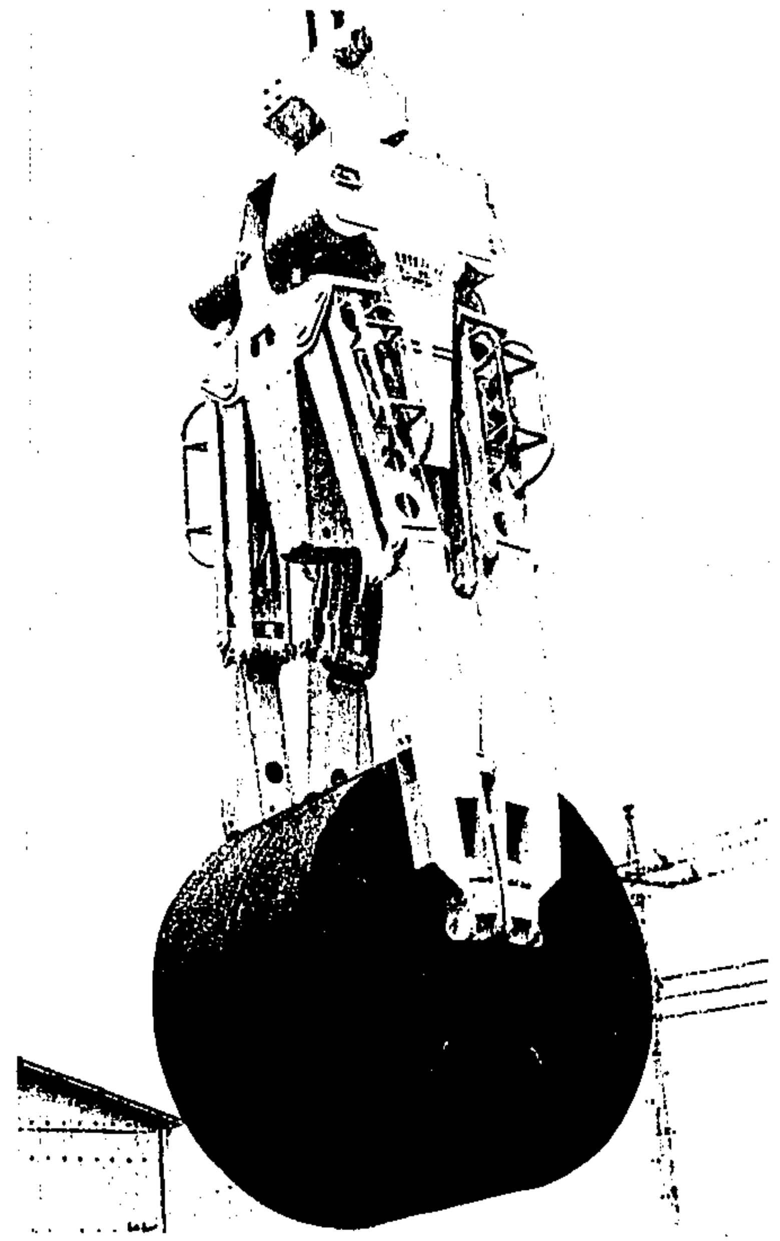

Lifting Attachment for Steel Coil

Figure 15.8.4 An Example Profile of the Multi-purpose Quay-side Gantry Crane

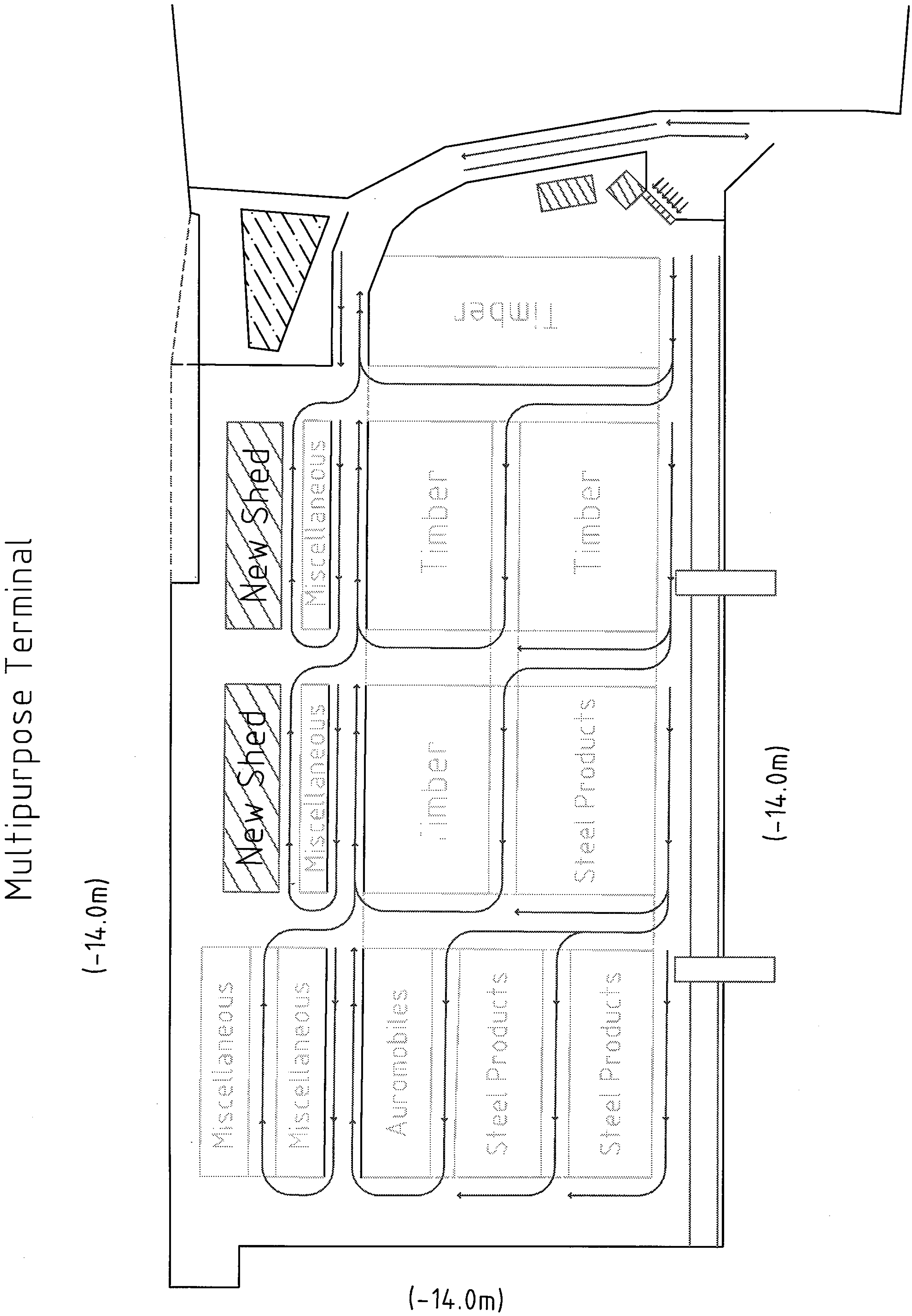


Figure 15.8.5 Cargo Flow in and around the Multi-purpose Terminal

Figure 15.8.6 Perspective of the Multi-purpose Terminal Master Plan

15.9 El Mahmudiya Quay Re-development Project

15.9.1 Necessity of the Re-development

There are presently hundreds of damaged containers behind the warehouses (nos.44, 45, 46 and 47) within the El Mahmudiya Quay area. Consequently precious land space is not utilized in this area to a full extent. On the other hand, the berths (nos.39 and 40 with water depth of 10.0 meters) next to the Ro-Ro berth (no.41) would be suitable for handling “long, heavy and/or bulky conventional cargoes”, if the warehouses (no.44 and 45) were to be demolished (as mentioned in Section 15.4). This terminal is expected to be operated by the new terminal operators (which is proposed in Section 18.4).

15.9.2 Conventional Cargo Handling at the El Mahmudiya Quay

Miscellaneous cargoes to be stored at the open yard are assigned to the berths (bnos. 39 and 40). Those cargoes are expected to be handled by forklifts at the apron as well as the open yard where the warehouses (nos. 44 and 45) are to be removed. 12 units of the forklifts are essential to secure an efficient cargo handling at the El Mahmudiya Quay.

15.9.3 Layout of the El Mahmudiya Quay Re-development

The El Mahmudiya Quay Re-development is also expected to provide a space and opportunities for the new terminal operators which is proposed in Section 18.4. The layout plan is presented in Figure 15.9.1.

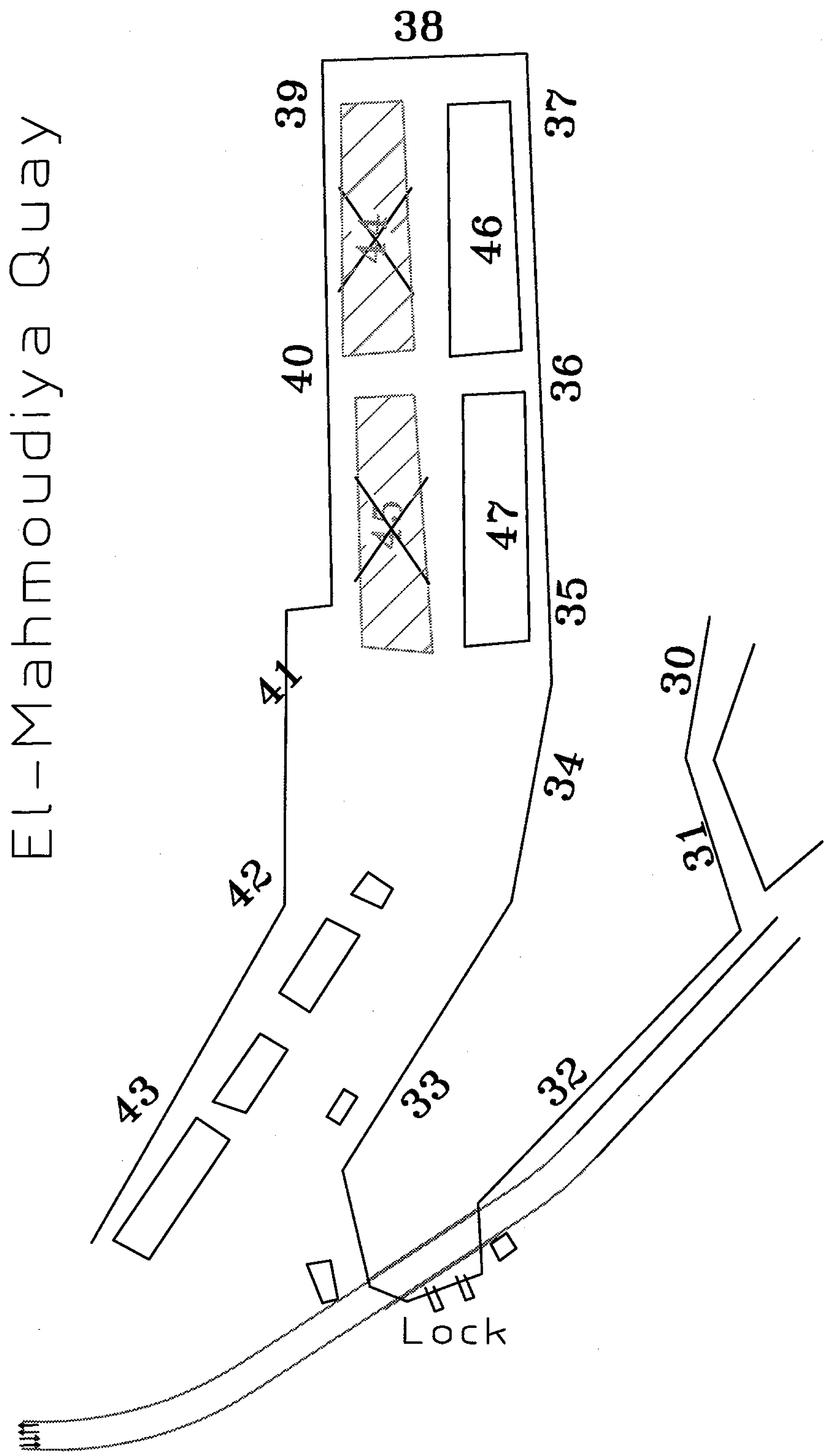


Figure 15.9.1 Layout of the El Mahmudiya Quay Re-development Project

15.10 New Port Road Bridge Project

15.10.1 Necessity of a New Port Road Bridge

Since the port road bridge on the lock between the berth no.32 and no.33 is aged and poorly-maintained as mentioned, heavy weight trucks are presently prohibited to ran across the bridge resulting in detour traffic through downtown and consequent heavy traffic congestion in the Alexandria city area. In order to fully utilize the port-dedicated road now under construction behind the port gate no.27, reinforcement of this bridge or a new bridge construction are essential.

15.10.2 Required Number of Lanes for the New Port Road Bridge

The lock between berth no.32 and no.33 belongs to the Water Transport Authority. It seems to be difficult to change or replace the bridge itself due to the port-related reasons. It is advisable to construct a new bridge right off the existing bridge, which will give no effective load on the lock. If the River Transport Authority which administrates the El-Mahmudiya canal agrees to reclaim the canal and provides the connection road land, it is a preferable alternative to the bridge construction option due to the lower construction cost.

Most of the cargo traffic originated from and destined to the East zone (berth no.5 through 17) and the Middle East zone (berth no.18 through 32) is expected to use the aged port road bridge in case that the new port road bridge is developed. Annual target volume of cargoes and the hourly maximum one-directional traffic are estimated and presented in Table 15.10.1. The hourly maximum one-directional traffic is estimated at 399 (vehicles/hour/direction), which implies that one (1) lane is required compared with the standard maximum hourly traffic volume per lane of 600 (vehicles/hour/lane). However, two (2) lanes for each direction should be planned taking into account of the case of emergency.

Table 15.10.1 Maximum Hourly Traffic through the New Port Road Bridge in 2017

Cargo Type	Annual volume	Expected using share of new bridge	Peaking factor to daily average	Peaking factor to hourly average	Unit load per vehicle	Maximum hourly traffic volume per lane
Unit	TEU/tons	%			TEU, tons /vehicle	Vehicles /hour/lane
Ro-Ro (TEUs)	50,000	100.0	1.37	2.5	1.5	13.0
Bagged	1,975,000	58.3	1.63	2.5	12	44.6
Bundled (Timber)	4,783,000	0.0	1.32	2.5	12	0
Bundled (Steel Prd)	1,955,000	0.0	1.43	2.5	12	0
Rolled (Paper)	659,000	50.0	1.75	2.5	8	20.6
Miscellaneous (Shed)	1,815,000	80.0	1.20	2.5	8	62.2
Miscellaneous (Yard)	1,815,000	33.3	1.29	2.5	8	27.8
Sub Total						168.2
Port-related traffic	Present port-related traffic percentage was measured as 57.8% to the total.*					230.4
Grand Total						398.6

Remarks) This percentage is calculated based on the traffic flow survey conducted by the Study Team. (see Table 3.4.5)

15.10.3 Layout of the New Port Road Bridge

Layout of the new bridge is planned right off the existing bridge, giving no effective load on the lock and avoiding demolishing the existing fire-fighting facilities. The layout plan is presented in Figure 15.10.1.

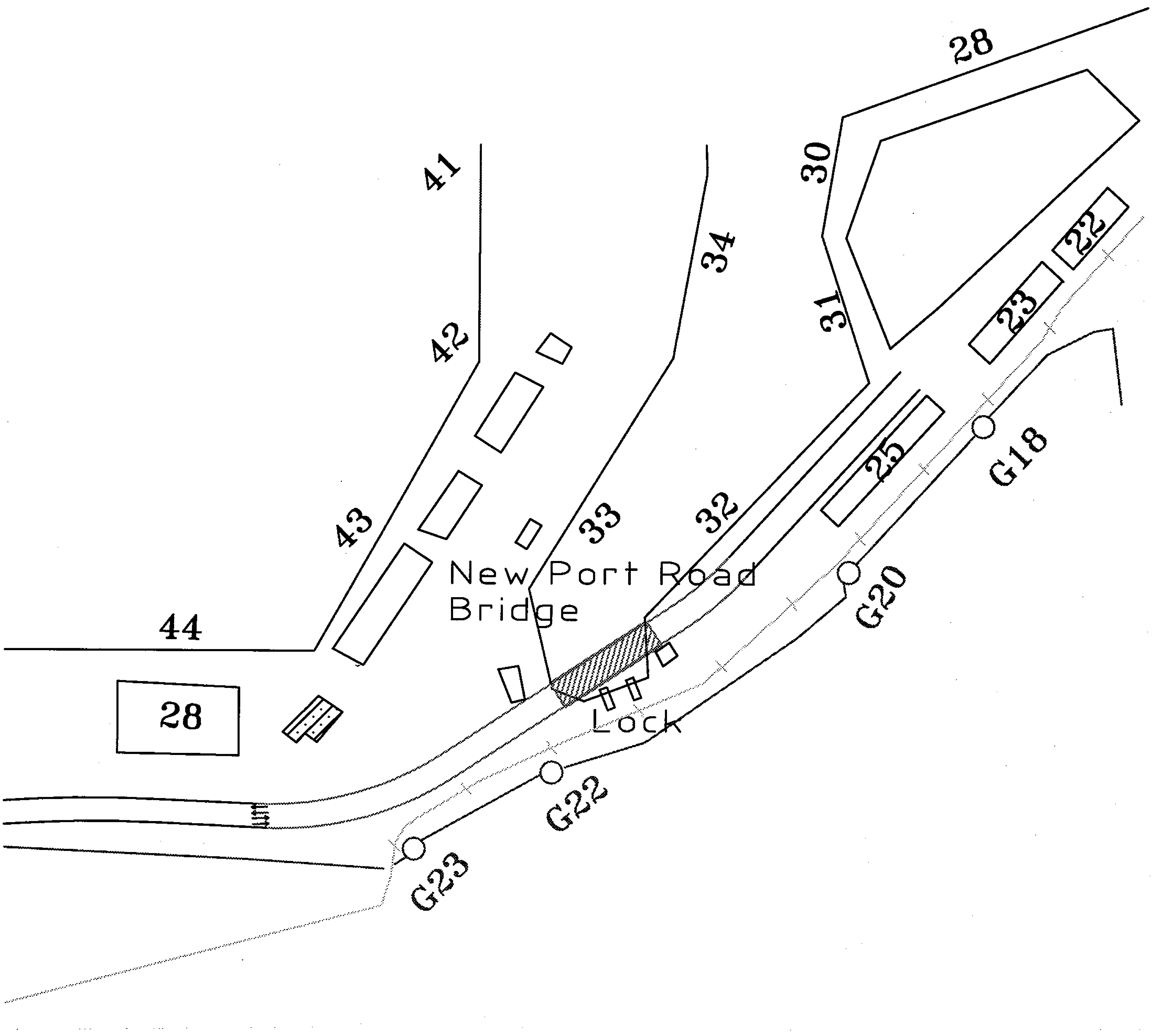


Figure 15.10.1 Layout of the New Port Road Bridge

15.11 Deep Water Coal Berth Project

15.11.1 Necessity of the Deep Water Coal Berth

Partially-loaded 65,000 DWT-class bulk carriers presently transporting "coal" could be fully loaded and save their transport costs, if the coal berths (no.63/64) were to be deepened to 14.0 meters below CD. Therefore, it is recommended that the existing coal berths (no.63/64) be deepened and utilize the existing infrastructure and handling and storing facilities with less investment (see Section 15.5).

15.11.2 Restrictions for the New Structure to Utilize the Existing Facilities

The new deep water coal berth is expected to accommodate fully-loaded 65,000 DWT-class dry bulk carriers (LOA is 230 (m) and moulded breadth is 32.2 (m)). Therefore, the required berth length and depth are 270 meters and 14.0 meters respectively. Additionally, it is recommended to utilize the existing infrastructure and handling and storing facilities so as to minimize the investment costs. The maximum additional extendable width of the berth without replacing the existing rail-mounted unloaders is examined and estimated at 10.0 meters, keeping the grabs reach approximately two thirds of the ship width (see Figure 15.11.1). Some structure types will be examined and the optimum one will be proposed in the later chapter.

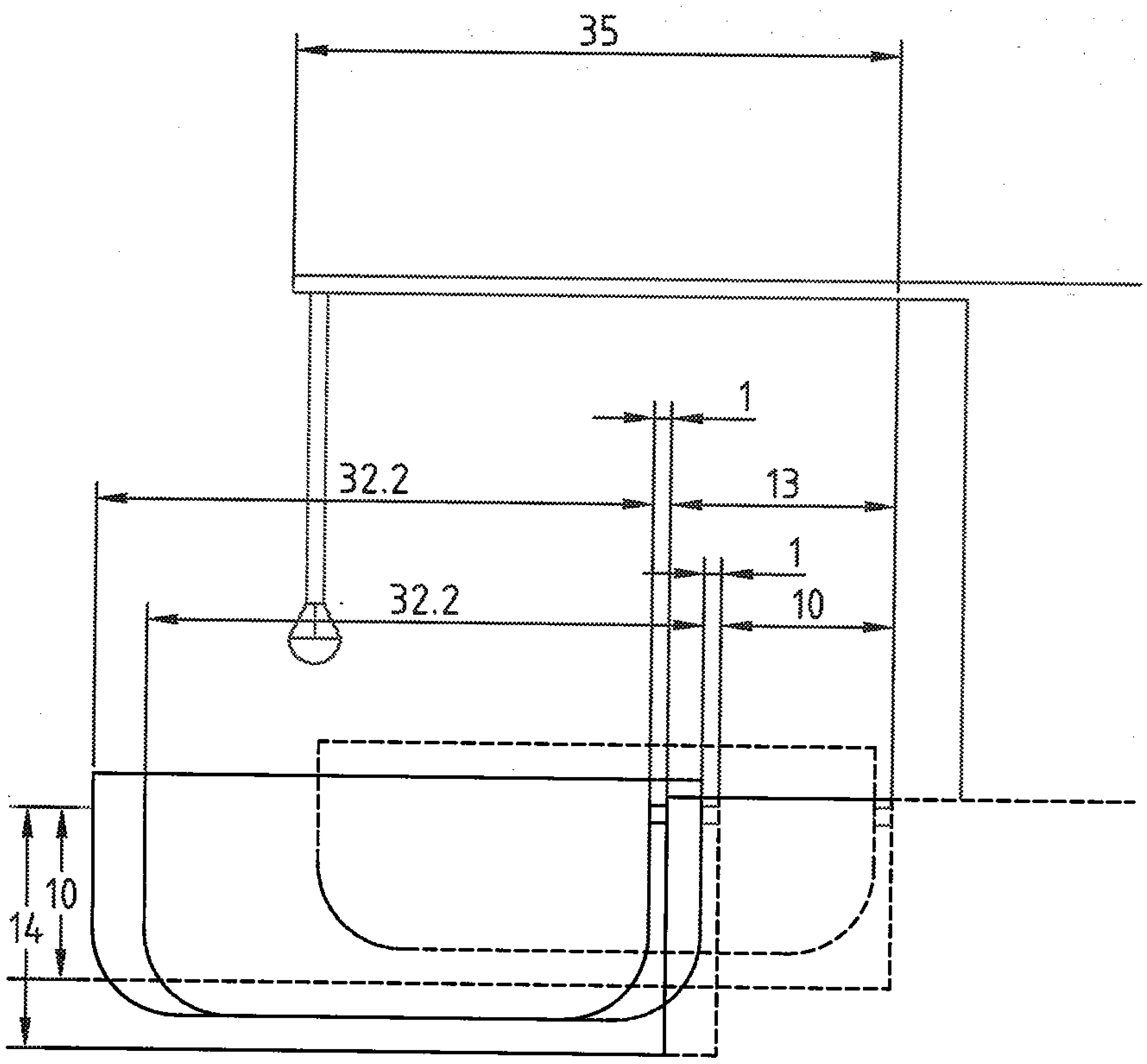


Figure 15.11.1 Relationship between Extension Width and Unloader's Outreach

15.11.3 Layout of the Deep Water Coal Berth

Layout of the deep water coal berth (-14.0 m*270 m) is planned to extend toward at most 10.0 meters off the existing berth. All the other existing facilities will remain and be utilized to a full extent. Layout plan is presented in Figure 15.11.2.

Two (2) ship-maneuvering basins are planned at water area between the coal/coke terminal and the grain terminal. These ship-maneuvering basins are to be designed for the fully-loaded 65,000 DWT-class dry bulk carriers transporting "coal" and "grain". Since LOA of the 65,000 DWT-class dry bulk carriers is 230 meters, diameter of ship-maneuvering circle is to be determined as 460 meters (twice as long as LOA of 230 meter). One of the ship-maneuvering basins, which is expected to be commonly used by both general cargo vessels and dry bulk carriers, is located off the eastern end of the new terminal area (see Figure 15.8.1).

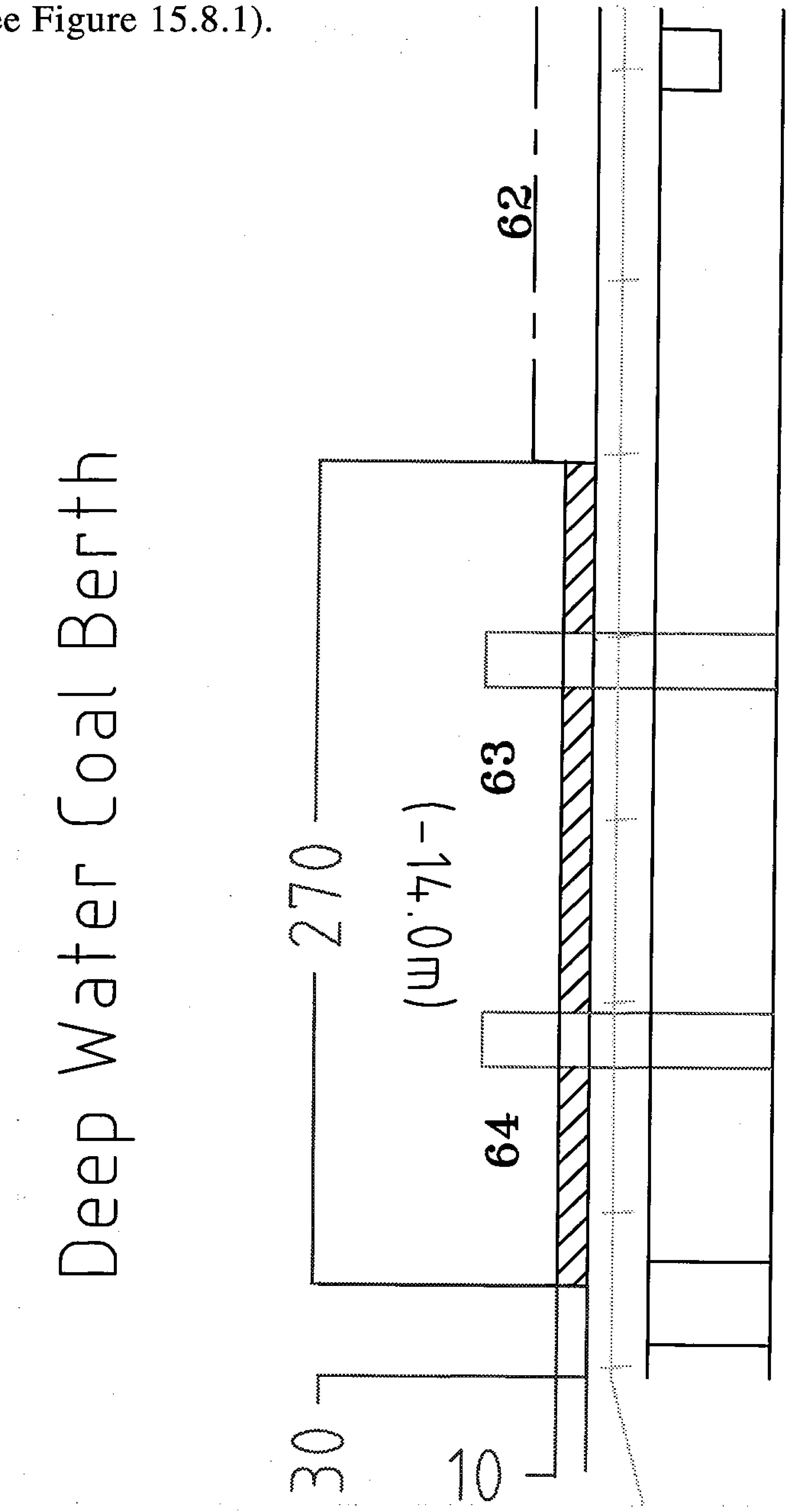


Figure 15.11.2 Layout of the Deep Water Coal Berth

15.12 Grain Terminal Modernization Project

15.12.1 Necessity of the Grain Terminal Modernization

Fully-loaded 65,000 DWT-class bulk carriers transporting "grain (wheat)" are presently using the existing 14.0-merter-deep berth (no.94-2) with two units of the highly efficient mechanical type unloaders. Since the water depth of the existing berths (no.82, 84 and 85) in the Alexandria Harbour is only 10.0 meters, these berths are extremely less utilized. Therefore, it is recommended that a new berth be constructed and utilize the existing silos with less investment (see Section 15.5).

15.12.2 Required Dimensions of the Facilities

The new grain terminal is expected to accommodate fully-loaded 65,000 DWT-class dry bulk carriers (LOA is 230 (m) and moulded breadth is 32.2 (m)). Therefore, the required berth length and depth are 270 meters and 14.0 meters respectively. A jetty-type structure of about 20 meters in width may be sufficient for a fully-automated grain terminal. However, the terminal will be used more flexibly with spacious back-up yards in case f maintenance and/or emergency. Therefore, the enclosed area by the existing breakwater and the new grain berth is recommended to be reclaimed and used as back-up yards.

Two (2) units of the efficient mechanical unloaders of which nominal productivity is 1,000 (tons/hour/unloader) are required to simultaneously be assigned to one ship so as to ensure an efficient grain cargo handling. Mechanical unloaders of which nominal productivity is 1,000 (tons/hour/unloader) are also required to ensure the same productivity of the unloaders installed at berth (no.94-2). An example profile of mechanical unloader is presented in Figure 15.12.1. Conveyor of 750 meters in length connecting the new grain berth and the existing silos is required so as to utilize the existing silos to a full extent.

Two (2) ship-maneuvering basins are planned at water area between the coal/coke terminal and the grain terminal. These ship-maneuvering basins are to be designed for the fully-loaded 65,000 DWT-class dry bulk carriers transporting "coal" and "grain". Since LOA of the 65,000 DWT-class dry bulk carriers is 230 meters, diameter of ship-maneuvering circle is to be determined as 460 meters (twice as long as LOA of 230 meter). One of the ship-maneuvering basins is expected to be commonly used by both general cargo vessels and dry bulk carriers (see Figure 15.8.4).

15.12.3 Layout of the Modernized Grain Terminal

Layout of the modernized grain terminal (-14.0 m*270 m) is planned at the east of the berth (no.85) along the existing breakwater surrounding the Mina Qamaria basin. Layout plan is presented in Figure 15.12.2.

An example profile of the mechanical grain unloader is also presented in Figure 15.12.3.

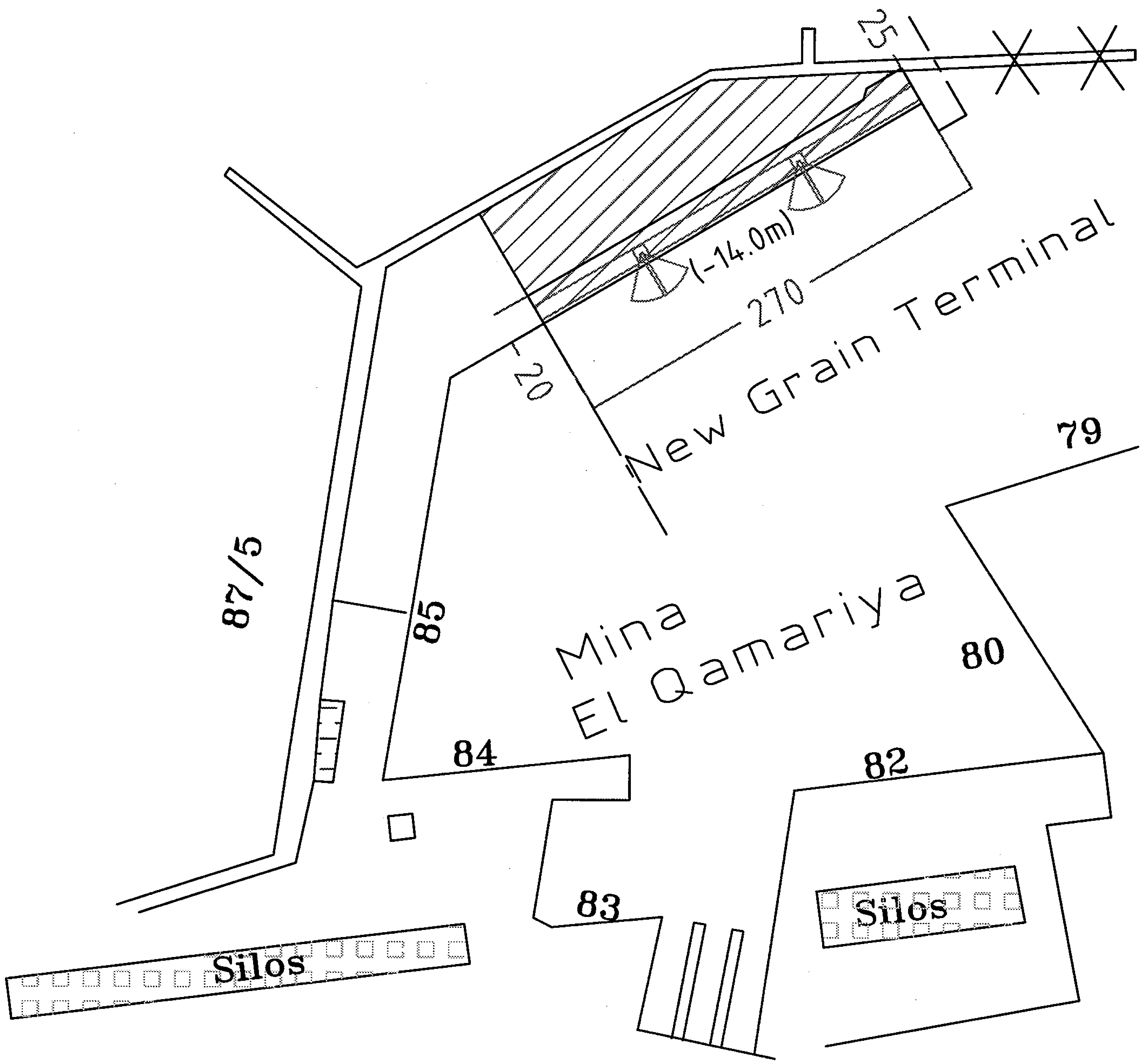


Figure 15.12.2 Layout of Modernized Grain Terminal

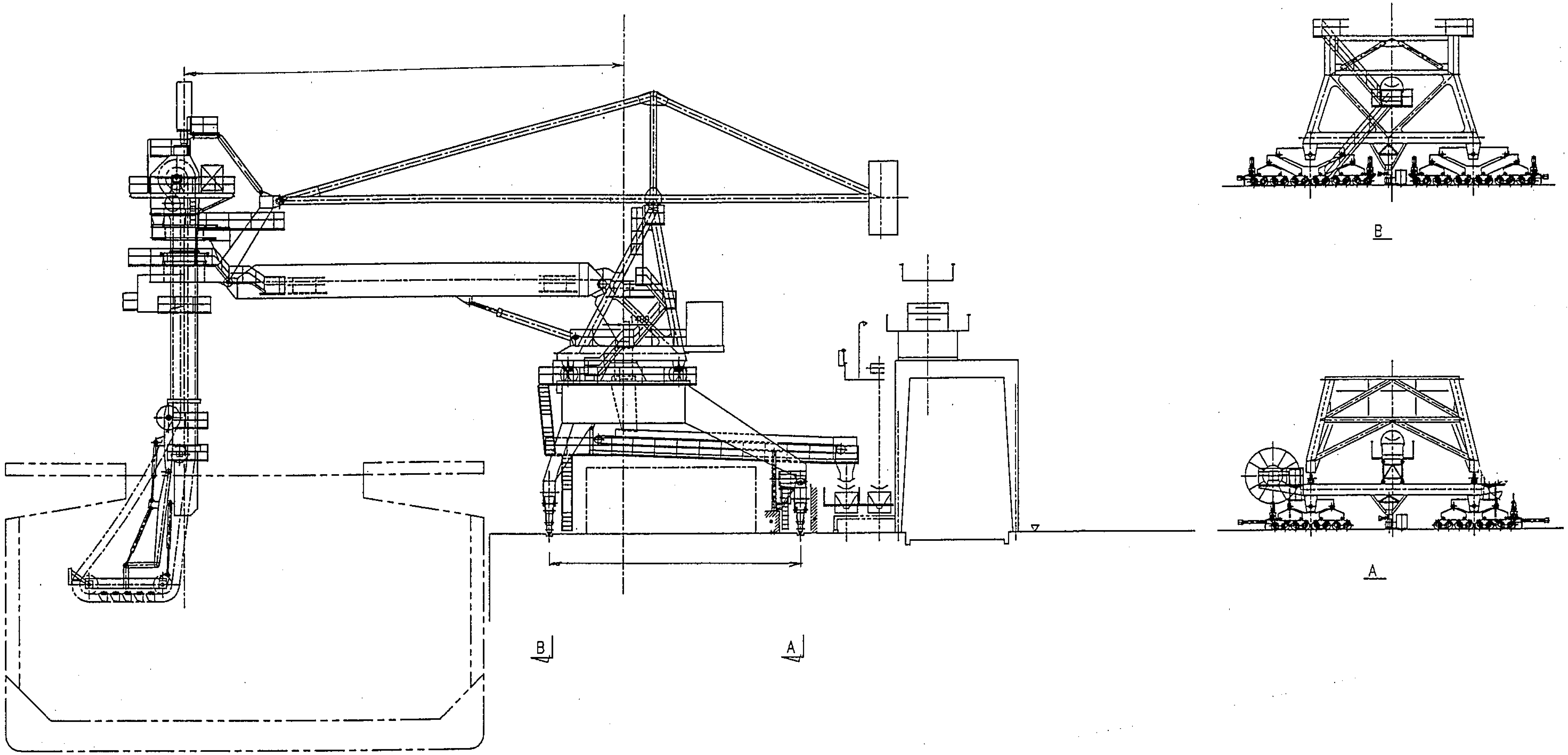


Figure 15.12.3 An Example Profile of the Mechanical Grain Unloader

Chapter 16 Preliminary Cost Estimation

16.1 Preliminary Structural Design

16.1.1 General

This Chapter covers the basis of preliminary design for major port facilities. In this study, we have investigated the optimum solution by berth among structural type of construction and materials. As discussed in the previous Chapter 15, each recommended project in the scheme of master plan of the greater Alexandria Port includes the following new port facilities to be constructed.

Project	New Facilities
Multipurpose Terminal	Berth Line Quay Structure
	Dredging
	Reclamation of Back-of-Terminal Area
	Back of Terminal Yard Facilities
New Port Road Bridge	Bridge Superstructure
	Its Abutment & Foundation
Deep Water Coal Berth	Quay in front of the existing quay
	Dredging
Grain Terminal Modernization	Berth Line Quay Structure
	Dredging
	Reclamation of Back-of-Terminal Area
	Onshore Facilities

16.1.2 Design Criteria for Alexandria Port

The port facilities to be constructed by the Project comprise of various structures. It is necessary to clearly set forth the design conditions in determining suitable type of structures, their structural dimensions and construction materials. Among others, the subsoil conditions at the designated project area for facilities are one of the major factors for executing preliminary design of port facilities.

As discussed in Chapter 2, the existing subsoil data within the center zone of Alexandria port were obtained through the 1st field survey works in Egypt. The subsoil condition within this area is composed of very soft clayey layers up to the depth of the bearing stratum, which would exist at an elevation between -23 to 28 meters. Although the consistency of these very soft deposits is uncertain, it would be assumed that the subsurface deposit is organic clay having a very low N-value, probably 0-2. Therefore, an assumption facilities that those soft deposits at the center zone of Alexandria Port would uniformly exist at each respective project area is made to the subsoil conditions to be used for designing port.

Based on the natural conditions, cargo handling operation on berth apron and/or at the back of terminal area and other factors related to designing structures, the following design criteria are exclusively used for designing the port facilities proposed in the master plan.

Design Criteria

1. Objective Vessel	
(1) Coal Berth	Panamax-type Coal Carries of 65,000 DWT (Vessel Size: L=230m, B=32.2, D=12.7m)
(2) Multipurpose Wharf	
Max. Size	3,000TEU full Container Carrier 45,000DWT (L=250m, B=32.2m, D=12.0m)
Ordinary Size	15,000DWT (L=153m, B=22.3m, D=9.3m)
(3) Grain Berth	
Maximum	Panamax-type Grain Carrier of 65,000DWT (L=230m, B=32.2m, D=12.7m)
2. Water Depth of Berth	
Planned Water Depth	DL. -14.0 m
Design Water Depth	depend on the type of Quay Wall Structure
3. Tides	
(1) H.W.L.	D.L.+0.8 meter approximately
(2) L.W.L.	D.L.+0.2 meter approximately
(3) Residual Water Level behind Quay Wall	
Gravity type Quay Wall	1/3(HWL-LWL)+LWL= DL. +0.4 m
Sheet Pile Wall	2/3(HWL-LWL)+LWL= DL. +0.6 m
4. Copeline Height of Quay Wall	D L. +2.4 m
5. Apron Width	20 meter
6. Loads	
(1) Uniform Live Load	2.0 tf/sq.m at Berth Apron (1.0 tf/sq.m for circular sliding analysis)
(2) Coal Stacking Load	4.0 tf/sq.m
(3) Multipurpose Pier	2.0 tf/sq.m
(4) Bollard Load	100 tf for ranges from horizon to perpendicularity
(5) Approach Velocity for Berthing	15 cm/s perpendicular toward berth face line
(6) Movable Load of Equipment	
Multipurpose Berth	Quay Gantry Crane Max. Lift capacity: 48.0 tf Lift Capacity under spreader: 35.0 tf Rail Span: 25 m Two (2) units per berth

Grain Berth:	Mechanical Continuous Grain Unloader 700 t/hr capacity Rail Span: 12 m Two (2) units per berth

7. Soil Conditions:

(1) Sand Reclamation	ϕ=30º, γ = 1.8 tf/cu.m (1.0 tf/cu.m in water)
(2) Sand Fill	ϕ=30º, γ = 1.8 tf/cu.m (1.0 tf/cu.m in water)
(3) Back-fill Stone	ϕ=35º, γ = 1.8 tf/cu.m (1.0 tf/cu.m in water)
(4) Rubble Mound	ϕ=40º, γ = 1.8 tf/cu.m (1.0 tf/cu.m in water)
(5) Sand Replacement (N=5~10)	ϕ=30º, γ = 1.8 tf/cu.m (1.0 tf/cu.m in water)
(6) In-situ Subsoil (N =1.0 approx.)	C= 1.0tf/sq.m, γ = 1.6 tf/cu.m (0.6 in water)
(7) Filling Sand for Concrete Caisson	γ = 1.8 tf/cu.m (2.0 tf/cu.m in 100% saturated)

8. Unit Weight

(1) Plain Concrete	w=2.2 tf/cu.m
(2) Reinforced Concrete for Deck & Beams	w=2.35 tf/cu.m
(3) Reinforced Concrete for Caisson	w=2.35 tf/cu.m

9. Design Standard

(1) Technical Standards for Port and Harbor Facilities : Japan Port & Harbor Association
(2) Standard Specifications for Concrete : Japan Society of Civil Engineers
(3) Standard Specifications for Prestressed Concrete : Japan Society of Civil Engineers
(4) Principles of Asphalt Pavement : Japan Road Association
(5) Standard Specifications for Road Bridges : Japan Road Association
(6) Japanese Industrial Standards : Japanese Standards Association

10. Road Way Dimensions

(1) New Port Road Bridge Project

Bridge Span	90 meters
No. of Lane	4 lanes (2 ways×2 lanes) (6.5 m width for one way)

(2) Fly-over Access Bridge from Multipurpose Terminal

Bridge Span	15 m standard span
No. of Lane	1-lane (1 way×1 lane) (5.0 m width for one way)

16.1.3 Preliminary Design of Port Facilities

(1) Options of Berth Line Structures

1) Multipurpose Terminal

Prior to construction of berth line substructure, the existing soft subsoil deposit along the berth line of the terminal must be artificially improved by such soil improvement as subsoil replacement, pre-loading or hardening treatment mixed by cement material or other technique. In this study, replacement of very soft clayey subsoil by sandy materials is applied along the proposed berth line. This subsoil improvement is implemented to obtain the sufficient stability in circular sliding of subsoil slopes and/or the bearing capacity of base mound to receive the gravity type of structures.

Considering typically adopted method of construction by APA and other types of structures, the following three types of construction have been selected as alternatives of berth line structure at multipurpose terminal.

Alternative-1: Concrete Block Gravity Type of Quay Wall
Alternative-2: Concrete Caisson Gravity Type of Quay Wall
Alternative-3: Open Deck Type Steel Pipe Piles Pier

The multipurpose terminal project includes access bridge construction for outgoing cargo transportation from the terminal to the gate no. 27. New Access Bridge from the terminal will be constructed from the point behind the berth no. 62, by flying over the existing railway lines and up to the existing elevated inner main port road for connection. This access bridge will be constructed by superstructure of reinforced concrete slab and girder spanning 15 meters. The total length of fly-over is estimated 360 meters.

2) Deep Water Coal Berth

It is recommended to construct new quay structures in front of the present quay walls so that the wharf water depth could be deepened to the designed depth of -14 meters for receiving larger size vessels. Considering the structural stability of existing quay wall during deepening the water depth by dredging, the following 3 type of open deck pier structures are selected as alternatives of quay front structures.

Alternative-1: Detached Pier Type provided at a certain intervals
Alternative-2: Open Deck Type Continuous Pier with Underwater Steel Pipe Piles Retaining Walls
Alternative-3: Batter Pile Open Deck Type Continuous Pier

3) Grain Terminal

The subsoil data has not been collected along the proposed berth line of the grain terminal within this area. It is therefore assumed that the soft subsoil having the same properties as those at the center zone exists upon the bearing stratum which would be located at an elevation of DL - 25 meters approximately. In this area, the subsoil replacement by sandy materials is also considered and the following three types of structure have been selected as alternatives of grain terminal wharf structure.

Alternative-1: Concrete Block Gravity Type of Quay wall
Alternative-2: Concrete Caisson Gravity Type of Quay Wall
Alternative-3: Steel Pipe Pile Open Deck Pier Type

(2) The Best Alternative for Berth Line Structure

Among others, each optional type of berth line structure has various advantages and disadvantages as summarized in the following table 16.1.1. As a result of comparing these alternatives, the traditional type of concrete block wall (Alternative-1) for multipurpose terminal and grain berth, and batter piled open deck pier (Alternative-3) for deep water coal would be the most suitable for construction.

Table 16.1.1 Comparison of Berth Line Structures

Alternative Type of Structure			1	2	3
			Concrete Block Gravity Wall	Concrete Caisson Gravity Wall	Open Deck Pier
1	Structural Stability	Differential Settlement	Utmost caution needed for Subsoil and Foundation	Utmost caution needed for Subsoil and Foundation	Minor owing to Piled Foundation
		Deterioration	Minor	Minor but Protection for R.B. needed	Protection for S.P.P. Foundation & R.B. needed
		Resistance for Horizontal Loads	Weak for Seismic Loads	Weak for Seismic Loads	Reliable
2	Construction	Easiness of Construction	Very Simple	Special Skill and Previous Experience Required	Simple
		Major Construction Equipment required	Floating Cranes, Pile Diving Machine & Wide Stocking Yard for Block Manufacturing	Floating Dock, Pile Driving Machine & Wide Water Area for Caisson Storing	Floating Pile Driving and Floating Cranes
		Construction Period required	Long term	Relatively Long term	Medium term
3	Availability of Materials		Most of construction materials are locally available	Most of construction materials are locally available	Steel Pipe Piles to be imported
4	Effect on Environment		Decreasing Water Area in the Port	Decreasing Water Area in the Port	would be minimum
Adaptability	Multi-purpose Terminal	Cost of Construction	Low Cost	Medium Cost	High Cost
		Overall Evaluation	Good for Recommendation	Fair	Fair
	Coal Terminal Deepening Project	Cost of Construction			Medium Cost
		Overall Evaluation			Batter Piles Open Deck Pier recommended
	Grain Terminal	Cost of Construction	Low Cost	Medium Cost	High Cost
		Overall Evaluation	Good for Recommendation	Fair	Fair

(3) New Port Road Bridge

New port road bridge construction is also envisaged in the master plan. New bridge to be constructed will be 90 meter length of spanning so that the bridge foundation structure could be built without any disturbance to such existing facilities as canal revetment and canal gate structure. Therefore, considering long spanning of new bridge construction, a steel truss superstructure will be the one of the most applicable type of bridge superstructure.

16.2 Preliminary Cost Estimation

Preliminary cost estimation for this study is carried out based on the conceptual layout plan and preliminary structural design of port facilities.

16.2.1 Basic assumption for Cost Estimation

(1) Unit Price and Exchange Rate

The project costs are estimated based on the unit prices as of May 1998 and the following foreign currency exchange rate is applied.

1 US$ = 3.4 L.E. (Egyptian Pound)

(2) Dredging and Pre-dredging Works

A port water area at the present coal terminal basin, Mina El Qamariya and outer harbor waiting area is planned to be deepened to DL –14.0m by dredging. Three major projects in the framework of the master plan by this study are located in the periphery of these proposed dredging area. In addition, pre-dredging of existing weak subsoil for replacement by sands along quay wall structure at multi-purpose terminal and grain berth are scheduled to be carried out for receiving gravity type of walls.

The seabed quality survey at the port of Alexandria shows that the seabed material around this proposed dredging area is heavily contaminated with high level of heavy metals. Therefore subsurface materials to be dredged must be dumped into such specially confined area as contaminated material dumping area. In this study, it is assumed that high level of heavy metals exist in the sea bottom surface of 1 meter depth and therefore the dredged materials only from 1 meter depth of the sea bed surface are considered to dispose into the contaminated material dumping area. The other dredged materials will be planned to dispose to an offshore open sea area. Seabed material volume to be dredged from this area is roughly estimated as follows.

1) Multipurpose Terminal Project

Dredging	1) dispose to the confined dumping area	475,000 m3
	2) dispose to an offshore open sea	334,000 m3
Predredging	1) dispose to the confined dumping area	186,000 m3
	2) dispose to an offshore open sea	1,179,000 m3

2) Deep Water Coal Berth Project

Dredging	1) dispose to the confined dumping area	25,000 m3
	2) dispose to an offshore open sea	45,000 m3

3) Grain Terminal Modernization Project

Dredging	1) disposed to the confined dumping area	75,000 m3
	2) dispose to an offshore open sea	25,000 m3
Predredging	1) dispose to the confined dumping area	28,000 m3
	2) dispose to an offshore open sea	189,000 m3

Total Volume of Dredging	979.000 m3
Total Volume of Pre-dredging	1,582,000 m3

In order to dispose the dredged materials of about 0.8 million cubic meters contaminated with high level of heavy metals, a confined water area of about 300 meters squared area will be prepared in the inner port beside of the existing breakwater of Alexandria port. Along the periphery of this water area, an embankment by means of double sheet pile walls will be planned to construct for confining the contaminated dredged subsoil. Other dredged subsoil from the depth deeper than 1 meter thickness will be transported by barge and dumped at offshore open sea. The transporting distance for this offshore dumping is assumed to be about 100 km far from dredging site and the transportation cost thereof is included in this cost estimate for the master plan.

(3) Pavement and Road in Multipurpose Terminal

Three alternatives for the layout plan of multipurpose terminal are proposed. But, the area to be reclaimed for each alternative layout plan is estimated about 300 Ha, having almost no difference between the three alternatives, as follows.

Apron & In-situ Concrete Area	50 Ha
Concrete Pavement (Open Storage)	11 Ha
Asphalt Concrete Pavement (Container Yard)	173 Ha
Crushed Stone Pavement (Heavy Duty Area)	46 Ha
Road	20 Ha
Total	300 Ha

16.2.2 Construction Cost

Each project cost including alternative layout plans for multipurpose terminal and alternative types of berth structures is broken down into cost items of civil works and the procurement costs of cargo handling equipment as presented in Tables of 16.2.1 to 16.2.8. In costing construction costs, the engineering fee for the detailed design and construction supervision amounting of 10% for civil works and 3% for procurement and, in addition, the physical contingency by 10% for civil works and 3% for procurement are included in the cost estimates by this study.

Table 16.2.1 Construction Cost of Multipurpose Berth at Alex. Port

(1) Layout Plan Alternative 1 (As of 400m X 720m reclaimed Area)

1) Structural Type Alternative 1. Gravity (Concrete Block) Type

Unit : L.E.

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay walls		Lm	1,500	102,349	153,523,275	24%	36,845,586
2	Crane foundation		Lm	700	30,699	21,489,475	65%	13,968,159
3	Revetment		Lm	150	84,793	12,718,943	15%	1,907,841
4	Reclamation		m3	3,200,000	23	73,600,000	15%	11,040,000
5	Dredging; dispose to confined area		m3	475,000	50	23,750,000	40%	9,500,000
6	Dredging; dispose to open sea		m3	334,000	20	6,680,000	70%	4,676,000
7	Predredging; dispose to confined area		m3	186,000	50	9,300,000	40%	3,720,000
8	Predredging; dispose to open sea		m3	1,179,000	20	23,580,000	70%	16,506,000
9	Replace & backfill	sand	m3	600,000	38	22,770,000	10%	2,277,000
10	Fly-over bridge		Lm	360	28,345	10,204,200	26%	2,653,092
11	Road & pavement		m2	249,700	63	15,731,100	10%	1,573,110
12	Gate & truck scale		set	4	1,167,825	4,671,300	23%	1,074,399
13	Lighting(yard & berth)		Ha	24	206,521	4,956,500	41%	2,014,950
14	Power supply	3500KVA	sum	1	460,000	460,000	60%	276,000
15	Utilities		Ha	28.4	3,450	97,980	30%	29,394
16	(Sub Total)		Lm	1,500	255,689	383,532,773	28%	108,061,531
17	Engineering service		%	10%	383,532,773	38,353,277	30%	11,505,983
18	Contingency		%	10%	383,532,773	38,353,277	30%	11,505,983
19	(Sub Total)					76,706,555	30%	23,011,966
	TOTAL of Civil Works					460,239,327	28%	131,073,497
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale units		nos.	8	1,000,000	8,000,000	75%	6,000,000
3	(Sub Total)					32,000,000	83%	26,400,000
4	Engineering service		%	3%	32,000,000	960,000	30%	288,000
5	Contingency		%	3%	32,000,000	960,000	30%	288,000
6	(Sub Total)					1,920,000	30%	576,000
7	TOTAL of Procurement					33,920,000	80%	26,976,000
C	Grand Total		LM	1,500	329,440	494,159,327	32%	158,049,497

2) Structural Type Alternative 2. Gravity (Concrete Caisson) Type

Unit: LE

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Sub total of Alt. 1		Lm	1500	255,689	383,532,773	28%	108,061,531
2	Quay walls		Lm	1,500	124,028	186,041,250	38%	70,695,675
3	Revetment		Lm	150	106,472	15,970,740	33%	5,270,344
4	Quay walls of concrete block type		Lm	-1,500	102,349	-153,523,275	24%	-36,845,586
5	Revetment of concrete block type		Lm	-150	84,793	-12,718,943	15%	-1,907,841
6	(Sub Total)		Lm	1,500	279,535	419,302,545	35%	145,274,123
7	Engineering service		%	10%	419,302,545	41,930,255	30%	12,579,076
8	Contingency		%	10%	419,302,545	41,930,255	30%	12,579,076
9	(Sub Total)					83,860,509	30%	25,158,153
10	TOTAL of Civil Works					503,163,054	34%	170,432,276
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale unit		nos.	8	1,000,000	8,000,000	85%	6,800,000
3	(Sub Total)					32,000,000	85%	27,200,000
4	Engineering services		%	3%	32,000,000	960,000	30%	288,000
5	Contingency		%	3%	32,000,000	960,000	30%	288,000
6	(Sub Total)					1,920,000	30%	576,000
7	TOTAL of Procurement					33,920,000	82%	27,776,000
C	GRAND TOTAL		LM	1,500	358,055	537,083,054	37%	198,208,276

3) Structural Type Alternative 3. Open Type Wharf

Unit : L.E.

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	1,500	140,541	210,811,500	66%	139,135,590
2	Revetment		Lm	150	122,141	18,321,150	63%	11,542,325
3	Reclamation		m3	2,800,000	23	64,400,000	15%	9,660,000
4	Retaining wall	concrete blocks	Lm	1,650	4,335	7,152,750	17%	1,215,968
5	Dredge/Predredging	confined area	m3	661,000	50	33,050,000	40%	13,220,000
6	Dredge/Predredging	open sea	m3	1,513,000	9	30,260,000	70%	21,182,000
7	Replace & back fill		m3	600,000	38	22,800,000	10%	2,280,000
8	Rubble base/armor		m3	642,000	75	48,150,000	15%	7,222,500
9	Fly-over bridge		LM	360	28,345	10,204,200	10%	1,020,420
10	Facilities on yard		sum	1	25,916,880	25,916,880	18%	4,691,853
11	(sub total)		Lm	1,500	314,044	471,066,480	45%	211,170,655
12	Engineering Services		%	10%	471,066,480	47,106,648	30%	14,131,994
13	Contingency		%	10%	471,066,480	47,106,648	30%	14,131,994
14	(sub total)					94,213,296	30%	28,263,989
15	TOTAL of Civil Works					565,279,776	42%	239,434,644
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale unit		nos.	8	1,000,000	8,000,000	85%	6,800,000
3	(Sub Total)					32,000,000	85%	27,200,000
4	Engineering services		%	3%	32,000,000	960,000	30%	288,000
5	Contingency		%	3%	32,000,000	960,000	30%	288,000
6	(Sub Total)			1		1,920,000	30%	576,000
7	TOTAL of Procurement					33,920,000	82%	27,776,000
C	GRAND TOTAL		Lm	1,500	399,467	599,199,776	45%	267,210,644

Table 16.2.2 Construction Cost of Multipurpose Berth at Alex. Port

(2) Layout Plan Alternative 2. As of 320m X 960m Reclaimed Area

1) Structural Type Alternative 1. Gravity (Concrete Block) Type

Unit : L.E.

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	1,440	102,349	147,382,560	24%	35,371,814
2	Crane foundation		Lm	960	30,699	29,471,040	65%	19,156,176
3	Revetment		Lm	790	84,793	66,986,470	15%	10,047,971
4	Reclamation		m3	3,300,000	23	75,900,000	15%	11,385,000
5	Dredging; dispose to confined area		m3	475,000	50	23,750,000	40%	9,500,000
6	Dredging; dispose to open sea		m3	478,000	20	9,560,000	70%	6,692,000
7	Predredging; dispose to confined area		m3	243,000	50	12,150,000	40%	4,860,000
8	Predredging; dispose to open sea		m3	1,550,000	20	31,000,000	70%	21,700,000
9	Replace & backfill	sand	m3	810,000	38	30,780,000	10%	3,078,000
10	Fly-over bridge		Lm	360	28,345	10,204,200	26%	2,653,092
11	Road & pavement		m2	249,700	63	15,731,100	10%	1,573,110
12	Gate & truck scale		set	3	1,167,825	3,503,475	23%	805,799
13	Lighting(yard & berth)		Ha	24	206,521	4,956,504	41%	2,032,167
14	Power supply	3500KVA	sum	1	460,000	460,000	60%	276,000
15	Utilities		Ha	28.4	3,450	97,980	30%	29,394
16	(Sub Total)		Lm	1,440	320,787	461,933,329	28%	129,160,523
17	Engineering service		%	10%	461,933,329	46,193,333	30%	13,858,000
18	Contingency		%	10%	461,933,329	46,193,333	30%	13,858,000
19	(Sub Total)					92,386,666	30%	27,716,000
	TOTAL of Civil Works					554,319,995	28%	156,876,523
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale units		nos.	6	1,000,000	6,000,000	75%	4,500,000
3	(Sub Total)					30,000,000	83%	24,900,000
4	Engineering service		%	3%	30,000,000	900,000	30%	270,000
5	Contingency		%	3%	30,000,000	900,000	30%	270,000
6	(Sub Total)					1,800,000	30%	540,000
7	TOTAL of Procurement					31,800,000	80%	25,440,000
C	Grand Total		LM	1,440	407,028	586,119,995	31%	182,316,523

2) Structural Type Alternative 2. Gravity (Concrete Caisson) Type

Unit: LE

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Sub total of Alt. 1		Lm	1,440	320,787	461,933,329	28%	129,341,332
2	Quay Walls		Lm	1,440	124,028	178,600,320	38%	67,868,122
3	Revetment		Lm	790	106,472	84,112,880	33%	27,757,250
4	Quay Walls of concrete block type		Lm	-1,440	102,349	-147,382,560	24%	-35,371,814
5	Revetment of concrete block type		Lm	-790	84,793	-66,986,470	15%	-10,047,971
6	(Sub Total)		Lm	1,440	354,359	510,277,499	35%	179,546,919
7	Engineering service		%	10%	510,277,499	51,027,750	30%	15,308,325
8	Contingency		%	10%	510,277,499	51,027,750	30%	15,308,325
9	(Sub Total)					102,055,500	30%	30,616,650
10	TOTAL of Civil Works					612,332,999	34%	210,163,569
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale unit		nos.	6	1,000,000	6,000,000	85%	5,100,000
3	(Sub Total)					30,000,000	85%	25,500,000
4	Engineering services		%	3%	30,000,000	900,000	30%	270,000
5	Contingency		%	3%	30,000,000	900,000	30%	270,000
6	(Sub Total)					1,800,000	30%	540,000
7	TOTAL of Procurement					31,800,000	82%	26,040,000
C	GRAND TOTAL		LM	1,440	447,315	644,132,999	37%	236,203,569

3) Structural Type Alternative 3. Open Type Wharf

Unit : L.E.

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	1,440	140,541	202,379,040	66%	133,570,166
2	Revetment		Lm	790	122,141	96,491,390	63%	60,789,576
3	Reclamation		m3	3,300,000	23	75,900,000	15%	11,385,000
4	Retaining wall	concrete blocks	Lm	2,430	4,335	10,534,050	17%	1,790,789
5	Dredge/Predredging	confined area	m3	718,000	50	35,900,000	40%	14,360,000
6	Dredge/Predredging	open sea	m3	2,028,000	20	40,560,000	70%	28,392,000
7	Replace & back fill		m3	810,000	38	30,780,000	10%	3,078,000
8	Rubble base/armor		m3	868,000	75	65,100,000	15%	9,765,000
9	Fly-over bridge		LM	360	28,345	10,204,200	10%	1,020,420
10	Facilities on yard		sum	1	25,916,880	25,916,880	18%	4,665,038
11	(sub total)		Lm	1,440	412,337	593,765,560	45%	268,815,989
12	Engineering Services		%	10%	593,765,560	59,376,556	30%	17,812,967
13	Contingency		%	10%	593,765,560	59,376,556	30%	17,812,967
14	(sub total)					118,753,112	30%	35,625,934
15	TOTAL of Civil Works					712,518,672	43%	304,441,923
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale unit		nos.	6	1,000,000	6,000,000	85%	5,100,000
3	(Sub Total)					30,000,000	85%	25,500,000
4	Engineering services		%	3%	30,000,000	900,000	30%	270,000
5	Contingency		%	3%	30,000,000	900,000	30%	270,000
6	(Sub Total)			1		1,800,000	30%	540,000
7	TOTAL of Procurement					31,800,000	82%	26,040,000
C	GRAND TOTAL		Lm	1,440	516,888	744,318,672	44%	330,481,923

Table 16.2.3 Construction Cost of Multipurpose Berth at Alex. Port

(3) Layout Plan Alternative 3. As of 250m X 1200m Reclaimed Area

1) Structural Type Alternative 1. Gravity (Concrete Block) Type

Unit : L.E.

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	1,450	102,349	148,406,050	24%	35,617,452
2	Crane foundation		Lm	1,200	30,699	36,838,800	65%	23,945,220
3	Revetment		Lm	1,080	84,793	91,576,440	15%	13,736,466
4	Reclamation		m3	3,300,000	23	75,900,000	15%	11,385,000
5	Dredging; dispose to confined area		m3	463,000	50	23,150,000	40%	9,260,000
6	Dredging; dispose to open sea		m3	538,000	20	10,760,000	70%	7,532,000
7	Predredging; dispose to confined area		m3	276,000	50	13,800,000	40%	5,520,000
8	Predredging; dispose to open sea		m3	1,758,000	20	35,160,000	70%	24,612,000
9	Replace & backfill	sand	m3	920,000	38	34,960,000	10%	3,496,000
10	Fly-over bridge		Lm	360	28,345	10,204,200	26%	2,653,092
11	Road & pavement		m2	249,700	63	15,731,100	10%	1,573,110
12	Gate & truck scale		set	3	1,167,825	3,503,475	23%	805,799
13	Lighting(yard & berth)		Ha	24	206,521	4,956,504	41%	2,032,167
14	Power supply	3500KVA	sum	1	460,000	460,000	60%	276,000
15	Utilities		Ha	28.4	3,450	97,980	30%	29,394
16	(Sub Total)		Lm	1,450	348,624	505,504,549	28%	142,473,700
17	Engineering service		%	10%	505,504,549	50,550,455	30%	15,165,136
18	Contingency		%	10%	505,504,549	50,550,455	30%	15,165,136
19	(Sub Total)					101,100,910	30%	30,330,273
	TOTAL of Civil Works					606,605,459	28%	172,803,973
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale units		nos.	6	1,000,000	6,000,000	75%	4,500,000
3	(Sub Total)					30,000,000	83%	24,900,000
4	Engineering service		%	3%	30,000,000	900,000	30%	270,000
5	Contingency		%	3%	30,000,000	900,000	30%	270,000
6	(Sub Total)					1,800,000	30%	540,000
7	TOTAL of Procurement					31,800,000	80%	25,440,000
C	Grand Total		LM	1,450	440,280	638,405,459	31%	198,243,973

2) Structural Type Alternative 2. Gravity (Concrete Caisson) Type

Unit: LE

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Sub total of Alt.3(Layout);Alt 1(Type)		Lm	1,450	348,624	505,504,549	28%	142,473,700
2	Quay Walls		Lm	1,450	124,028	179,840,600	38%	68,339,428
3	Revetment		Lm	1,080	106,472	114,989,760	33%	37,946,621
4	Quay Walls of concrete block type		Lm	-1,450	102,349	-148,406,050	24%	-35,617,452
5	Revetment of concrete block type		Lm	-1080	84,793	-91,576,440	15%	-13,736,466
6	(Sub Total)		Lm	1,450	386,450	560,352,419	36%	199,405,831
7	Engineering service		%	10%	560,352,419	56,035,242	30%	16,810,573
8	Contingency		%	10%	560,352,419	56,035,242	30%	16,810,573
9	(Sub Total)					83,860,509	30%	33,621,145
10	TOTAL of Civil Works					644,212,928	36%	233,026,976
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale unit		nos.	6	1,000,000	6,000,000	85%	5,100,000
3	(Sub Total)					30,000,000	85%	25,500,000
4	Engineering services		%	3%	30,000,000	900,000	30%	270,000
5	Contingency		%	3%	30,000,000	900,000	30%	270,000
6	(Sub Total)					1,800,000	30%	540,000
7	TOTAL of Procurement					31,800,000	82%	26,040,000
C	GRAND TOTAL		LM	1,450	466,216	676,012,928	38%	259,066,976

3) Structural Type Alternative 3. Open Type Wharf

Unit : L.E.

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	1,450	140,541	203,784,450	66%	134,497,737
2	Revetment		Lm	1,080	122,141	131,912,280	63%	83,104,736
3	Reclamation		m3	3,300,000	23	75,900,000	15%	11,385,000
4	Retaining wall	concrete blocks	Lm	2,530	4,335	10,967,550	17%	1,864,484
5	Dredge/Predredging	confined area	m3	739,000	50	36,950,000	40%	14,780,000
6	Dredge/Predredging	open sea	m3	2,296,000	20	45,920,000	70%	32,144,000
7	Replace & back fill		m3	920,000	38	34,960,000	10%	3,496,000
8	Rubble base/armor		m3	985,000	75	73,875,000	15%	11,081,250
9	Fly-over bridge		LM	360	28,345	10,204,200	10%	1,020,420
10	Facilities on yard		sum	1	25,916,880	25,916,880	18%	4,665,038
11	(sub total)		Lm	1,450	448,545	650,390,360	46%	298,038,665
12	Engineering Services		%	10%	650,390,360	65,039,036	30%	19,511,711
13	Contingency		%	10%	650,390,360	65,039,036	30%	19,511,711
14	(sub total)					130,078,072	30%	39,023,422
15	TOTAL of Civil Works					780,468,432	43%	337,062,087
B	Procurement							
1	Gantry Crane	Panamax	unit	2	12,000,000	24,000,000	85%	20,400,000
2	Scale unit		nos.	6	1,000,000	6,000,000	85%	5,100,000
3	(Sub Total)					30,000,000	85%	25,500,000
4	Engineering services		%	3%	30,000,000	900,000	30%	270,000
5	Contingency		%	3%	30,000,000	900,000	30%	270,000
6	(Sub Total)			1		1,800,000	30%	540,000
7	TOTAL of Procurement					31,800,000	82%	26,040,000
C	GRAND TOTAL		Lm	1,450	560,185	812,268,432	45%	363,102,087

Table 16.2.4 Cost Summary of Multipurpose Terminal

Layout Plan		Structural Type	Matrix	Ratio	Cost	F/c%	F/C
1	Altnative-1 (400X720m)	Alt. 1 Concrete Block	I - I	100	494,159,327	32%	158,049,497
		Alt. 2 Concrete Caisson	I - II	109	537,083,054	37%	198,208,276
		Alt. 3 Open Type	I - III	121	599,199,776	45%	267,210,644
2	Alt. 2 (320X960m)	Alt. 1 Concrete Block	II - I	119	586,119,995	31%	182,316,523
		Alt. 2 Concrete Caisson	II - II	131	646,252,999	37%	237,939,569
		Alt. 3 Open Type	II - III	151	744,318,672	44%	330,481,923
3	Alt. 3 (250X1200m)	Alt. 1 Concrete Block	III - I	129	638,405,459	31%	198,243,973
		Alt. 2 Concrete Caisson	III - II	137	676,012,928	38%	259,066,976
		Alt. 3 Open Type	III - III	164	812,268,432	45%	363,102,087

Table 16.2.5 Construction Cost of Deep Water Coal Berth at Alex. Port

(1) Structural Type Alternative 1 Detached Pier Type(19 units; etc 14m)

No.	Item	Spec	Unit	Quantities	Prices	Amount	F/c %	F/c Portion
A	CIVIL WORKS							
1	Dolphin		units	19	1,296,068	24,625,292	62%	15,267,681
2	Dredging; dispose to open sea		m3	45,000	20	900,000	70%	630,000
3	Dredging; dispose to confined area		m3	25,000	50	1,250,000	40%	500,000
3	Armor Stone	D=0.6m	m3	1,500	66	99,000	0%	0
4	Place stone		m2	2,500	132	330,000	10%	33,000
5	miscellaneous	5% of above	sum	0.05	31,145,150	1,557,258	10%	155,726
6	(Sub Total)					28,761,550	58%	16,586,407
7	Engi. Services		%	10	28,761,550	2,876,155	30%	862,846
8	Contingency		%	10	28,761,550	2,876,155	30%	862,846
9	(Sub Total)					5,752,310	30%	1,725,693
10	Total	Berth length	m	270	127,829	34,513,859	53%	18,312,100

(2) Structural Type Alternative 2. Open Type Pier with Underwater Steel Pipe Piles Retaining Wall

(Foundation Soil Protection by Sheet Piles)

No.	Item	Spec	Unit	Quantities	Prices	Amount	F/c %	F/c Portion
A	CIVIL WORKS							
1	Steel pipe pile	L=33m, 14mm	ton	1,672	5,280	8,828,160	90%	7,945,344
2	Steel sheet pile	L=7m; SP II	ton	180	3,250	585,000	90%	526,500
3	Piling of SPP		m	5,280	462	2,439,360	61%	1,488,010
4	FRP cover		m2	685	1,344	920,640	90%	828,576
5	Piling of sheet pile		m	3,763	185	696,155	61%	424,655
6	Beam concrete		m3	1,000	898	897,600	15%	134,640
7	Deck slab		m2	1,500	397	595,800	14%	83,412
8	Stage work		m2	3,000	268	802,800	27%	216,756
9	Supporting	jacky base	m2	2,430	300	729,000	27%	196,830
10	Grating		m2	405	600	243,000	80%	194,400
11	Fender		nos.	11	240,000	2,640,000	90%	2,376,000
12	Bollard		nos.	11	60,000	660,000	80%	528,000
13	Dredging, dispose to open sea		m3	45,000	20	900,000	70%	630,000
14	Dredging, dispose to confined area		m3	25,000	50	1,250,000	40%	500,000
15	Miscellaneous		sum0	0.05	22,187,515	1,109,376	10%	110,938
16	(Sub Total)					23,296,891	69%	16,184,060
17	Engineering services		%	10%	23,296,891	2,329,689	30%	698,907
18	Contingency		%	10%	23,296,891	2,329,689	30%	698,907
19	(Sub Total)					4,659,378	30%	1,397,813
20	TOTAL		m	270	103,542	27,956,269	63%	17,581,873

(3) Structural Type Alternative 3 Open Type with Steel Pipe Batter Piles

(Slope Protection by Armor Stone)

No.	Item	Spec	Unit	Quantities	Prices	Amount	F/c %	F/c Portion
1	Direct cost Alt 2		sum	1		23,296,891	74%	17,248,594
2	SPP		ton	180	-3,250	-585,000	90%	-526,500
3	SPP rate		ton	1,672	-480	-802,560	90%	-722,304
4	Slope protection	stone	m3	1,800	66	118,800	0%	0
5	Grading	stone	m2	3,000	132	396,000	10%	39,600
6	(Sub Total)					22,424,131	72%	16,039,390
7	Engineering service		%	10%	23,315,995	2,331,600	30%	699,480
8	Contingency		%	10%	23,315,995	2,331,600	30%	699,480
9	(Sub Total)					4,663,199		1,398,960
10	Total		m	270	100,323	27,087,330	64%	17,438,350

Table 16.2.6 Construction Cost of Grain Berth at Alex. Port

(1) Structural Type Alternative 1. Gravity (Concrete Block) Type

Unit : LE

No.	Item	Spec	Unit	Quantities	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	270	102,349	27,634,190	24%	6,632,205
2	Crane foundation		Lm	250	30,699	7,674,813	65%	4,988,628
3	Revetment		Lm	10	84,793	847,930	15%	127,189
4	Reclamation		m3	265,000	23	6,095,000	15%	914,250
5	Dredging; dispose to open sea		m3	25,000	20	500,000	70%	350,000
6	Dredging; dispose to confined area		m3	75,000	50	3,750,000	40%	1,500,000
7	Predredging; dispose to open sea		m3	189,000	20	3,780,000	70%	2,646,000
8	Predredging; dispose to confined area		m3	28,000	50	1,400,000	40%	560,000
9	Replace & backfill	sand	m3	132,000	38	5,009,400	10%	500,940
10	Power supply		sum	1	460,000	460,000	60%	276,000
11	Utilities		Ha	2.2	3,450	7,590	30%	2,277
12	(Sub Total)		Lm	280		57,158,922	32%	18,497,490
13	Engineering service		%	10%	57,158,922	5,715,892	30%	1,714,768
14	Contingency		%	10%	57,158,922	5,715,892	30%	1,714,768
15	(Sub Total)					11,431,784	30%	3,429,535
	TOTAL of Civil Works					68,590,706	32%	21,927,025
B	Procurement							
1	Mechanical Unloader	700t/hrs	unit	2	20,000,000	40,000,000	85%	34,000,000
2	Quay conveyor	800t/hrsX2row	lm	750	30,000	22,500,000	85%	19,125,000
3	(Sub Total)					62,500,000	85%	53,125,000
4	Engineering service		%	3%	62,500,000	1,875,000	30%	562,500
5	Contingency		%	3%	62,500,000	1,875,000	30%	562,500
6	(Sub Total)					3,750,000	30%	1,125,000
7	TOTAL of Procurement					66,250,000	82%	54,250,000
C	GRAND TOTAL		Lm	270	499,410	134,840,706	56%	76,177,025

(2) Structural Type Alternative 2. Gravity (Concrete Caisson) Type

Unit: LE

No.	Item	Spec	Unit	Quantities	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	280	124,028	34,727,700	38%	13,196,526
2	Crane foundation		Lm	250	30,699	7,674,813	65%	4,988,628
3	Revetment		Lm	80	106,472	8,517,728	33%	2,810,850
4	Reclamation		m3	265,000	23	6,095,000	15%	914,250
5	Dredging; dispose to open sea		m3	25,000	20	500,000	70%	350,000
6	Dredging; dispose to confined area		m3	75,000	50	3,750,000	40%	1,500,000
7	Predredging; dispose to open sea		m3	189,000	20	3,780,000	70%	2,646,000
8	Predredging; dispose to confined area		m3	28,000	50	1,400,000	40%	560,000
9	Replace & backfill	sand	m3	132,000	38	5,009,400	10%	500,940
10	Power supply		sum	1	460,000	460,000	60%	276,000
11	(Sub Total)		Lm	280		71,914,641	39%	27,743,194
12	Engineering service		%	10%	71,914,641	7,191,464	30%	2,157,439
13	Contingency		%	10%	71,914,641	7,191,464	30%	2,157,439
14	(Sub Total)					14,382,928	30%	4,314,878
15	TOTAL of Civil Works					86,297,569	37%	32,058,073
B	Procurement							
1	Mechanical Unloader	700t/hrs	unit	2	20,000,000	40,000,000	85%	34,000,000
2	Quay conveyor	800t/hrsX2row	lm	750	30,000	22,500,000	85%	19,125,000
3	(Sub Total)					62,500,000	85%	53,125,000
4	Engineering services		%	3%	62,500,000	1,875,000	30%	562,500
5	Contingency		%	3%	62,500,000	1,875,000	30%	562,500
6	(Sub Total)					3,750,000	30%	1,125,000
7	TOTAL of Procurement					66,250,000	82%	54,250,000
C	GRAND TOTAL		Lm	270	564,991	152,547,569	57%	86,308,073

(3) Structural Type Alternative 3. Open Type Wharf with Steel Pipe Piles

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
1	Quay Walls		Lm	270	140,541	37,946,070	66%	25,044,406
2	Revetment		Lm	20	122,141	2,442,820	63%	1,538,977
3	Reclamation		m3	265,000	23	6,095,000	15%	914,250
4	Retaining wall	concrete blocks	Lm	270	4,335	1,170,450	17%	198,977
5	Dredge/Predredging	confined area	m3	103,000	50	5,150,000	40%	2,060,000
6	Dredge/Predredging	open sea	m3	214,000	20	4,280,000	70%	2,996,000
7	Replace & back fill		m3	132,000	38	5,016,000	10%	501,600
8	Rubble base/armor		m3	105,000	75	7,875,000	15%	1,181,250
9	Power supply		sum	1	460,000	460,000	10%	46,000
10	Utilities		Ha	2.2	3,450	7,590	18%	1,366
11	(sub total)					70,442,930	49%	34,482,826
12	Engineering Services		%	10%	70,442,930	7,044,293	30%	2,113,288
13	Contingency		%	10%	70,442,930	7,044,293	30%	2,113,288
14	(sub total)					14,088,586	30%	4,226,576
15	TOTAL of Civil Works					84,531,516	46%	38,709,401
B	Procurement							
1	Mechanical Unloader	700ton/hrs	unit	2	20,000,000	40,000,000	85%	34,000,000
2	Quay conveyor	800ton/hrsx2row	Lm	750	30,000	22,500,000	85%	19,125,000
3	(Sub Total)					62,500,000	85%	53,125,000
4	Engineering services		%	3%	62,500,000	1,875,000	30%	562,500
5	Contingency		%	3%	62,500,000	1,875,000	30%	562,500
6	(Sub Total)			1		3,750,000	30%	1,125,000
7	TOTAL of Procurement					66,250,000	82%	54,250,000
C	GRAND TOTAL		Lm	1,500	100,521	150,781,516	62%	92,959,401

Table 16.2.7 Construction Cost of New Port Road Bridge Project

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	CIVIL WORKS							
1	Truss module	Steel	tons	545	12,000	6,540,000	30%	1,962,000
2	Steel Pipe Pile	D=800,t=12mm	tons	130	5,280	686,400	90%	617,760
3	Pile driving	20nos, l=27m	Lm	540	265	143,100	16%	22,896
4	Abutment	concrete	m3	500	1,330	665,000	10%	66,500
5	Walkway		m	184	500	92,000	30%	27,600
6	(Sub Total)					8,126,500	33%	2,696,726
7	Engineering services		%	10%	8,126,500	812,650	30%	243,795
8	Contingency		%	10%	8,126,500	812,650	30%	243,795
9	(Sub Total)					1,625,300	30%	487,590
10	Total of Civil Works					9,751,800	33%	3,184,316
	GRAND TOTAL					9,751,800	33%	3,184,316

Table 16.2.8 Unit Cost of Breakwater Extension Project (Per 100 m) in Dikheila

Unit : EL

No.	Item	Spec	Unit	Quantity	Prices	Amount	F/c %	F/c Portion
A	Civil Works							
	Breakwater		Lm	100				
1	Bedding sand		m3	18,500	38	703,000	10%	70,300
2	Base course stone	5-100kg	m3	11,300	63	711,900	0%	0
3	Core armor stone	200kg	m3	2,200	63	138,600	0%	0
4	Armor stone	2ton	m3	2,000	69	138,000	0%	0
5	Ditto, rough grading		m2	2,000	63	126,000	10%	12,600
6	Core armor stone	1ton	m3	3,700	69	255,300	0%	0
7	Core stone	50-200kg	m3	17,600	63	1,108,800	0%	0
8	Ditto, rough grading		m2	3,000	63	189,000	10%	18,900
9	Deformed concrete block	25tons	unit	636	5,091	3,238,052	22%	704,183
10	Deformed concrete block	8tons	unit	438	2,202	964,296	24%	229,912
11	Precast concrete block	20ton	m3	3,000	792	2,376,619	21%	496,648
12	Ditto, top placement		m3	1,400	792	1,109,089	21%	231,769
14	(Sub Total)					11,058,655	16%	1,764,313
15	Contingency		%	10%	11,058,655	1,105,866	30%	331,760
16	Engineering service		%	10%	11,058,655	1,105,866	30%	331,760
17	(Sub Total)					2,211,731	30%	663,519
18	TOTAL		Lm	100	132,704	13,270,386	18%	2,427,832

Table 16.2.9 Installation Cost of Vessel Traffic Management System (VTMS)

(Unit : LE)

No.	Item	Specification	Unit	Quantity	Price	Amount	F/c %	F/c Portion
1	Procurement		LS	1	2,700,000	2,700,000	90	2,430,000
2	Indirect Cost		%	6	2,700,000	162,000	30	48,600
3	Total					2,862,000	87	2,478,600

Table 16.2.10 Installation Cost of Waste Oil Receiving Facility

(Unit : LE)

No.	Item	Specification	Unit	Quantity	Price	Amount	F/c %	F/c Portion
1	Procurement		LS	1	1,000,000	1,000,000	90	900,000
2	Indirect Cost		%	6	1,000,000	60,000	30	18,000
3	Total					1,060,000	87	918,000

Chapter 17 Preliminary Economic Analysis

17.1 Purpose and Methodology

A preliminary economic analysis is conducted to appraise the economic feasibility of the Master Plan for the Greater Alexandria Port before conducting a feasibility study of the Short-term Development Plan. The preliminary economic evaluation of a project should show whether the project is justifiable from the viewpoint of the national economy by assessing its contribution to the national economy.

Preliminary economic analysis will be carried out according to the following method. Master Plan will be defined and it will be compared to the "Without the project" case (hereinafter referred to as the "Without" case). All benefits and costs in market price of the difference between "With the project" case (hereinafter referred to as the "With" case) and "Without" case will be calculated and evaluated.

In this study, the economic internal rate of return (EIRR) and the benefit/cost ratio (B/C ratio) based on a cost-benefit analysis are used to appraise the feasibility of the project. The EIRR is a discount rate which makes the costs and the benefits of the project during the project life equal. The benefit/cost ratio is obtained by dividing the benefits by costs based on the present value.

17.2 Prerequisites for Economic Analysis

17.2.1 Base Year

The "Base Year" here means the standard year in the estimation of costs and benefits. In this study, 1998 is set as the "Base Year".

The target year of the Master Plan is 2017 and starting year of construction is assumed to start prior to the target year.

17.2.2 Project Life

The period of calculation (project life) in the economic analysis is assumed to be 30 years from the time of construction, taking into consideration the depreciation period of the main facilities.

17.2.3 Foreign Exchange Rate

The exchange rate adopted for this analysis is US$ 1.00 = LE 3.40 = ¥ 136.00 (as of May 1998), the same rate as used in the cost estimation.

17.2.4 "With" Case and "Without" Case

In the preliminary economic analysis, the four projects, Multipurpose Terminal Project, Grain

Terminal Modernization Project ,Deep Water Coal Berth Project and New Port Road Bridge Project are assessed individually.

A cost-benefit analysis is conducted on the difference between the “With” case where investment is made and the “Without” case where no investment is made. In other word, incremental benefits and costs arising from the proposed investment are compared.

Following conditions are adopted as the "Without" case for each project.

(1) Multipurpose Terminal Project
  1) No investment is made for the port. (Multipurpose terminal is not constructed.)
  2) The working efficiency of cargo handling is not the same as the “With” case.

(2) Grain Terminal Modernization Project
  1) No investment is made for the port. (A new grain terminal is not constructed.)
  2) The working efficiency of cargo handling is not the same as the “With” case.

(3) Deep Water Coal Berth Project
  1) No investment is made for the port. (The coal terminal is not improved.)
  2) Coal berth is not deepened from present level.
  3) The size of vessels is the same as the "With" case, but the unit load per vessel is not the same.

(4) New Port Road Bridge Project
  1) No investment is made for the port. (A new port road bridge is not constructed.)
  2) The time and distance required for the land transportation is not the same as the “With” case.

17.3 Costs of the Projects

The following items are identified as costs of the Master Plan.
(1) Construction and dredging costs
(2) Maintenance costs
Above costs are shown in Table 17.3.1.

Table 17.3.1 Result of Cost Calculation (Unit: thousand LE)

Project	Multipurpose Terminal	Grain Terminal Modernization	Deep Water Coal Berth	New Port Road Bridge	Whole
Construction costs	494,159	134,841	27,087	9,752	665,839 (669,761)
Maintenance costs	200,778	159,655	7,585	2,730	370,748 (375,140)
Total	694,937	294,496	34,672	12,482	1,036,587 (1,044,901)

Note: ( ) is calculated based on the total costs including VTMS and Waste Oil Receiving Facility.

17.4 Benefits of the Projects

As benefits brought about by the master plan of the study port, the following items are identified. And benefits are shown in Table 17.4.1.

(1) Savings in ship staying costs at a berth
(2) Savings in ship waiting costs at an offshore anchorage
(3) Savings in sea transportation costs
(4) Savings in land transportation costs

Table 17.4.1 Result of Benefits Calculation (Unit: thousand LE)

Project	Multipurpose Terminal	Grain Terminal Modernization	Deep Water Coal Berth	New Port Road Bridge	Whole
Savings in ship staying costs	46,803	73,305	0	0	120,108
Savings in ship waiting costs	3,150,769	856,041	0	0	4,006,810
Savings in sea transportation costs	0	0	333,090	0	333,090
Savings in land transportation costs	0	0	0	50,290	50,290
Total	3,197,572	929,346	333,090	50,290	4,510,298

17.5 Results of Preliminary Economic Analysis

17.5.1 Calculation of the EIRR

The economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the economic feasibility of the project. The EIRR is the discount rate which makes the costs and benefits of a project during the project life equal.
It is calculated by using the following formula.

$$\sum_{i=1}^{n} \frac{Bi - Ci}{(1+r)^{i-1}} = 0$$

where, n : Period of economic calculation (project life = 30 years)
Bi : Benefits in i-th year
Ci : Costs in i-th year
r : Discount rate

The results of the EIRR calculation are shown in Table 17.5.1.

Table 17.5.1 Result of EIRR Calculation (Unit: %)

Project	Multipurpose Terminal	Grain Terminal Modernization	Deep Water Coal Berth	New Port Road Bridge	Whole
EIRR	19.8	20.3	36.3	15.9	20.6 (20.5)

Note: ( ) is calculated based on the total costs including VTMS and Waste Oil Receiving Facility.

17.5.2 Calculation of the Benefit/Cost Ratio

The benefit/cost ratio is obtained by dividing the benefit by the cost. The results of the B/C are shown in Table 17.5.2. The discount rate adopted for calculation of B/C is 10% in this study.

Table 17.5.2 Result of B/C Calculation

Project	Multipurpose Terminal	Grain Terminal Modernization	Deep Water Coal Berth	New Port Road Bridge	Whole
B/C	1.83	1.67	3.58	1.50	1.86 (1.84)

Note: ( ) *is calculated based on the total costs including VTMS and Waste Oil Receiving Facility.*

17.5.3 Calculation of the Net Present Value (NPV)

The Net Present Value is calculated by using the following formula.

$$NPV= \sum_{i=1}^{n} \frac{Bi - Ci}{(1+r)^{i-1}}$$

where, n : Period of economic calculation (project life = 30 years)
B : Benefits in i-th year
Ci : Costs in i-th year
r : Discount rate = 10%

The results of the NPV calculation are shown in Table 17.5.3.

Table 17.5.3 Result of NPV Calculation (Unit: thousand LE)

Project	Multipurpose Terminal	Grain Terminal Modernization	Deep Water Coal Berth	New Port Road Bridge	Whole
NPV	438,227	112,471	72,499	5,062	628,259 (623,188)

Note: ( ) *is calculated based on the total costs including VTMS and Waste Oil Receiving Facility.*

17.6 Evaluation of the Projects

The resulting EIRRs of the four projects and whole project are in the range of 15.9% - 36.3%, exceeding the general criterion used to assess economic justifiability, and all B/C ratios are greater than one. All of the NPVs also show plus value.

Therefore, all projects proposed in the master plan are considered to be feasible from the viewpoint of the national economy.

Chapter 18 Improvement Plan of the Port Management and Operation

18.1 Alexandria Port Authority

18.1.1 Background on Management, Operations and Institutional Matters of Alexandria Port

A port is a vital infrastructure in terms of both national and economic security. Gigantic capital investment is often required for its development and many public organizations and private parties are involved. Hence it is generally considered that a port should be administered and controlled comprehensively by a public organization called a port authority, whereas cargo-handling operations should be performed by private companies because their pursuit of profit can promote efficient cargo-handling operations. Such a port is called a “landlord port”. The current worldwide trend in the port field is undoubtedly towards the “landlord port”. In fact, purely private ports are exceptional among worldwide ports.

Although Alexandria Port is a landlord port, cargo-handling operations have not necessarily been efficient. This has presumably resulted from monopolistic operations by the state-owned companies. Private companies had been allowed to conduct only limited operations. However, recent decrees (including Decree No.30, May 1998) on private participation have dramatically changed this situation. Private companies are now able to participate in various maritime works including loading/discharging works, storage/warehouses activities, container activities and shipping agency services if they satisfy the conditions stipulated by the decrees.

Together with the promulgation of the above decrees on private participation, the government announced its intention to privatize stated-owned companies in the maritime sector by selling a majority of their shares held by the governmental holding company through public subscription.

Thus, the current key issue facing the Egyptian ports including Alexandria Port is how to effectively implement private participation and privatization of the existing state-owned companies. Taking into account that private participation and privatization are closely related, the coordinated plans shown below are essential.

18.1.2 Monitoring the Performance of Operators

As mentioned above, based on the new policy, law and regulations, private companies are allowed to perform cargo-handling operation. APA should monitor the performance of operators and recommend the improvement of productivity if the performance is poor and reject the renewal of lease contract if improvement is not expected. APA needs to put pressure on port operators to improve the productivity of operation. This will become an important role of APA.

18.1.3 Financial Independence of Port Authority

Currently revenues derived from port activities are transferred to the central government and spent for other sectors' development. Concerning operational expenses, APA receives a budget from the central government. Every year APA has to negotiate with the central government to decide the budget for APA. Once the amount of the budget is fixed, it is very difficult to change the amount or purpose of use. Therefore APA can not spend its budget flexibly, timely or effectively in accordance with requirements. One consequence of the insufficient budget is that port infrastructures are maintained poorly. It is necessary to ensure that APA is independent or self-sustainable financially. APA should have the freedom to borrow money from commercial banks or issue bonds when funds for investment are required. To borrow money from commercial banks or issue bonds, the financial performance of APA needs to be solid.

18.2 Reorganization to Encourage Competition in the Port Sector

18.2.1 Private Participation and Privatization of State-Owned Companies

To improve cargo handling efficiency, it is necessary to introduce competition in the field of cargo handling operation. According to the new law, private companies can perform stevedoring operation using mechanical equipment at quay.

As a method of privatization of state-owned companies, Egyptian Government opted to sell their shares to the public. If capital gain or dividend is not expected due to the poor performance of the company, nobody might be interested in subscribing for the shares. Therefore, the performance of the company must first be improved to attract potential investors.

After some investors underwrite the shares of the company, majority shareholders should exert influence on the board of directors of the state-owned companies to improve the performance or service level to customers. Even after the majority of shares is handed over to the public, the Government might remain the largest shareholder. Such a situation should be avoided. Many private shareholders having small stakes can not exert influence on the management of the companies to improve the service level. They might be unwilling to make further investment even if it is required.

Some private investors in Egypt may be interested in managing maritime transport business. If they were to hold enough stakes to participate in management of the company, they would demand that a customer-oriented approach be adopted from the top management to the lowest level of employees to earn profit. Customers' demands are efficient cargo handling and speedy procedure for cargo delivery with lower costs. Management will have to meet these demands to survive severe competition. When management fears dismissal or that the company could be taken over, they will be motivated to improve management and service level to customers to survive competition and earn profit. Conversely, good management should be rewarded or employees should be motivated by incentives to achieve good performance. This is a key element for the success of the privatization in which the aim is to improve the service level to customers.

18.3 Improvement of Container Handling Operation

18.3.1 Necessary Measures to Achieve the Targeted Productivity

It is required to achieve the targeted productivity (24 boxes/hour per crane) of container loading/unloading operation to handle the future container traffic in the existing facilities. This target means that a crane operator has to finish one cycle of movement within two minutes and 30 seconds. In case of unloading, a crane operator has to know in advance the location of containers to be lifted in a hold or on deck. An operator of quayside crane should not stop a spreader to find a container to be lifted. In addition, he has to put a spreader on a container exactly and should not hit a spreader or container against other containers. Sway of containers prevents a crane operator from loading containers onto tractor/trailers quickly and smoothly. A crane operator should move a spreader at the appropriate and constant speed to prevent the sway of containers. Drivers of yard tractors should cooperate with a crane operator to minimize delay at the interface between a quayside crane and stacking area to achieve the targeted productivity. A crane operator should not stop the movement of spreader to wait for arrival of trailers. Three trailers usually work for one quayside crane. Three drivers make up a team and they transfer containers in turn from quayside to stacking area or vice versa. If a trailer needs more than 7.5 minutes to return to quayside, it is necessary to increase the trailers of one team.

In case of loading operation, before arrival of a vessel, it is necessary to get together and stack containers to be loaded in accordance with the stowage bay plan of vessels. It is essential to pick up containers to be loaded onto a vessel quickly based on the sequence list of loading containers.

In case of delivering containers to consignees, it is required to retrieve nominated containers from stack quickly. Information system in chapter 18.3.3 should be adopted for precise and efficient operation.

Although efficiency of container loading/unloading operation depends largely on the skill or technique of a crane operator, signalman’s role to support a crane operator is also very important for quick and smooth operation. A signalman must consider the standing position to give signals to a crane operator. If signalman’s position is improper, the operator can not see the signalman. To avoid misunderstanding signals, hand signals must be standardized and unified. A signalman on shore must instruct a tractor/trailer driver properly to adjust the halt position so that an operator of quayside crane/RTG can load containers onto tractor/trailers smoothly. To give proper signals to crane operators, a crane operator needs to work as a signalman in turn while he is not operating a quayside gantry crane.

18.3.2 Introduction of Advanced Technology

To improve the efficiency of container handling operation, it is essential to exchange information and communicate effectively between crane operators and the supervisor at the control center. The following systems for transmitting information are currently used at container terminals.

(1) Radiotelephone (handy talkies) system
This system has been used since the start of container transport. In this system, communication is only one way at a time. After the number of containers increased and electronic communication devices developed remarkably, this system ceased to be the major means and has only been used as a supplementary means of communication at ordinary container terminals. It is still popularly used, however, at small-scale container terminals and van pools and more extensively by drivers of marine container tractor/trailers.

(2) Mobile radio terminal on vehicle system
In this system, the mobile radio (receiver/transmitter) terminals installed on vehicles are connected with the host computer in the operation room, though partly off the line. Information is exchanged in a real time through the radio terminals on vehicles or the handy terminals carried and operated by the workers in the container yard. Although the output power is low, the range performance covers the whole terminal area with the help of a network of antennas linked with coaxial cables. As several manufacturers of various countries are making and developing this type of equipment, this system is expected to be widely introduced to various physical distribution facilities before long.

(3) Mobile telephone system (PHS = Personal Handy phone System)
This is a communication system with mobile telephones using weak radio waves, whose band is different from that of ordinary mobile telephones. As their range performance is a radius of approximately 100 meters, antennas need to be installed at vast container terminals. This system is extensively used as the information transmittal system at small-scale container terminals and warehouses. Since the initial investment costs for the system are low, it is expected to be more popular at inland depots, van pools, etc.

(4) Global Positioning System (GPS)
GPS is not a communication system between crane operators and a supervisor in the terminal office but a system for detecting and indicating the accurate position of objectives in the world using satellites and their ground stations. The GPS receivers, which are installed in the container handling equipment, can indicate the location of the equipment in real time. By grasping the exact location of container handling equipment, the supervisor can instruct the operator in the nearest position to retrieve/stack containers quickly and efficiently based on information from gate offices or container inventory system. Consequently, the operation time can be minimized. There might be some places in the terminal where radio waves can not reach the receivers due to quayside crane or high stack of containers. To solve these problems, it is necessary to set up antennas which are different from those of the communication system. This system is not adopted at many terminals yet because the initial investment costs are high. However it is expected to become widely adopted as the size of container terminal becomes larger and this system can be introduced in a short time without special civil works.

18.3.3 Introduction of Computer Systems

(1) Documentation

Currently computers are used only for transmission of data from APA to the Egyptian Maritime Data bank of MOMT. APA does not make full use of the potential of computer systems. There is a lot of paper work between port users and APA. Once a document is submitted to APA, basic information on the document is entered on other sheets or ledgers repeatedly. This may cause some errors. A lot of personnel are engaged in such manual documentation. If a computer system is introduced for other fields, for example, documentation, berth assignment, accounting, administration work and personnel management as well as statistics, the documentation will be streamlined and the required time for port users to finish necessary procedures will be shortened. Consequently, the dwelling time of cargoes will be shortened and capacity of the port will increase.

Computerization will make it unnecessary to enter the same information on other documents and possible to use repeatedly the information once fed into computers. It is also expected that compiling statistics concerning port activities will become easier.

Although the ultimate goal of computerization is EDI (Electric Data Interchange), it takes a long time to enact or amend relevant laws and regulations and to establish consensus and cooperation among concerned parties to implement EDI. Therefore at first, port authority should introduce the computer system concerning documentation inside the port authority, and as a next step, it is necessary to upgrade functions and expand the areas covered by the computer system. Consequently, the computer system will become an open system in which the parties concerned can participate.

Introduction of a computer information system inevitably results in job losses, so it is essential to consider a method to minimize such losses or a retraining program so that they may find work elsewhere.

(2) Container Inventory Control

Inventory control of containers stored in CY is the most important task in container terminal operation. It is essential to grasp the location and kind of containers stored in CY to operate a container terminal efficiently.

Before the introduction of computer systems, a black (white) board was used for container inventory control in developed countries. This black (white) board was designed like CY and rectangles drawn on the black (white) board indicated slots of containers. Personnel were engaged in entering and changing container numbers on each slot manually. As the number of containers increased and the size of container terminal became larger, a method using cards was adopted. This method, still seen in some container terminals of developing countries, is to control container inventory with cards on which basic information on containers is written. Personnel arrange these cards by shipping line, yard location and container number and grasp location or situation of containers. According to experience in developed countries, it becomes impossible to control container inventory by the card system when the number of containers in CY exceeds 3,000 TEUs. In such a case, it is necessary to introduce a computer system for container inventory control as a next step.

Containers in CY must be sorted and stored by the following classifications.

1) Shipping line
2) Container size (20' or 40'), kind (dry, reefer, open top, flat bed, tank)
3) Loaded containers (by vessels, port of discharge)
4) Empty containers (damaged or not)

Gate offices, yard control center and container handling equipment should be linked with each other to exchange information effectively and assure the accuracy of information on containers. The above information is entered into the terminal computer at the gatehouse and transmitted to the control center in real time. The yard control center instructs operators of container handling equipment to pick up/stack the designated containers.

(3) Container delivering/receiving control system

Gate offices of container terminal play important roles in receiving/delivering containers from/to shippers/consignees. Every container must pass through terminal gates, which are the final check points to find a mistake. If a gate clerk does not identify an error, both the shipper/consignee and shipping line would have trouble. Delivering containers is one of the most important functions of a container terminal. Gate is the boundary separating the limit of responsibilities between shippers/consignees and the container terminal. After an export container enters through the gate, it is the responsibility of the container terminal. After an import container passes through the gate, the responsibility of the container terminal is terminated.

In receiving an export container, it is important to decide its optimum location in CY based on the container's information for efficient operation. In CY, heavy containers should be stacked on light containers since heavy containers must be loaded at the bottom of holds to keep the stability of vessels.

In delivering an import container, it is important to instruct the tractor/trailer driver to go to the location of the containers quickly and to inform the operator of container handling equipment of the tractor/trailer's arrival. After loading the container on the tractor/trailer, it is necessary to check the container number, container damage and container seal number at the gate.

It is possible to grasp the storing location and exact information on container by inputting and renewing it into a terminal computer in real time after verifying the driver's documents and the container. Necessary information to be inputted into a terminal computer at the gate is as follows:

1) Carrying in an export container
    - Name of vessel, Voyage number
    - Container number, size, type
    - Port of loading

Weight
Special cargo (hazardous or refrigerated)

2) Carrying out an import container
Name of vessel, Voyage number
Container number, size, type
Number of Customs permission
Destination
Name of shipping line
Date to return the container

3) Carrying in an empty container
Container number, size, type
Outside condition of the container (damaged or not)
Name of shipping line
Name of transporter (or consignee)

4) Carrying out an empty container
Container number, size, type
Booking number
Destination of the container
Name of shipping line
Name of transporter (or shipper)

(4) Loading/unloading operation control system

When two or more than two quayside gantry cranes serve a vessel, it is necessary to equalize the work loads of each quayside gantry crane. Furthermore, it is important to prepare an operation plan so that one crane does not interfere with the operation of another crane. In loading export containers, it is very important to load containers based on the yard planning system by weight, port of discharge and container size for stability and safe navigation of vessels. Refrigerated containers and hazardous containers must be loaded according to international regulations.

Required functions for the loading/unloading operation system are as follows:

1) Container unloading operation system
2) Container loading operation system
3) Container re-handling system
4) Gantry crane allocation system
5) Hull strength calculation system

Necessary information on containers should be obtained from shipping lines or agents as early as possible. Obtaining the information in advance enables a terminal operator to prepare the working schedule indicating the order of unloading/loading containers and to minimize the operation time. Before preparing the working schedule, it is necessary to obtain the latest stowage bay plan after the last port's operation. The necessary information is as follows:

1) Name of vessel and voyage number
2) Date of departing the last port
3) Estimated time of arrival

4) Details of containers
   a) Container number, size and weight
   b) Port of loading/unloading
5) Special containers
   a) Temperature of refrigerated cargoes
   b) IMO classification of hazardous cargoes
6) Draft of vessel at departing the last port and estimated draft at the entry

In advanced ports, the above information is transmitted by EDI between the terminal operator and the shipping line/agent but in ordinary ports, facsimile is used.

After loading containers, the terminal operator prepares the stowage bay plan, which indicates the result of the operation, and passes it to a captain or shipping agent. Making the stowage bay plan is an important task of a terminal operator. In advanced container terminals, the operation section makes stowage plans with a computer system. Stowage bay plan includes the following information:

1) Prefix and container size
2) Container number
3) Port of loading and unloading
4) Weight and description of special cargo
5) Location in hold/on deck (bay-row-tier)

18.3.4 Minimizing the Breakdown Time of Container Handling Equipment

To achieve the targeted productivity, it is essential to minimize the breakdown time of container handling equipment. Competent personnel should be appointed as a yard operator. This yard operator should always stand by in the terminal office to monitor both loading/unloading and yard operation. If some trouble with a quayside crane or container handling equipment occurs, the yard operator contacts the maintenance department to repair it. To minimize the breakdown time of quayside gantry crane or RTG, backup spreaders must be procured. It is also advisable to conduct preventive maintenance at a regular interval.

18.4 Improvement of Conventional Cargo Handling

18.4.1 Establishment of Terminal Operators

As mentioned in the chapter 14.2.4, it is necessary to establish terminal operators that perform general cargo handling operation comprehensively. APA should designate the new multi-purpose terminal, Timber Quay and Mamoudiya Quay as port terminal for handling conventional cargoes. These areas are divided into some portions and they are allocated to the terminal operators. Each terminal should have the appropriate size for conventional cargo handling and have open storage yards and warehouses for exclusive use. In addition, a terminal operator can preferentially use a berth in front of its storage area. To choose competent terminal operators, it is necessary to have tender on concession or lease fee.

APA should allow both existing state-owned and private companies to apply for this tender.

18.4.2 Avoiding Direct Loading/Delivery

In case of conventional general cargoes, loading/unloading operations are generally performed with ship's cranes/derricks or mobile shore cranes. Currently, unloaded cargoes from a vessel are directly loaded onto trucks/trailers. Although this method reduces cargo damage during operation, productivity is lower than when landing on the quay. Landing cargoes on small platforms of trucks/trailers makes the cycle time longer. The throughput of cargoes depends on the arrival of trucks and the turn-around on the apron. It is advised that this method should be adopted only for handling specific cargoes, such as hazardous cargoes, frozen cargoes, perishable cargoes and special heavy cargoes.

In handling steel products, large apron and sorting/storing yards are needed for smooth operation. It is necessary to demolish the warehouses that are not used adequately to secure enough open space for cargo handling and to reshuffle the warehouse or open yard to minimize the distance of transportation within the port area.

18.4.3 Proper Use of Cargo Handling Equipment

It is necessary to use pallets for landing cargoes on the quay so that forklifts could pick up, carry and sort the landed cargoes and store them in the sheds/warehouse behind the quay. In particular, bagged cargo, such as fertilizer and sugar, must be handled with pallets to increase the throughput.

Currently raw sugar is transported with a bulk carrier. Although many people are involved in unloading operation, productivity is not high. A lot of empty hemp bags are carried into holds of the vessel. Dock workers in holds put sugar into hemp bags. After being stuffed, every 10-15 bags are tied with rope and hooked with ship cranes. Ship cranes land on platform of trailers on the quay. Dock workers arrange sugar bags neatly on platform. As some hemp bags have holes, some sugar spills from bags over deck and quay. Dock workers stuff spilled sugar into bags again with sand on the quay, but they discard some sugar into sea. It is necessary to use a grab and a hopper equipped with a bagging machine and belt conveyer to raise the productivity of unloading and reduce wastage.

Cargo damage is likely to happen during the loading/unloading operation rather than the sea transportation. The lack of adequate cargo handling equipment, such as rope/wire slings spreaders and attachment for forklifts is a main factor. In addition, the condition of open yard is also a contributing factor. The following figures depict forklifts with the attachments to handle the various kinds of cargoes properly.

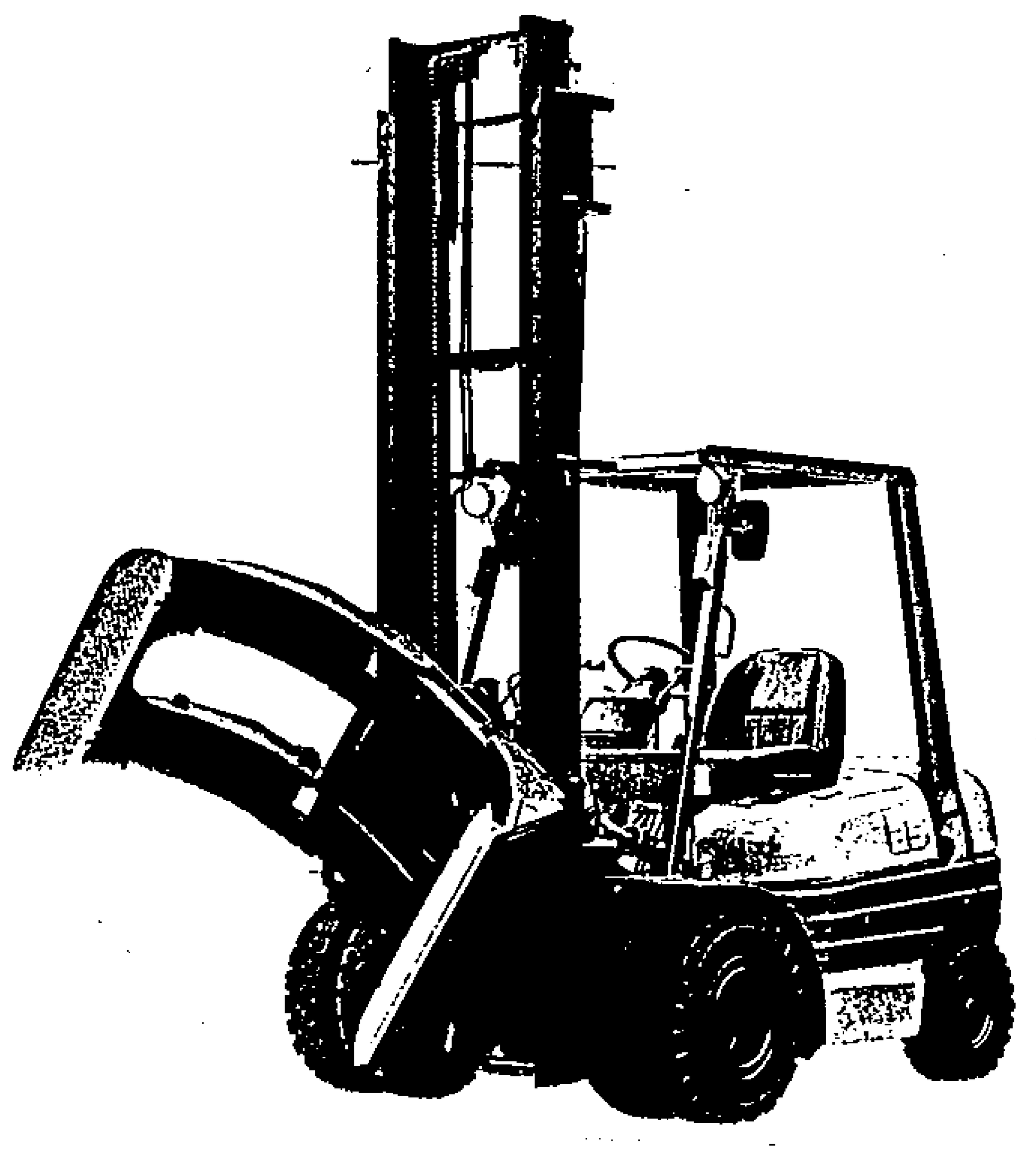


Figure 18.4.1 Full Turn Roll Clamp
(for paper roll)

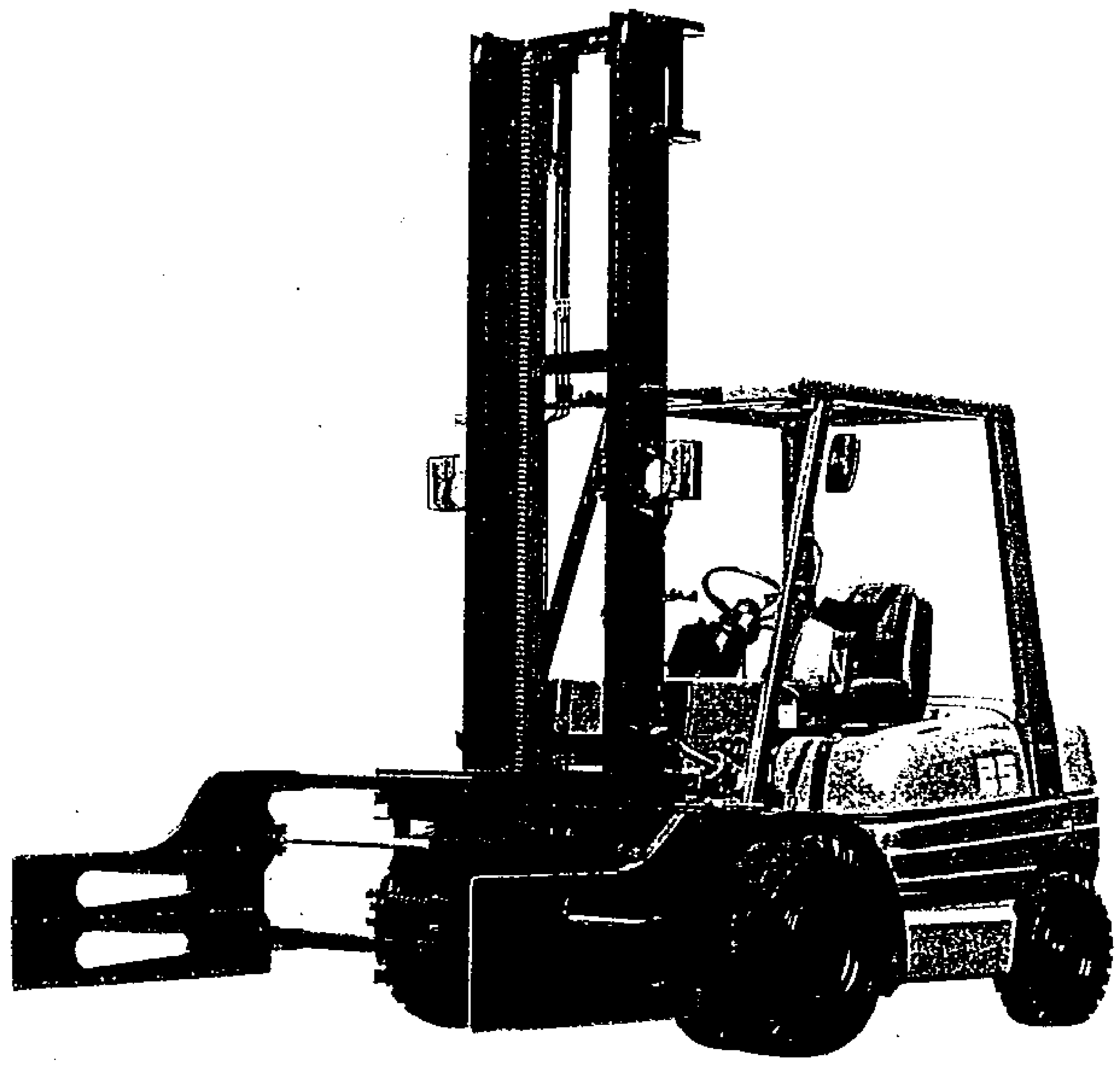


Figure 18.4.2 Bale Clamp
(for raw cotton)

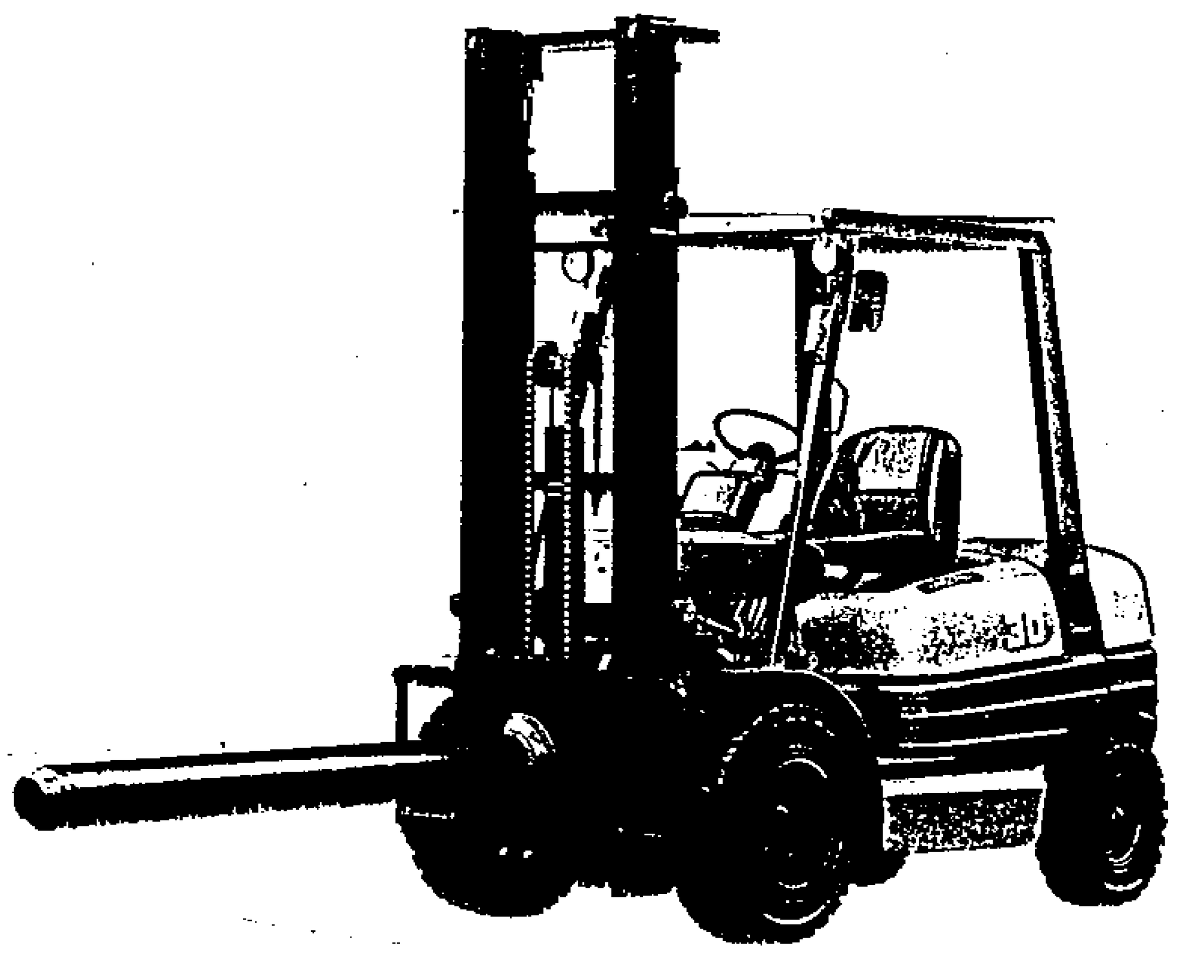


Figure 18.4.3 Steel Ram
(for steel coil)

Figure 18.4.4 Crane Bar and Hook
(for flexible bag)

18.4.4 Targeted Productivity by Cargoes

Concerning the unloading operation, the targeted productivity by cargoes is summarized as below.

(1) Bagged Cargo
Typical examples are sugar, rice, flour and fertilizer. These commodities are usually stuffed in bags made of hemp, vinyl or paper. Forklifts transfer cargoes from quayside to shed/warehouse and load cargoes onto trucks.

Cycle time: 3 minutes (20 moves/hour)
Productivity: 50kgs * 40bags=2t/sling 20moves * 2t = 40t/hour

(2) Steel bar, angle and beam
These commodities are unloaded with ship's gear and landed onto flat bed trucks. The cargo is transferred to open yards.

Cycle Time: 3.5 minutes (17 move/hour)
Productivity: 5t/sling 17 moves * 5t = 85t/hour

(3) Steel sheet
Steel sheets are enveloped with tin plate and attached with wooden skid. Forklifts transfer this cargo from quayside apron to open yards.

Cycle Time : 2.5 minutes (24 moves/hour)
Productivity : 5.0 tons/sling 24 moves * 5t = 120t/hour

(4) Steel coil
Wooden skid is attached with steel coils. Steel ram forklifts, which have a special attachment for handling a steel coil, should be used to transfer cargo from quay side to open yards.

Cycle time : 2.5 minutes (24 moves/hour)
Productivity : 2 coils/sling = 4t/sling 24 moves * 4t =96t/hours

(5) Steel wire
This cargo should be handled with steel ram forklifts.

Cycle time : 3.25 minutes (18 moves/hour)
Productivity : 7 coils/sling = 3.5 t/sling 18 moves * 3.5t = 63t/hour

(6) Timber (Length 3', 6', 9' and 12')
Timber is usually bundled with steel bands. There are two ways to unload timber, unloading on quay or barges.

a) Unloading on quay
Forklifts are used to transfer timber from quayside to open yards.

Cycle Time : 3 minutes (20 moves/hour)
Productivity : 2 bundles/sling = 5t/sling 20 moves * 5t = 100t/hour

b) Unloading into barges

Truck cranes are used to unload timber from barges onto quayside. Forklifts are used to transfer timber from quayside to open yards.

Cycle time : 4 minutes (15 moves/hour)

Productivity : 2 bundles/sling = 5t/sling 15 moves * 5t = 75t/hour

(7) Paper Products (kraft paper, newsprint paper)

These commodities are enveloped with paper. Roll clamp forklifts should be used to handle the cargoes both at quayside and in warehouses/sheds.

Cycle Time : 3.5 minutes (by belt sling) 17 moves/hour

Productivity : 2 rolls/sling = 3t/sling 17 moves * 3t = 51t/hour

(8) Paper pulp

This cargo is enveloped with paper. Bale clamp forklifts should be used to handle the cargoes both at quayside and in warehouses/sheds.

Cycle time : 3 minutes (by rope sling with hooks) 20 moves/hour

Productivity : 10 bales/sling = 3t/sling 20 moves * 3t = 60t/hour

The above figures can be achieved under the ideal conditions. Actual productivity may be lower due to the local conditions, e.g. operators' skill, climate, facilities and equipment. However, it is necessary to raise the productivity and the throughput to the target level in the long run.

The overall throughput depends on not only the productivity at the quayside but also the productivity of transfer from quayside to storage area (open yards or warehouse/sheds). From this point of view, it is advisable to promote the establishment of the integrated terminal operators mentioned earlier.

Currently, operation is performed only at the first shift, from 8:00 to 16:00 (lunch time 12:00–13:00) and exceptionally performed at the second shift, from 17:00 to 21:00, if a shipping agent requests and pays extra fee. Extending the operation time can increase the throughput per day, shorten the berthing time and reduce the costs of vessels. To attract shipping lines, operation at the second shift should be always performed without extra payment.

18.5 Measures to Mitigate the Impact on Barge Operators

Currently, some cargoes including sawn timber and dust cargo such as phosphate and clay are discharged from ocean-going vessels onto barges in the inner harbor of Alexandria Port. And then they are landed on some berths within the port or directly hauled inland through Nabaria Canal. (The process is reversed in the case of export.) In the stage of the Master Plan, those cargoes are planned to be discharged/loaded at a berth from/onto an ocean-going vessel so as to enable economical, swift and safe operations with less risk of cargo damage for shippers/consignees and less environmental impact on the water areas in the harbor. In other words, it is proposed to replace the current barge operations within the harbor by quayside operations at least in the long term. To meet the increasing demand for handling long/heavy cargoes including sawn timbers and simultaneously enable the replacement of the barge operations by quayside operations, the construction of a new multi-purpose terminal is proposed by this study.

In the replacement mentioned above, the mostly small-sized barge operators will have to acquire new licenses to conduct quayside stevedoring and barge skippers will have to be retrained for land work. To avoid social unrest that could result from an abrupt loss of jobs, the conversion of barge operators must be done gradually and prudently. In this regard, port development by APA can make the conversion smoother by attracting a larger amount of port cargoes and generating more port-related job opportunities. In addition, the other governmental authorities are also required to make it easier for the mostly small-sized barge operators to become eligible licensees for stevedoring through making a joint cooperation with sufficient capital, if necessary.

In this view, in the stage of the Short-Term Plan, the barge operations are planned to be kept at the present level and only the incremental volume of the said cargoes is planned to be received by quayside operations. Although the barge operations are planned to be kept at the present level for the time being, the current landing places and basins for barges, viz. berths No.57-61, need to be relocated elsewhere prior to constructing a multi-purpose terminal.

18.6 Port Environmental Improvement Action Plan

18.6.1 Introduction

The Alexandria port water and sea bed material are severely polluted and it would require genuine concerted effort by the Alexandria Port Authority (APA) to reverse this seeming trend of ever continuing indiscriminate disposal of wastes. At first pollution control due to the direct ship movement and cargo handling (in other words due to direct port operational activity) be given the highest priority. This is in due consideration to the basics of pollution control, “pollution control always begins at home”. This is identified as the basic step in realizing long-term port water environmental improvement.

This is not to recognize the importance of controlling and regulating the external elements of pollution source entering into the port water environment. However, APA can only gain the required legal and moral authority to force control of external pollution source when it demonstrates itself as an entity having “Corporate Environmental Ethics (CEE)” by controlling its own pollution. External pollution source can not justify inaction in the part of APA to strive to become an entity having CEE.

It is further noted that with the progressing sewerage development of the city, the discharge of untreated wastewater into the port water environment, the external pollution source, has been steadily declining.

18.6.2 Port Pollution Mitigation Programs

(1) Ballast and bilge waste treatment system

The Environmental Law of Egypt (Law. No.4/1994) clearly stipulates the provision of ballast and bilge waste treatment system (Articles 56&68 of Section3, Chapter1) by all major ports of Egypt (ref. Also section 3.3.1 of Chapter3). Hence APA is legally bound to provide ballast and bilge waste treatment plant.

With due consideration to this legal requirement and as well the means of providing the basic environmental pollution control infrastructure and also for promoting CEE, Ballast and Bilge Waste Treatment System is provided by this master plan to treat the ballast and bilge waste generated in the port except the petroleum basin.

It is noted that the ballast and bilge waste generated at the petroleum basin is directly collected and conveyed for independent treatment by the Alexandria Petroleum Corporation (APC). It is presumed that APC would continue to provide independent treatment for the ballast waste generated at the petroleum basin throughout the planning frame of this master plan (2017).

(2) Sewerage management improvement in port area

Reception facility and its temporary storage to accept sewage from ships need to be provided by the port. Since the collected sewage will be disposed into the city sewerage system no specific sewage treatment plant for the port is required. The necessary facilities to convey the collected sewage to the city sewerage system is only required.

Moreover all wastewater outlets from administrative and other operational facilities of the port shall be connected to the city sewerage system and no out-fall into the port waters be permitted. There are some sewage out-falls still discharging directly into the port waters. It is presumed that some of these out-falls carry significant quantity of untreated wastewater discharged from the port administrative buildings and other port facilities, though external sources also may be involved. It is emphasized that untreated wastewater discharged by the port facilities into the port waters also pollution source due to direct port operational activity.

Anyhow improvement plan for any port berth area shall automatically incorporates the sewage (wastewater) out-falls in the berth area concerned, if any, to be redirected to the city sewerage system. It is recommended that the port (APA) shall formulate a direct sewage out-fall elimination plan into the port water environment in coordination with the relevant concerned authorities like the local municipality and the sewerage management authority of Alexandria, AGOSD (Alexandria General Organization for Sanitary Drainage).

(3) Solid waste management of port facilities and ships

Solid waste transfer stations, one each in Alexandria port and Dekheila port, to temporarily store solid waste generated both from the administrative buildings and shipping and cargo handling activity is recommended to be provided. Transportation to the transfer station may be independently conducted by shipping agents, but APA should have the necessary facilities to provide solid waste hauling service for a fee, if requested by a ship. Transportation of solid waste to final disposal site will be the responsibility of APA, which may also be assigned to the local municipality in the form of a co-operative agreement. Independent transportation of solid waste to final disposal site by shipping agents shall be abolished to ensure proper final disposal of solid waste.

(4) Institutional and port surveillance and management aspects

It is strongly recommended that a new general management section be established in the APA administrative structure solely being responsible for “Port Safety and Environment”. The section will be responsible for the management of all dangerous cargo terminals, including the new dangerous cargo terminal proposed in Dekheila port by this master plan and the petroleum basin.

Moreover this new management section will be responsible for the entire waste management of the port, both due to direct operational activity of the port as well as indirect non-port activity, as elaborated in the foregone items (also refer to section 3.3 of Chapter3). Also it would be responsible for the surveillance of ships to ensure that they dispose of the wastes as designated and nothing is dumped in the port waters with no impunity.

The management section of Port Safety and Environment will have the necessary facilities to conduct periodic cleanup of the port waters of floating oils and other debris and to conduct surveillance patrolling of port water environment. With this new institutional formation, it is expected that CEE (Corporate Environmental Ethics) could be instilled in the administrative structure of APA.

Chapter 19 Initial Environmental Examination (IEE)

19.1 Overview of the Master Plan

The target year of this master plan and rehabilitation scheme of the Greater Alexandria Port is 2017. The master plan is aimed to enhancing the overall operational efficiency and safety of the port facilities including the rectification of deficiency in the port environmental (pollution control) infrastructure. In particular the necessity of the port to have its own ballast and bilge waste treatment plant confirming to the Environmental Law of Egypt (Law No. 4/1994) is emphasized (refer to section 3.3.1 of Chapter3). It is noted that the port is yet to have a ballast and bilge waste treatment system and hence a ballast and bilge waste treatment plant is proposed as a very significant environmental infrastructure component of this master plan.

A detailed description of the facilities of the master plan is presented in Chapter 15. The port rehabilitation master plan until its planning frame of the year 2017 basically relies in increasing the productivity and safety of ship movement and cargo handling, with not very significant provision of new cargo handling civil infrastructure such as new port terminals. This is in consideration to the low cargo handling efficiency at present that could be increased essentially with the provision of appropriate additional cargo handling machinery and equipment.

The significant civil infrastructure development and rehabilitation project components of the master plan are mostly confined to the Alexandria Port area only. This is due to the fact that the new Dekheila Port is evaluated to have adequate infrastructure facilities to meet the shipping and cargo demand throughout the planning frame of the master plan (2017).

The significant new civil infrastructure development/rehabilitation projects planned in the Alexandria Port area are Multipurpose Terminal Project, New Port Road Bridge Project, Deep Water Coal Berth Project and Grain Terminal Modernization Project. Details of these project components could be referred to in sections 15.8 through 15.12 of Chapter 15 on Master Plan of the Greater Alexandria Port.

It is noted as per the cargo demand forecast until the year 2017 by this master plan containerized cargo transportation will increase at a much higher rate in comparison to other types of cargo. Still this master plan is made on the presumption that the present container handling capacity of Alexandria port and Dekheila port will be utilized to its full capacity by the year 2017 and no additional container handling terminal is planned.

The Multipurpose Terminal Project is basically aimed at handling, on a priority basis, specialized conventional cargo such as long, heavy and bulky cargo, thereby increasing the overall efficiency of conventional cargo handling in the Alexandria port.

It is noted that concerning liquid bulk handling, the existing facility is adequate to meet the forecasted demand growth until the year 2017, provided the existing broken facilities in the petroleum basin is repaired and made functional. Accordingly liquid bulk handling improvement is not considered as a significant project component and hence not targeted in this initial environmental examination (IEE).

Zoning of the port activities as proposed by this master plan for Alexandria Port and Dekheila Port is shown respectively in Figure 15.2.1 and Figure 15.2.2 of Chapter15.

19.2 Initial Environmental Examination

19.2.1 Introduction

This initial environmental examination (IEE) for the proposed master plan of the Greater Alexandria Port is made on the presumption that the facilities of the master plan are implemented as planned.

It is noted that the proposed port facility improvement of the master plan is basically aimed at increasing the efficiency and safety of the port operation.

This increased efficiency of the port operation in combination with increased containerization of the cargo handling would essentially lead to decrease in cargo damage and the subsequent reduced loss of product (cargo) in cargo handling operation. This in itself would lead to decrease of potential pollution and environmental deterioration inherent to loss of product in port area including port water environment and hence to long term environmental improvement of the port.

19.2.2 Baseline Environment of the Port

The baseline environmental condition of the port area is described in details in Chapter3. Basically it is evident simply from visual observation that the port water quality is severely deteriorated. This is further confirmed from the sampling results of sea water and seabed material quality conducted by the study team (refer to Table 3.4.1 and Table 3.4.2 of Chapter3 for the analytical results of port water and seabed material quality).

The causative elements for this severe water pollution problem of the port are very complex both due to the very long history of port operation as well as a variety of potential pollution sources involved. The variety of pollution sources is both due to direct port operational activity as well as non-port related activities attributed to land based industrial, agricultural and domestic pollution load run-off into the port waters. The environmental issues concerned to these pollution sources of direct port operational activity and that of non-port activity are illustrated respectively in section 3.3.1 and section 3.3.2 of Chapter3.

It is noted that with the progressing sewerage development of the Alexandria city, the pollution sources of non-port activity have been steadily declining, though there are still some sewage out-falls discharging directly into the port water environment. Even concerning these remaining sewage out-falls they are suspected of discharging significant quantity of wastewater originating from the land based port administrative buildings and other facilities directly concerned to port operational activity. So it is high time for the port authority (APA) to undertake its own clean-up measures to control the pollution of port water environment due to direct port operational activity. In this respect the requirement of the port to have its own ballast and bilge waste treatment plant as stipulated by the Environmental Law (Law No. 4/1994), is emphasized as the first step in controlling port water pollution due to direct port operational activity.

The potential long-term environmental impact consequent to the implementation of this master plan is evaluated as beneficial in an overall sense as illustrated in the subsequent sections. The impacts are illustrated distinguished between social impacts and other impacts.

19.2.3 Social Impacts

All the facilities of the proposed master plan are confined within the present administrative boundary of the Greater Alexandria Port. Moreover, all land and the offshore areas of the port facility expansion and rehabilitation by this master plan belong to the port authority (APA). Accordingly, no land acquisition or resettlement of population for the implementation of the facilities proposed by the master plan is required.

Based on the above aspects, potential adverse social effect by the implementation of this master plan is evaluated as insignificant.

19.2.4 Other Impacts

Prior to attempting to evaluate the long-term environmental impacts due to this master plan, it should be emphasized that Alexandria port, if not the Dekheila port, is in existence for a very long time. This very long time existence of the port has irreversibly changed the environmental condition of the port on a long-term basis.

With due consideration to this baseline environmental condition as a functional port, it could be visualized that the proposed improvement plan of the port by this master plan, leading to both improved port navigational and operational safety as well as port operational efficiency, would result in improved overall long term environmental condition of the port.

The most significant port operational and safety improvement realized consequent to the implementation of this master plan and the resultant environmental improvement, with due consideration to potential adverse environmental effects, is illustrated hereunder for each significant planned component of the master plan.

(1) Increased containerized cargo handling

Container handling is estimated to increase from about 0.4 million TEUs in 1997 (present) to 1.5 million TEUs in 2017, an increase of about 4 times, by this master plan. This increase will be accommodated in the existing Alexandria container terminal and Dekheila container terminal with the provision of additional container cargo handling machinery only. The additional container cargo handling machinery to be provided are Quay-side Gantry Cranes (QGCs), Rubber Tired Gantry cranes (RTGs) and tractor-trailers.

Increased containerized cargo will lead to safer cargo handling with negligible cargo damage and hence potential port water pollution due to loss of product (cargo). Hence as far as the potential port water pollution due to cargo handling is concerned increased containerization will result in decreased port water pollution due to the cargo handling activity.

Still it is noted that increased cargo handling machinery will lead to increased exhaust gas emission due to the operation of machinery at the terminals and hence potential increase in air pollutants. However, the potential air quality deterioration due to increased emission of air pollutants is evaluated as insignificant in consideration to the favorable topographic condition of the terminal areas having open air environment with active exchange of air between land and sea. It is noted that in general since ports are located invariably along sea coast, ambient air quality deterioration is not a serious concern due to their favorable location having active exchange of air between land and sea and the resultant diffusion and dispersion of air pollutants.

(2) Rationalized conventional cargo handling

The master plan envisages rationalization of conventional cargo handling in the Greater Alexandria port (Alexandria and Dekheila ports) which is handled in a haphazard manner at present resulting in significant loss of product (cargo), principally during loading and unloading operation, not to mention the inefficient nature of cargo handling. This invariably leads to pollution of port water as well in addition to the primary economic loss due to loss of product and inefficient cargo handling.

The rationalization proposed by this master plan principally separates the conventional cargo into two groups by separating long, heavy and bulky conventional cargo from the rest. The proposed Multipurpose Terminal Project described in section 15.8 of Chapter 15 is intended specifically at handling long, heavy and bulky conventional cargo. The zoning plan of the port shown in Figure 15.2.1 and Figure 15.2.2 of Chapter15 shows the specific zones reserved for handling long, heavy and bulky conventional cargo from the rest of the conventional cargo.

The following overall environmental benefits are realized consequent to this rationalized conventional cargo handling;

- Decreased loss of product (cargo) and the resultant decrease in potential port water quality deterioration and as well increased efficiency and safety in conventional cargo handling.
- Rationalized timber cargo handling by this master plan, which is also grouped under the category of long, heavy and bulky conventional cargo, will lead to direct unloading of cargo from the ship to the terminal. This is in contrast to the present inefficient practice of intermediate unloading of timber cargo to barges from the ship and then unloading from the barges to the terminal. The improved direct unloading of timber cargo to terminal will also mitigate the loss of timber into port water and the resultant pollution and aesthetic deterioration of port water environment during the intermediate unloading to barges at sea from the ship.

(3) Improved dry bulk cargo handling

The most significant improvement proposed by the master plan concerning the dry bulk cargo handling targets the handling of grain and coal. It is noted that the overall dry bulk cargo handling in the Greater Alexandria Port (Alexandria and Dekheila ports) is forecasted to increase from 10.6 million tons at present (1997) to 16.9 million tons by the year 2017, an increase of about 1.5 times, by this master plan.

Establishment of the modernized grain terminal to facilitate effective utilization of the existing grain silos near the petroleum basin of the Alexandria port is proposed as the improvement plan for handling of grain. Two units of highly efficient mechanical unloaders will be provided to ensure efficient handling of grain cargo. The modernized grain terminal will be deepened to have a water depth of 14m to provide sufficient draft for dry bulk grain carriers (refer to section 15.11 of Chapter15 for description of the project).

The improvement plan contemplated for coal handling is the deepening of the existing coal basin in the Alexandria port to 14m water depth to have sufficient draft for dry bulk carriers, similar to that of the above modernized grain terminal (refer to section 15.10 of Chapter15 for description of the project).

The environmental benefit realized due to the improved and efficient handling of dry bulk cargo of grain and coal would encompass the mitigation of both the port water and air pollution. This is due to the fact that any loss of dry bulk material during cargo handling has the potential to generate dust emission, an air pollutant, in addition to causing potential port water pollution due to loss of product (cargo).

The direct access of dry bulk carriers to terminals of both the grain terminal and coal terminal would help reduction of loss of product in cargo handling and hence the mitigation of potential port water and air pollution. Moreover, the highly mechanized unloading of grain in the proposed modernized grain terminal would further ensure the mitigation of product loss and the resultant air pollution due to dust emission.

(4) Improved and safe handling of dangerous cargo at new terminal

A new terminal exclusive for the handling of dangerous cargo will be established, by this master plan, at the most remote and spacious location of the developing port of Dekheila. This location is far away from the highly congested Alexandria port that is further surrounded by developed urban and commercial development of the city. The proposed location of the new dangerous cargo terminal is adjacent to the container terminal of the Dekheila port as shown in the Dekhiela port zoning map of Figure 15.2.2 of Chapter15.

This new terminal will also replace the fertilizer (ammonium nitrate) and sulfur handling wharf located at present in the very center of the congested Alexandria port area near the coal basin. These cargoes also fall into the category of dangerous cargo.

The enhanced safety and security of dangerous cargo handling and the resultant mitigation of potential handling damage and leakage of dangerous cargo, having higher environmental hazard in comparison to normal cargo, is evaluated as a very significant port safety and environmental benefit of the proposed new dangerous cargo handling terminal in Dekheila Port.

(5) Improved port transportation network

The improvement in port transportation network by this master plan basically targets the congested internal road network of the Alexandria port. The planned replacement of the old bridge, located near birth no.32 in the hub of the conventional cargo handling area of the Alexandria port, by the New Port Road Bridge Project (refer to section 15.9 of Chapter15) is also considered as an important integral component of the port transportation network improvement plan.

It is noted that the improved transportation network within the port would lead to efficient transportation of cargo and others thereby resulting in decreased in traffic congestion, an aesthetic nuisance. Moreover, in general, reduced traffic congestion would lead to reduction in noxious gaseous exhaust emission from vehicles as well, resulting in improved ambient air quality, an environmental benefit.

(6) Rehabilitated and improved ship navigation system

The ship navigation system for the Greater Alexandria Port instituted in the port control tower located in the container terminal of the Alexandria port is not functional at present, posing very significant threat to ship navigational safety, not to mention the effect of inefficient ship movement.

In order to rectify this very important ship navigational issue of the port, a modern VTMS (Vessel Traffic Management System) type navigation system will be instituted by this master plan. The environmental benefit of ship navigational safety is very obvious and does not require any further elaboration.

(7) Ballast and bilge waste treatment system

The proposed ballast and bilge treatment plant by this master plan in itself is an environmental (pollution control) infrastructure development project aimed at mitigating potential ship related oil pollution due to indiscriminate disposal of ship based oily waste into the port waters. It is noted that the port water is visibly polluted with floating oil, which is an aesthetic nuisance in addition to be a water pollution issue.

This is considered as the very first step in controlling potential pollution due to activity directly concerned to the operation of the port. Moreover, the provision of ballast and bilge waste treatment system by the port is to meet its legal obligation as mandated by the Environmental Law of Egypt (Law No. 4/1994).

It is noted that the proposed ballast and bilge waste treatment plant is intended at treating the waste disposed by all ships and vessels berthed in all terminals of the

Greater Alexandria Port (Alexandria and Dekheila ports), except the petroleum basin. The ballast and bilge waste generated at the petroleum basin is being independently collected and treated by the Alexandria Petroleum Corporation (APC). It is presumed that APC will continue to treat the waste generated at the petroleum basin throughout the planning frame of this master plan (2017).

19.3 Conclusion

It is concluded that the proposed master plan targeting principally the enhancement of operational efficiency and safety of the Greater Alexandria Port will lead to overall long-term environmental improvement of the port as well in tandem, in comparison to the baseline (present) environmental condition of the port.

Still, the most crucial constraint in achieving these multiple benefits of port operational safety, efficiency as well as environmental improvement, even if the required financial resource allocation is met, is the effective enhancement of the port operational management, including the human resources development. This would ensure proper operational management of the facilities provided by the master plan and hence the realization of multiple benefits including effective port environmental improvement.

A summary of environmental impact evaluation of the port rehabilitation master plan is shown in Table 19.1. It is emphasized that this environmental impact evaluation is based on the long-term condition of the port followed with the implementation of the individual project components of this port rehabilitation master plan.

Table 19.1 Environmental Impact Evaluation of Port Rehabilitation Master Plan

Significant Activity	Concerned Significant Port Env. Component			Adverse Effect		Benefical Effect		Remarks
	Water	Air	Land	S	I	S	I	
1 Social Impact Activity								
1.1 Land Acquisition and Resettlement	—	—	✓	—	✓	—	✓	No requirement for land acquisition and resettlement
2 Other Impact Activity								
2.1 Increased containerized cargo handling	✓	✓	—	—	✓	✓	—	Improved port operational management be ensured
2.2 Rationalized conventional cargo handling	✓	—	—	—	✓	✓	—	
2.3 Improved dry bulk cargo handling	✓	✓	—	—	✓	✓	—	
2.4 Improved and safe dangerous cargo handling at new terminal	✓	✓	—	—	✓	✓	—	
2.5 Improved port transportation network	—	✓	—	—	✓	✓	—	Improved traffic operational management is required
2.6 Rehabilitated and improved ship navigation system	✓	—	—	—	✓	✓	—	
2.7 Ballast and bilge waste treatment system	✓	—	—	—	✓	✓	—	The project component is specific to port water pollution control

Note : S:Significant; I:Insignificant; —:not significant; ✓:related / significant