2.3 Master Plan of Latakia Port

2.3.1 The Basic Concept of the Port Development

The purpose of the Master Plan (target year 2010) is to serve as a target and guideline for phase plans including the Short-Term Plan (target year 2003). In making the Master Plan for Latakia Port, the following problems on the current port operations are recognized:

(1) Container-handling

Despite the recent sharp increase in the number of containers through Latakia Port (134,000 TEUs in 1994), quay-side container gantry cranes are not yet installed, causing inefficient container-handling and consequent long berthing times of costly container vessels. In addition, the modern terminal operation system has not yet been introduced at Latakia Port.

(2) Grain-handling

Notwithstanding the large amount of grains to be handled at Latakia Port, the grain-handling capacity of its existing grain-terminal is much lower than required. The existing terminal has no unloader and shiploaders with small grain-handling capacity are obsolete. The water depth along the berth is only 8.5 m.

(3) Handling of conventional cargo

Some of quay-side cranes are already obsolete and hence do not function well. In addition, there is found a shortage of other cargo-handling machines such as forklifts.

(4) Passenger service

The existing passenger terminal is placed on the berth at the old port area without a passage connected to the outside of the port to separate the flows of passengers and cargo.

In the meantime, the volume of cargoes to be handled at the port is expected to continuously increase in the future, being estimated as 10.8 million tons in 2010, 3.8 times as much as the volume in 1994.

Thus, to resolve the present problems in Latakia Port and meet increasing demand for the port in the future, the following concept of the development of Latakia Port is proposed:

(1) Establishment of a full-scale new container terminal
(2) Modernization of the existing container terminal

(3) Introduction of a closed terminal system in the container terminals
(4) Construction of a new grain terminal
(5) Modernization of the existing grain terminal
(6) Construction of additional general cargo berths
(7) Preparation of required cargo-handling machines
(8) Construction of a new passenger terminal having a direct access to the outside of the port

2.3.2 Usage Plan for the Existing Port Facilities

In order to decide the appropriate number of berths in the target year, vessels are divided into ten types, then the estimated cargoes are distributed to each type of vessel. The vessels are distributed on the following premises considering the actual operations and records at similar ports.

Table 2.3.2-1 Usage Plan of the Berths by Vessel Type

Vessel Type	Vol.	Ve.Cap.	No Ve.	H Prod.	Quay No.
General (var.)	1,156	1,390	832	33	1,2,3,4,5,6,7,8,9,10,11,12,N1*,N2,N3
Foodstuff	452	1,950	232	35	1,2,3,4,5,6,7,8,9,N1,N2,N3
Steel	617	1,880	329	80	10,11,12,N1
Wood	500	1,370	365	22	7,8,9,10,11,12,N2
Car	281	340	827	15	1,2,3,4,5,6,7,8,9,10,N3
Chemicals	250	2,550	99	37	1,2,3,4,5,6,7,8,9
Ro/Ro	252	990	255	36	5,13
Grain (import)	440	27,000	17	236	Existing,12A
Grain (export)	1,200	19,500	62	320	Existing,12A
Container	712*	830	858	48	14,NC1*,NC2

Note : Vol.: Cargo Volume(Thousand tons), Ve.Cap.: Average Vessel Capacity(tons), No Ve.: Number of Vessels, H Prod.: Cargo Handling Productivity(ton/hr) *(1000TEUs) *N1(New Berth No.1) *NC1(New Container No1)

As for the grain carriers, three cases are considered.

Case 1 (Concentration): One berth, No.12A is used for grain carriers. Cargo handling productivity is 403 ton/hr for import grain, 422 ton/hr for export grain.

Case 2 (Concentration): The same berth as in Case 1 is used. Cargo handling productivity is 280 ton/hr for import, 422 ton/hr for export grain.

Case 3 (Two Berths): Grain carriers can berth at either the existing terminal or the new terminal. Cargo handling productivity is shown in Table 2.3.1.

The usage plan was analyzed by using simulation method, excluding container

terminals. In the study, reference to the actual statistical distribution forms for ship arrivals and mooring periods at the Latakia Port is made. The port operates 24 hours a day and 285 days per year.

The results of the simulation are as follows:

		Average Waiting Time(hours)
General(Var.)	:	5.5
Foodstuff	:	7.9
Steel	:	7.2
Wood	:	8.9
Car	:	11.1
Chemicals	:	16.4
Ro/Ro	:	18.8
Grain(Case 1)	:	29.2
Grain(Case 2)	:	50.4
Grain(Case 3)	:	4.3

2.3.3 Container Terminal Plan

(1) Establishment of a New Container Terminal

The number of containers to be handled at the container terminals in 2010 is estimated as 712,000 TEUs. To receive the forecast container traffic, it is proposed to establish a new container terminal (Terminal-2) north of the existing terminal together with the modernization of the existing container terminal at the new port area. The main facilities of the new terminal are summarized as follows:

- Infrastructures
  - Berths: Total berth length: 700 m
    Water depth: 14 m
  - Marshaling yard: 24.5ha (700mx350m)
  - Stuffing/unstuffing yard
  - Off-dock empty container storage yard

- Upper-structures
  - Container freight station (CFS)
  - Terminal control office
  - Gate house
  - Repair shop for container-handling equipment
  - Maintenance shop for container boxes

- Container-handling equipment
  - Quay-side container gantry cranes: 4 units
  - Straddle carriers, forklift trucks and tractors/trailers

(2) Modernization Plan of the existing Terminal

To increase container-handling capacity of the existing container terminal (Terminal-1), it is necessary to modernize the existing terminal through the installation of quay-side container gantry cranes, rearrangement of yard facilities and introduction of the closed terminal operation system.

2.3.4 Grain Terminal

A grain terminal is located in the old port. However there are the following problems at the terminal.

i. The terminal capacity is insufficient for the future demand
ii. It is impossible to unloading from ship and the loading capacity(150 t/h x 2 units) is shortage
iii. The ship size is limited and smaller because the berth depth is less than 8.5m.
iv. The available land behind the berth is not sufficient for expansion of silo

Further more it is impossible to stop the handling operation during the existing terminal reconstruction.
The study team have made three alternative plans (case 1: one berth system and large handling capacity, case 2: one berth system and medium handling capacity, case 3: two berth system)
and studied from economical point of view. Two berth system is finally selected and its outline are as follows: Silo capacity (total 100,000 t: new port 65,000 t, existing 35,000 t) Handling capacity (new port 400/400 t/h x 2 units, existing 400/200 t/h x 2 units)
Remarks: The silo at the existing terminal will be only used without break.

Costs of three cases described in Chap.2.3.2 are compared.

Cost Comparison : (Unit:US$ million, Discount Rate 0.1, Project Life 30 years)

	Case 1	Case 2	Case 3
Construction Cost			
Berth	-	-	12.1
Silo	6.2	6.2	4.0
Machine Tower	2.9	2.7	4.8
Loader/unloader	9.7	7.3	10.6
Handling equip	28.4	26.5	35.0
Waiting Cost	16.5	25.7	0.2
Total	63.7	68.4	66.5
Index	100	107	104

Total cost of Case 1 is the lowest and Case 3 is the second lowest. However, the difference between all alternatives is under 5 percent. Moreover, Case 3 has other advantages. i.e. it is available for two grain vessels simultaneously.

2.3.5 Conventional Terminal and Other Facility Plan

(Conventional Terminal)
In order to decide the proper number of new berths, the original plan (add three new berths- Case 1) is compared with other alternatives -- add two berths (Case 2) and add four berths (Case 3).

Costs consisting of waiting cost and berth construction cost of each case are as follows:

	Cost Index (waiting cost + berth construction cost)
Case 1	100
Case 2	145
Case 3	102

Consequently, Case 1 is selected as the most economical plan. The depth of the new berths is decided based on the distribution of present general cargo vessels.

(Passenger Terminal)
At present, regular passenger vessel serves between Alexandria and Latakia weekly. The average number of passengers is around 50. In addition passenger vessels call Latakia Port from Germany, Russia, France and Greece irregularly. Average number carried on these vessels is around 500.

Considering future increase of tourism and business activities, new regular service route to Cyprus and Libya will be increased in addition to the existing line, and irregular route vessels will visit Latakia twice a month on average.

Number of passenger will be (50+50+500) X 50 = 30,000 (Regular Service)
500 X 2 X 12 = 12,000 (Irregular Service)
Total Number = 42,000

2.3.6 Cargo Handling System

There are two types of cargo handling systems(excluding container cargoes and grain) at Latakia port. One is direct delivery/receiving and the other is delivery after custody in storage facilities in the port area.

As to the cargo flow of the former system(direct delivery), the cargo is first unloaded from ship onto trucks or rail wagons. Then, the cargo is sent to storage facilities of consignees.

The cargo flow of the latter system(delivery after custody in the storage facilities) has four steps, unloading from ship to apron, transferring from the apron to the storage facilities, storage at the facilities and delivery from the port.

The former system has the following demerits:

1. Many trucks are necessary for delivery of cargo in general.
2. Cargo handling efficiency is low because the landing of cargoes by cranes onto trucks/rail wagons is very difficult due to the small working area of each truck/rail wagon.

The major demerit of the latter system is the relatively large quantity of cargo handling equipment required, especially forklift and mobile cranes.

In the master plan, three shift system for cargo handling is adopted, namely, from 7.00 a.m. to 3.00 p.m. for first shift, from 3.00 p.m. to 11.00 p.m. for second shift and from 11.00 p.m. to 7.00 a.m. for third shift. Break time(about 15 minute) is set at the middle of each shift, that is 11.00 a.m., 7.00 p.m., and 3.00 a.m..

2.3.6.1 Cargo Handling Systems in the Master Plan for Each Commodity

(1) General Cargo for import

In the master plan, 100% of bagged cargo and cases should be pelletized in the hold. Then, almost cargoes except dangerous cargoes should be transported to storage facilities after being unloaded from ship to apron. But, some cargoes are delivered from the apron to consignees directly.

The cargo handling equipment for bagged cargo at apron and sheds is mainly forklift. If these sheds are located near the berth which is concerned with the cargo handling, the cargoes are transported to the sheds by forklifts. If the location of the sheds is not near the berth, trucks are used for transportation to the sheds. As for rolled paper, forklifts with special attachment for rolled cargo are used for cargo handling at apron and sheds.

(2) General Cargo for Export

Hundred percent of export general cargo should be stored and pelletized at sheds in the port area. Then, the cargoes are loaded by quay cranes or ship cranes.

(3) Heavy cargo

Iron & steel and other metal products are handled by trailer and heavy forklift after being unloaded from ship. Some of these cargoes are delivered from the apron to storage facilities of consignees, directly.

(4) Wooden Products

Loose lumber and timber should be secured in slings in the hold, then the cargo is unloaded onto trucks. But, bundled timber and lumber are unloaded to apron. After unloading of lumber and timber for both packing styles, almost all of these cargoes are stored at open yards in the port. But, some of them are directly delivered to consignees.

2.3.7 Access Channel and Basins

The largest vessel that moors at Latakia Port is container vessel. Its dimensions are as follows:

- Capacity : 3,000 TEUs (50,000 DWT)
- Draft : 13 m
- LOA(Length Over All) : 290 m
- Breadth : 32.2 m

Entrance to the port is at the northern end of the port. Access channel between the port entrance and the basin in front of Container Terminal-2 has 290m width with a water depth of 15m at the entrance. The width is decided as 1L(LOA of the maximum container vessel). Beyond Container Terminal-2, the width of access channel to the existing port zone becomes 260m, that is to say, navigable for a container vessel with capacity of 2,000 TEUs.

A turning basin, 580 m (2 X Vessel Length) in diameter and -14 m in depth, is planned in front of Terminal-2. Mooring basins for new container terminal, general cargo terminals and grain terminal are also planned.

Total dredging volume for these basins is 1.9 million m^3, while total reclamation volume is estimated to be 2.2 million m^3. The balance of dredged and reclaimed materials indicates that there is a small shortage.

2.3.8 Breakwaters

To determine the length of the breakwater to be extended, calmness at container berth, general cargo berth and turning basin is examined in the following 3 cases.

Plan-1 No extension (existing breakwater)
Plan-2 600m extension of main breakwater
Plan-3 600m extension of main breakwater and 900m length of sub-breakwater

Figure 2.3.8-1 shows the diffraction from SW-deep water wave. Plan-3 the case with sub-breakwater maintains the necessary calmness.

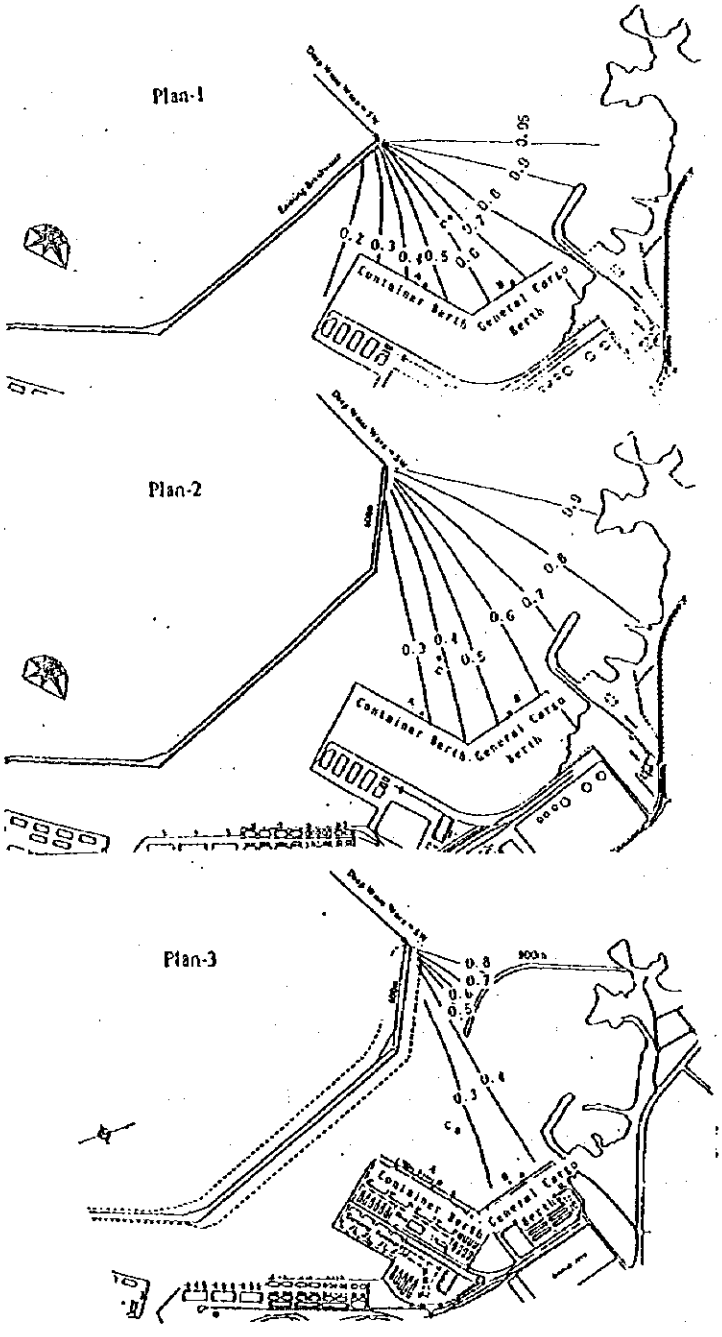


Figure 2.3.8-1 Wave Diffraction from SW Deep Water Wave

2.3.9 Access Roads and Railways

The traffic volume of vehicles originating from or destined to the port in the year 2010 is estimated to be 8,378 vehicles per day each way in total. The hourly traffic is estimated to be 1,048 each way.

Traffic volume related to container is estimated to be 1,295 per day and 162 per hour each way. Since the container operations are special compared to other cargoes, the access to the container terminal is planned separately. In order to avoid mixture of container related traffic with other traffic, access roads with two lanes are planned to enter the port at the north area of the port.

As hourly capacity of traffic volume per road lane is estimated as 600 vehicles, two lanes each way need to be shared for the entire traffic above. Since the port has two entrances, two access roads with two lanes each way are planned.

As for railway wagons, daily traffic is estimated to be 60. Since the present railway has enough capacity, the plan does not include new railways.

2.3.10 Alternative Layout Plans

Expanded facilities in the Master Plan are, container terminals, general cargo terminals, grain terminals, passenger terminal and yard for containers handled outside of the container terminals.

Three alternatives are proposed in relation to the future expansion of the port (see Fig.2.3.10-1, Fig.2.3.10-2, Fig.2.3.10-3).

- Case 1: Concentration Type: The new general cargo berths are located adjacent to the new container terminal.
- Case 2: Separate Type: The new general cargo berths are located opposite of the new container terminal.
- Case 3: Mixed Type: The area for the future container terminal is reserved between the new terminals and the new general cargo terminal.

a) Potential for Further Expansion Beyond the Target Year
In Case 1 and Case 3, expansion of the port is possible without restrictions.
A floating dock with the capacity of 100,000 DWT vessel, pier, berth and relative factories will be planned after the year 2010.
Case 1 and Case 3 are affordable for that dock.

b) Access and Land Acquisition
In Case 1 and Case 3, land acquisition and accessibility is easy, because the new port facilities are concentrated. In Case 2, the new road must be constructed only for the isolated general cargo terminals. Area of land acquisition in Case 2 is larger than that of other cases.

c) Impact of existing use

In Case 2, the area for oil storage is shifted for container storage area in the year 2010. Moreover, in Case 2, the present small vessel berths should be relocated by the year 2010.

d) Construction Cost

Result of comparison of costs is as follows:

(Unit: Million SP)

	Case 1	Case 2	Case 3
Cost Index	100	107	103

Consequently, Case 1 is the most economical among the alternatives.

LATAKIA PORT MASTER PLAN

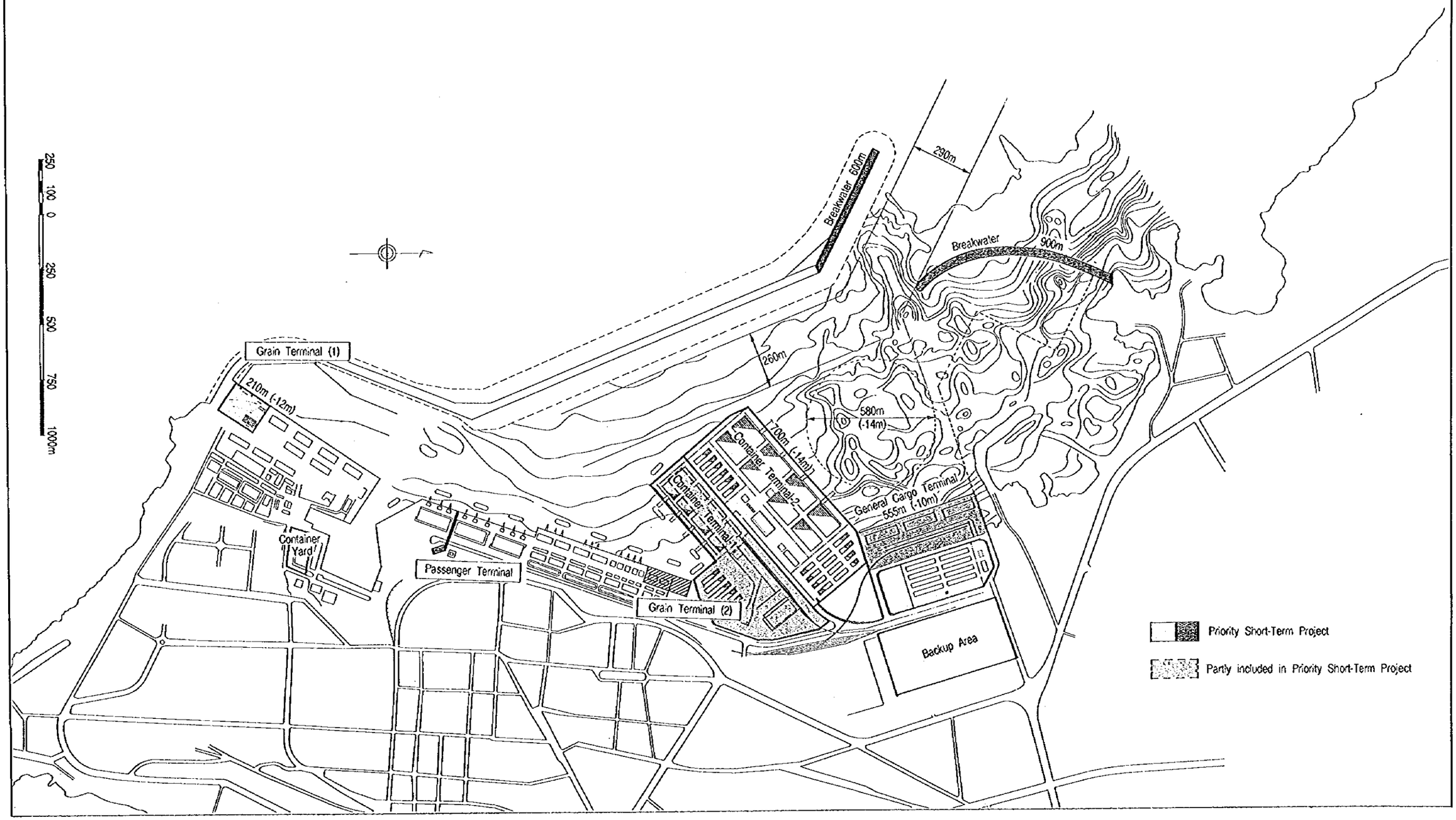


Figure 2.3.10-1 Master Plan of LATAKIA PORT - Case (1)

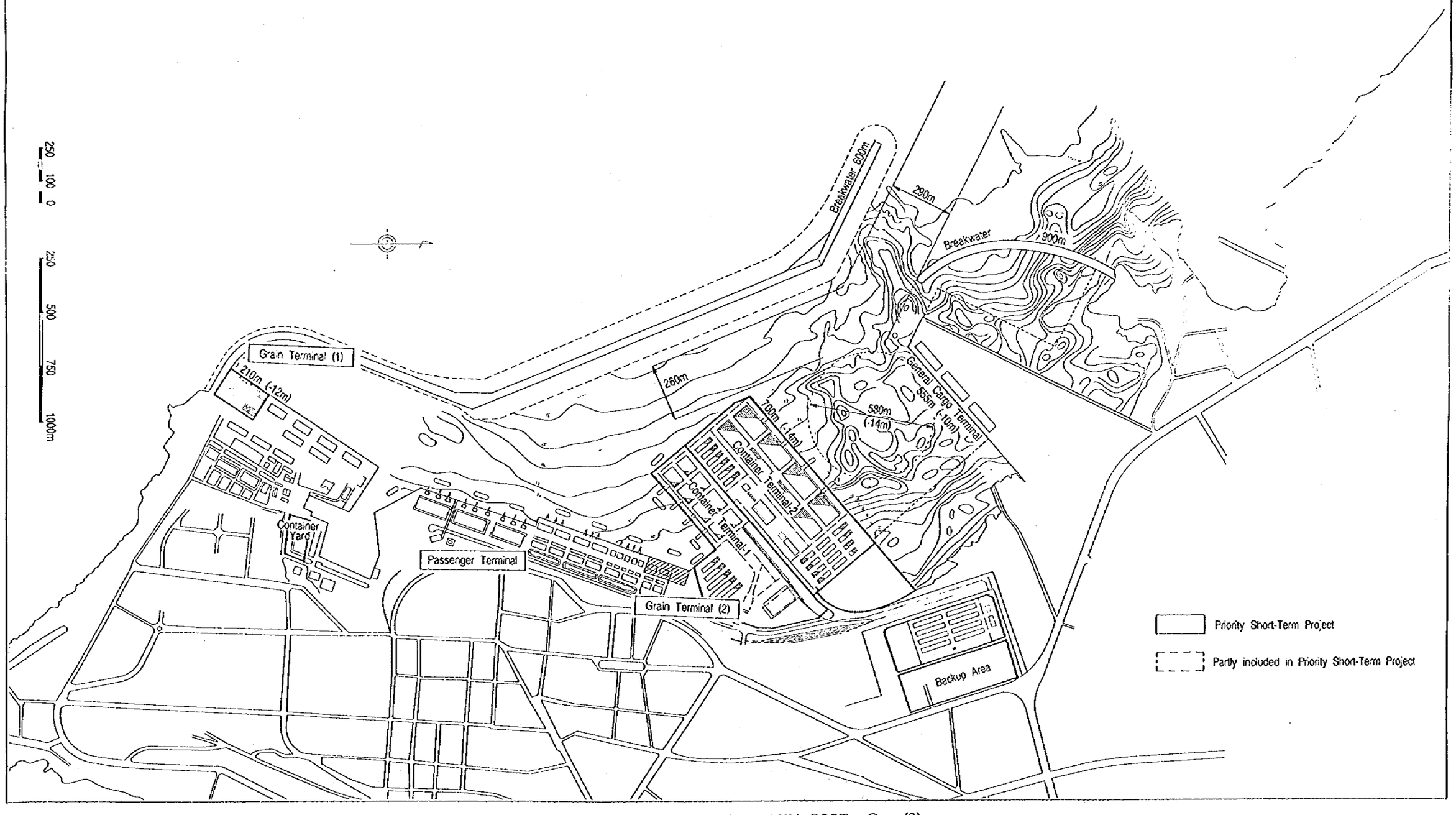


Figure 2.3.10-2 Master Plan of LATAKIA PORT - Case (2)

LATAKIA PORT MASTER PLAN

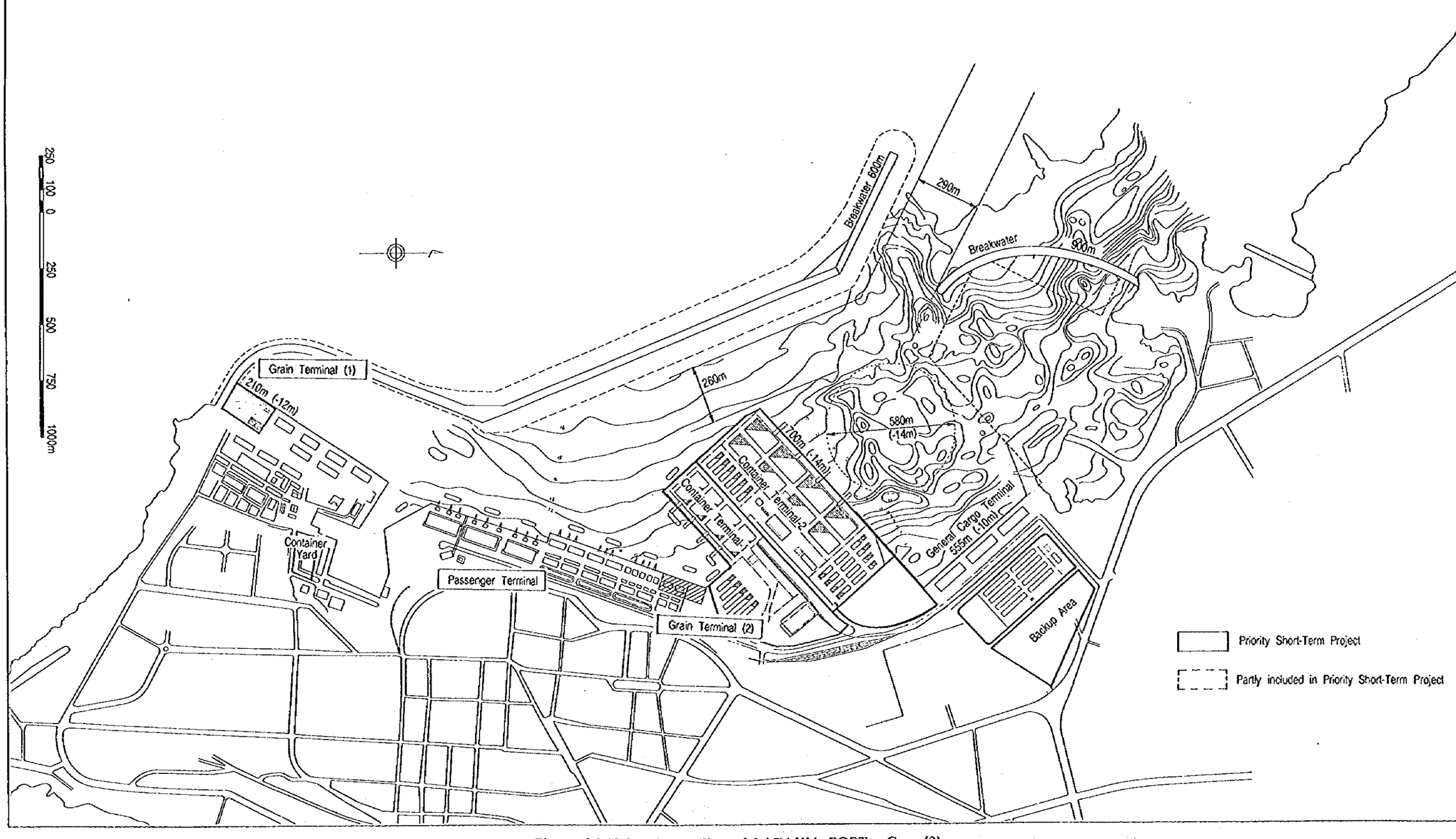


Figure 2.3.10-3 Master Plan of LATAKIA PORT - Case (3)

2.3.11 Initial Environmental Examination

The existing water quality and sediment quality were assessed by the site survey. Not all of the chemical and biological parameters are covered by standards but those which are subject to water quality guidelines have been examined. In general the water quality is acceptable. It could be classed as good quality for a port where some polluting discharges are inevitable, and the uses of the water do not need such high water quality as say bathing beaches. Areas of concern are the high sulphides and low dissolved oxygen (at one location) which together with the slightly high COD indicate that a substantial pollution load is entering the harbour. This may be due to the large number of sewage outfalls which enter the harbour, and the new planned sewage master plan should overcome these problems.

Heavy metals in the sediments are high, particularly mercury and to a lesser extent zinc. Disturbance of the seabed is to be avoided. If not possible, the disposal of any dredged material must be done in a careful way. However at the moment the intention is to use the dredged material for reclamation.

There are no environmental reasons why the planned activities should not proceed and a full EIA and remedial measures are not considered necessary. Monitoring for mercury in water during dredging is recommended as a precaution.

2.3.12 Facility Design

In the Master Plan of Latakia Port, the extension of the breakwater and the development of the berths (2 container berths and 3 general cargo berths) are planned based on the long term demand forecast.

(1) Breakwater

Design conditions at the extension area are seemed to be almost same as the existing breakwater excepting geological conditions. The maximum water depth of planned breakwater will reach to -18m depth which is deeper than the existing ones.
It is generally said that the construction cost of rubble mound breakwater in the deep water increases sharply due to the increase of construction materials. So, two alternatives, that is, rubble mound type and caisson type are proposed and investigated technically and economically.
As a result, the construction cost of caisson type is almost same as the rubble mound type. It is noticed that the caisson type breakwater has not been constructed in Syria so far, and that the caisson type has some difficulties when weak sub-soil conditions appear. But, judging from the past experience of the port construction in Syria, both types are feasible technically.
Though the final decision depends on the future subsoil survey, the rubble mound type is chosen due to its easy construction method in this study.
The standard cross section of existing breakwater is chosen for the rubble mound type. (see, Fig. 2.3.12-1)

(2) Berths

Geological conditions at the planned site will be different by location. But, existing berths at Latakia Port were mostly constructed by adopting the gravity type, that is, concrete block type excepting the inner port area where the steel sheet pile type berths were partly constructed due to the weak ground condition. In this study, standard cross sections of gravity type as similar to the existing berths are adopted assuming the sufficient bearing capacity of the sub-soil in the planned site. (Fig. 2.3.12-2)

(3) Container Yard

Cement concrete pavement is recommended for the container yard. The design loads are presumed as follows.

Forklift truck	15t
Straddle carrier	60t

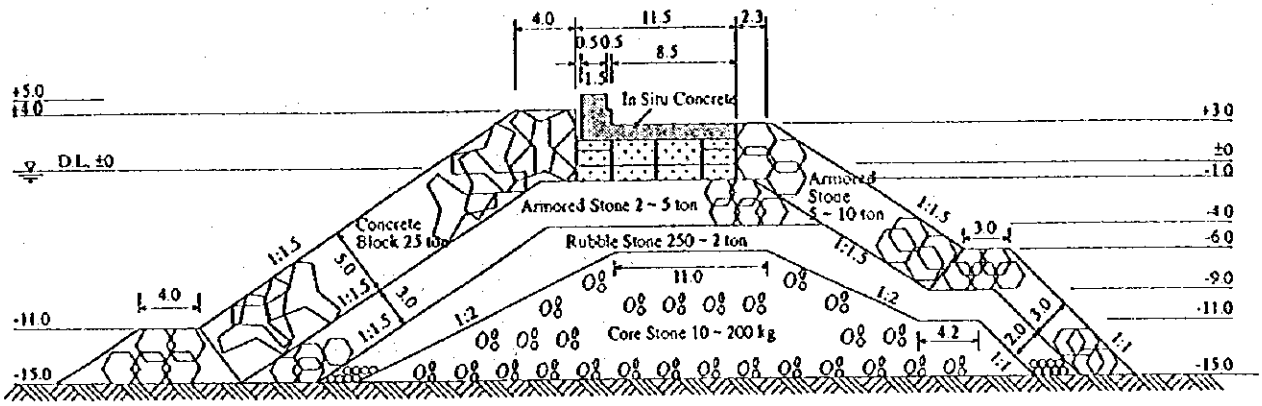


Figure 2.3.12-1 Standard Cross Section of Breakwater Rubble Mound Type (-15.0m)

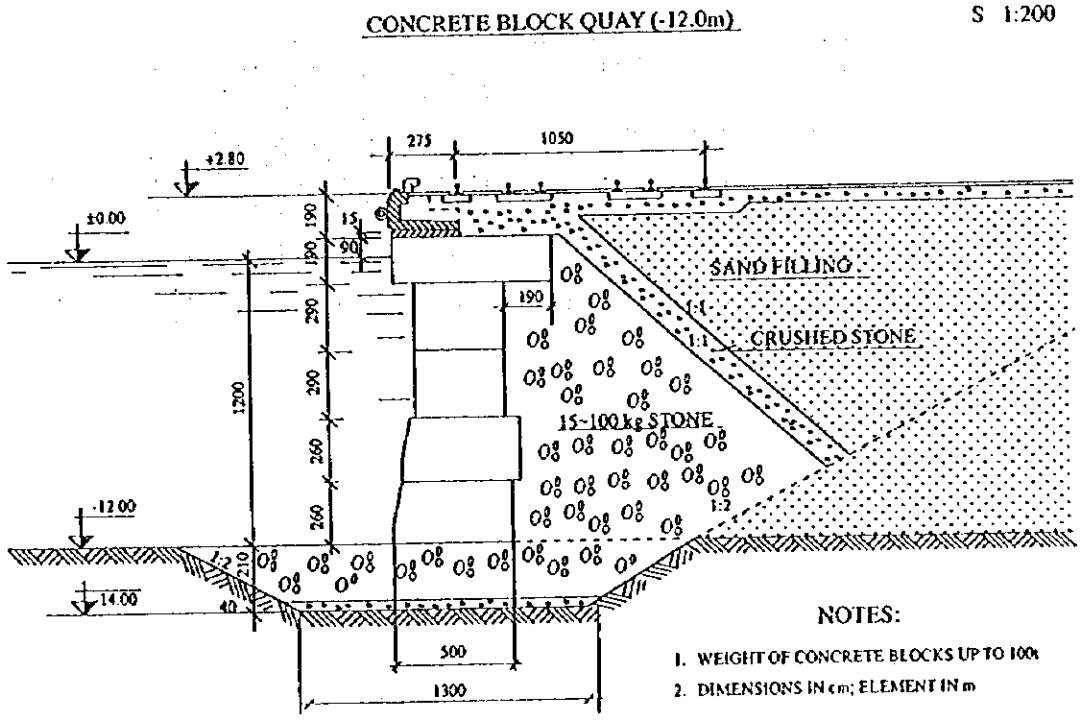


Figure 2.3.12-2 Standard Cross Section of Quay Block Type (-12.0m)

The standard composition of concrete pavement is designed below.

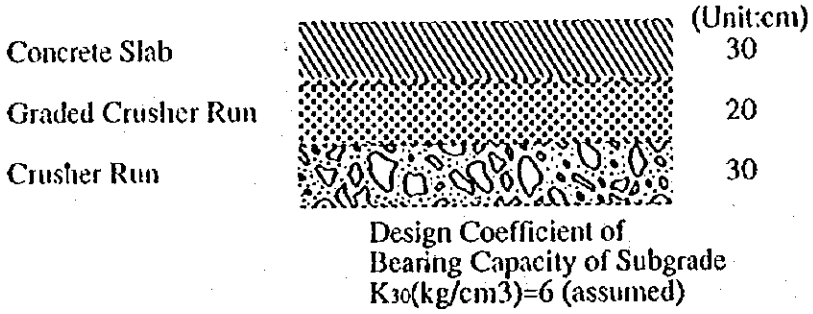


Figure 2.3.12-3 Standard Cross Section of Container Yard

(4) Open Yard, Road

Open yard, apron and road are planned to be paved by asphalt concrete. The composition of the bituminous pavement is shown below.

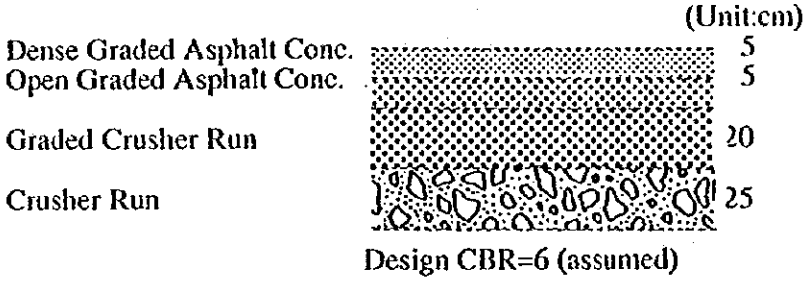


Figure 2.3.12-4 Standard Cross Section of Yard, Apron

2.3.13 Cost Estimation

(1) Condition of Cost Estimate

Cost estimate is carried out based on the general condition of estimate which is mentioned in Chapter 1.6.

(2) Total Cost

As the result, total cost of Master-plan is shown in Table 2.3.13-1.

Table 2.3.13-1 Total Cost of Master-Plan

(ATAKIA PORT(Master Plan)

No.	Facilities	Unit	Q'ty	Unit Cost (Unit:S.P)			Cost (Unit:1,000 S.P)		
				F.C	L.C	Total	F.C	L.C	Total
A	Civil Works								
1	Berakwater								
	Main Breakwater	m	600	0	1,750,000	1,750,000	0	1,050,000	1,050,000
	Sub-Breakwater	m	900	0	1,035,000	1,035,000	0	931,500	931,500
	Sub-Total						0	1,981,500	1,981,500
2	Grain Terminal(1)								
	Dredging(-12m)	m3	322,000	600	0	600	193,000	0	193,000
	Wharf(-12m)	m	210	235,000	822,000	1,035,000	49,350	168,000	217,350
	Revetment	m	20	0	490,000	490,000	0	9,800	9,800
	Reclamation	m3	332,000	0	300	300	0	99,000	99,000
	Sub-Total						229,350	276,800	506,150
3	Container Terminal								
	Wharf(-14m)	m	700	222,000	898,000	1,120,000	155,400	628,600	784,000
	Transition	m	50	300,000	890,000	1,200,000	15,100	44,900	60,000
	Revetment	m	370	300,000	890,000	1,200,000	111,000	332,000	444,000
	Dredging(-14m)	m3	1,643,000	600	0	600	985,800	0	985,800
	Reclamation	m3	1,886,000	0	300	300	0	565,800	565,800
	Marshaling/Back Yard etc	m2	315,000	0	1,100	1,100	0	346,500	346,500
	Stuffing Yard etc	m2	44,000	0	1,000	1,000	0	44,000	44,000
	Sub-Total						1,268,040	1,962,060	3,230,100
4	General Cargo Terminal								
	Wharf(-12m)	m	555	130,000	690,000	820,000	72,150	382,950	455,100
	Revetment	m	140	0	300,000	300,000	0	42,000	42,000
	Dredging(-10m)	m3	370,500	600	0	600	222,300	0	222,300
	Reclamation	m3	92,500	0	300	300	0	27,750	27,750
	Open Space etc	m2	230,000	0	720	720	0	165,600	165,600
	Sub-Total						294,450	618,300	912,750
5	Mobilization	LS	1	2,500,000	0	2,500,000	2,500	0	2,500
	Total of Civil Works						1,794,340	4,838,660	6,633,000
B	Building								
1	Grain Silo(Metallic)	LS	1	117,600,000	50,400,000	168,000,000	117,600	50,400	168,000
2	Machinery Tower(new)	Nos	1	0	105,000,000	105,000,000	0	105,000	105,000
3	Machinery Tower(exist)	Nos	1	0	94,500,000	94,500,000	0	94,500	94,500
4	C.F.S	m2	2,400	0	12,000	12,000	0	28,800	28,800
5	Terminal Office	m2	3,000	0	12,000	12,000	0	36,000	36,000
6	Work Shop/Cleanning	m2	3,000	0	12,000	12,000	0	36,000	36,000
7	Passenger Terminal&	m2	2,300	0	9,130	9,130	0	21,000	21,000
	Total of Building						117,600	371,700	489,300
C	Utilities	LS	1				0	98,050	98,050
D	Cargo Handling Equipment								
	Total of Equipment	LS	1				5,716,770	0	5,716,770
E	Physical Cont/Engineering Fee	LS	1				268,000	40,000	308,000
F	Grand Total						7,880,710	5,340,410	13,237,120

2.3.14 Preliminary Economic Analysis

(1) Methodology

The purpose of the preliminary economic analysis is to appraise the economic feasibility of the master plan for the study ports before a feasibility study on the short term plan can proceed. The preliminary economic evaluation of a project should show whether the project is justifiable from the viewpoint of the national economy of Syria.

Master plan will be defined and compared to the "Without" case. All benefits and costs of it in market price for the difference from "With" case will be calculated and evaluated. In this study, the economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project.

(2) Costs of the Projects

The items that should be considered as costs of the projects are construction costs and maintenance costs.

(3) Benefits of the Projects

As for benefits from the projects, three kinds of economic benefits are estimated through the so-called "With" and "Without" comparison. In the "Without" cases of the container and grain terminal projects, the size of vessels and the working efficiency of cargo handling are not the same as "With" case.

1) Savings in waiting costs of ships
In accordance with the implementation of the projects, the total ship staying time, namely ship waiting time for berthing and ship mooring time for unloading/loading in the port, will be greatly decreased.

2) Savings in water transportation cost by enlargement of ship size
When the size of calling ships becomes larger to capitalize on mass transportation, large ship can call at deep berths but can not at existing shallow berths. The water transportation cost per ton of cargo will become cheaper by enlargement of ship size.

3) Savings in land transportation costs
When handling volume reaches the maximum volume of handling capacity of the port, the cargoes which can not be handled in the port will be handled in other foreign ports and then be transported to Syria by trucks. In accordance with the implemention of the projects, the land transportation cost will be greatly decreased.

Table 2.3.14-1 Costs and Benefits of the Projects

Items of Cost	Cost (Million SP)	Items of Benefit	Benefit (Million SP)
Construction	13,237.1	Waiting Cost	2,612.6
Maintenance	279.5	Ship Size	293.5
		Land Transpotation	1,068.0
		Total	3,974.1

(4) Evaluation of the Projects

Economic evaluation of a project is carried out by calculating EIRR. The EIRR of the master plan is calculated as 19.0%. As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR exceeds 10 %. Therefore, this master plan development project is feasible from the viewpoint of the national economy.

2.4 Master Plan of Tartous Port

2.4.1 The Basic Concept of the Port Development

The purpose of the Master Plan (target year 2010) is to serve as a target and guideline for phase plans including the Short-Term Plan (target year 2003). In making the Master Plan for Tartous Port, the following problems in the current port operations are recognized:

(1) Container-handling

Although the degree of containerization of cargoes which pass through Tartous Port still remains at a modest level, the number of containers has recently shown a steady increase, reaching around 23,000 TEUs in 1994. At Tartous Port, quay-side container gantry cranes are not yet installed. In addition, the container marshaling yard is not allocated just behind the berths. This contributes to inefficient and time-consuming operations and consequent longer berthing times of costly container vessels.

(2) Phosphate-handling

Despite the recent recovery of phosphate rock export, the shortage of phosphate-handling capacity of the existing phosphate terminal at Tartous Port often induces the refusal of purchase offers of phosphate rock. Furthermore, it is strictly required to prevent the current dust emissions from the terminal.

(3) Handling of conventional cargo

Some of quay-side cranes installed on the pier A are obsolete and therefore need to be renewed.

(4) Passenger service

The existing passenger terminal is placed on the berth of the pier A without a passage connected to the outside of the port to separate the flows of passengers and cargo.

In the meantime, the volume of cargoes to be handled at the port is expected to continuously increase in the future, being estimated as 7.56 million tons in 2010, 2.1 times greater than the volume in 1994.

Thus, to resolve the present problems in Latakia Port and meet increasing demand for the port in the future, the following concept of the development of Tartous Port is proposed:

(1) Modernization of the existing container terminal

(2) Introduction of a closed terminal system in the container terminal
(3) Shift of the present phosphate-handling at Tartous Port to the new port and conversion of the existing phosphate terminal to a grain terminal and general cargo/Ro-Ro berths
(4) Construction of additional general cargo and Ro-Ro berths
(5) Preparation of required cargo-handling machines
(6) Construction of a new passenger terminal having a direct access to the outside of the port

2.4.2 Usage Plan for the Existing Port Facilities

In order to decide the appropriate number of berths in the target year, vessels are divided into eleven types, then the estimated cargoes are distributed to each type of vessel. The vessels are distributed on the following premises considering the actual operations and at similar ports.

Table 2.4.2-1 Usage Plan of the Berths by Vessel Type

Vessel Type	Vol.	Ve.Cap.	No Ve.	H Prod.	Quay No.
General (var.)	1,189	1,710	696	33	4,5,9,10,12,14,18, 19,20,21,N1,N2,N3*
Foodstuff	512	3,560	144	44	9,10,12,13,14
Livestock	327	260	1,258	12	4,5,16,17
Steel	1,062	2,240	475	80	4,5,21,N1
Wood	693	1,390	499	22	4,5,9,21,N2,N3
Car	295	520	568	39	9,10,11,12,14
Chemicals	480	1,990	242	32	4,9,12
Ro/Ro	154	1,270	122	34	5,6,10,21,N3
Grain (import)	660	16,640	40	168	12
Grain (export)	800	20,000	43	202	12,19,20
Container	200*	630	318	48	7,8

Note : Vol.: Cargo Volume(Thousand tons), Ve.Cap.: Average Vessel Capacity(tons), No Ve.: Number of Vessels, H Prod.: Cargo Handling Productivity(ton/hr)
*(1000TEUs) *N1 (Newly constructed next to the shipyard), N2,N3 (New Berths behind the breakwater)

The usage plan was analyzed by using simulation method, excluding container terminals. In the study, reference to the actual statistical distribution forms for ship arrivals and mooring periods at the Tartous Port is made. The port operates 24 hours a day and 285 days per year.

The results of the simulation are as follows:

		Average Waiting Time (hours)
General(Var.)	:	3.1
Foodstuff	:	14.6
Livestock	:	5.1
Steel	:	6.8
Wood	:	7.9
Car	:	12.3
Chemicals	:	22.4
Ro/Ro	:	7.4
Grain(Import)	:	1.2
Grain(Export)	:	0.5

2.4.3 Container Terminal Plan

The number of containers to be handled at the container terminal in 2010 is estimated as 200,000 TEUs. To receive the forecast container traffic, it is proposed to modernize the existing terminal at north of the pier B through the introduction of required container-handling equipment and a closed terminal operation system. The main upper-structures and container-handling-equipment to be newly prepared through the modernization are as follows:

- Upper-structures
  - Terminal control office
  - Gate house
  - Repair shop for container-handling equipment

- Container-handling equipment
  - Quay-side container gantry cranes: 2 units
  - Rail-mounted transfer cranes: 3 units
  - Tire-mounted transfer cranes: 3 units
  - Forklift trucks and tractor/trailers

2.4.4 Conventional Terminal and Other Port Facilities

(Conventional Terminal)

In order to decide the proper number of new berths, three cases, construction of three berths, two berths and one berth, will be compared. Location of the new berths is behind the breakwater.

Cost Index of waiting cost and berth construction cost is described as follows:

Cost Index (waiting cost + berth construction cost)

one berth	120
two berths	100
three berets	102

(5,000 DWT general cargo vessels)
(Project Life: 30 years, Discount Rate 0.1)

Consequently, Case 1 is selected as the most economical plan. water depth of new berths is determined as -10 m, that is, 15,000 DWT.

(Passenger Terminal)

At present there is no regular service. Regular passenger vessel has recently served between Larnaka and Tartous on a by-weekly basis. In addition passenger vessels call Tartous Port from Germany, Ukraine, Italy and Greece irregularly. In future, the following services will be taken into consideration.

- Regular Service: Regular service route between Cyprus will start in the near future, because future development in tourism will attract tourists and business persons from Cyprus. In addition, the New Port will attract many labors from north Africa.

- Irregular Service: Syrian Government lays emphasis on tourism. The more Syria opens its door to foreigners, the more irregular passenger vessels will visit Syrian ports.

Number of passenger will be (60+500) X 50 =28,000 (Regular Service)
500 X 2 X 12 = 12,000 (Irregular Service)
Total Number = 40,000

2.4.5 Cargo Handling System

The cargo handling system for general cargo, heavy cargo and woods & wood products in the Master Plan is the same as at Latakia Port in general. The cars are transported by car carrier. Live stock is unloaded from special ship to special trucks on apron using slope under their own volition. Then, all of the live stock is delivered to consignees, directly.

As for the pelletizable cargo, all pelletaizable cargoes should be pelletized in the master plan. This is the same as at Latakia Port.

The official cargo handling time at Tartous Port should be changed to agree with Latakia Port in general. In the Master Plan, for example from 7.00 a.m. to 3.00 a.m. for first shift, from 3.00 p.m. to 11.00 p.m. for second shift and 11.00 p.m. to 7.00 p.m. for third shift. A fifteen minute break middle of each shift, such as 11.00 a.m., 7.00 p.m. and 3.00 a.m..

2.4.5.1 Cargo Handling System in the Master Plan for Each Commodity

(1) General Cargo(Except Container Cargo)

In the master plan, the cargo handling system for general cargo at this port should adopt the system used at Latakia Port, such as pelletization of pelletizable cargo, storing in the port for almost general cargo. Cargo handling equipment is mainly forklift trucks at apron and storage facilities.

(2) Heavy cargo

In the master plan, the heavy cargoes are handled at apron, and are transported to storage facility by heavy forklift trucks or trailers.

(3) Wooden Products

In the master plan, loose lumber and timber should be installed in the hold of ship by slings, then the cargo is unloaded from ship onto trucks, directly. Almost all of the loose timber and lumber are transported to open yard in the port. Bundled timber and lumber is handled at apron by forklift trucks after being unloaded from ship to apron. Then, they are transported to storage facilities by forklift trucks or trailers. However, some of them are directly delivered to consignees.

2.4.6 Alternative Layout Plans

The present phosphate pier and silo will be converted into grain terminals. The pier will also be utilized for general cargo vessels. The root of the pier will be reclaimed to reserve necessary area for trucks and cargo handling. The present sulphur berth will be used for general cargo vessels, Ro/Ro vessels and passenger vessels. Yard behind the existing sulphur berth will be used mainly for steel and wood.

New berths will be planned in the back of the breakwater, one of the berths is used both for Ro/Ro and general cargo vessels.
The berths are connected by the road that passes behind the breakwater.

Layout of the Mater Plan is shown in Fig. 2.4.6-1.

TARTOUS PORT MASTER PLAN

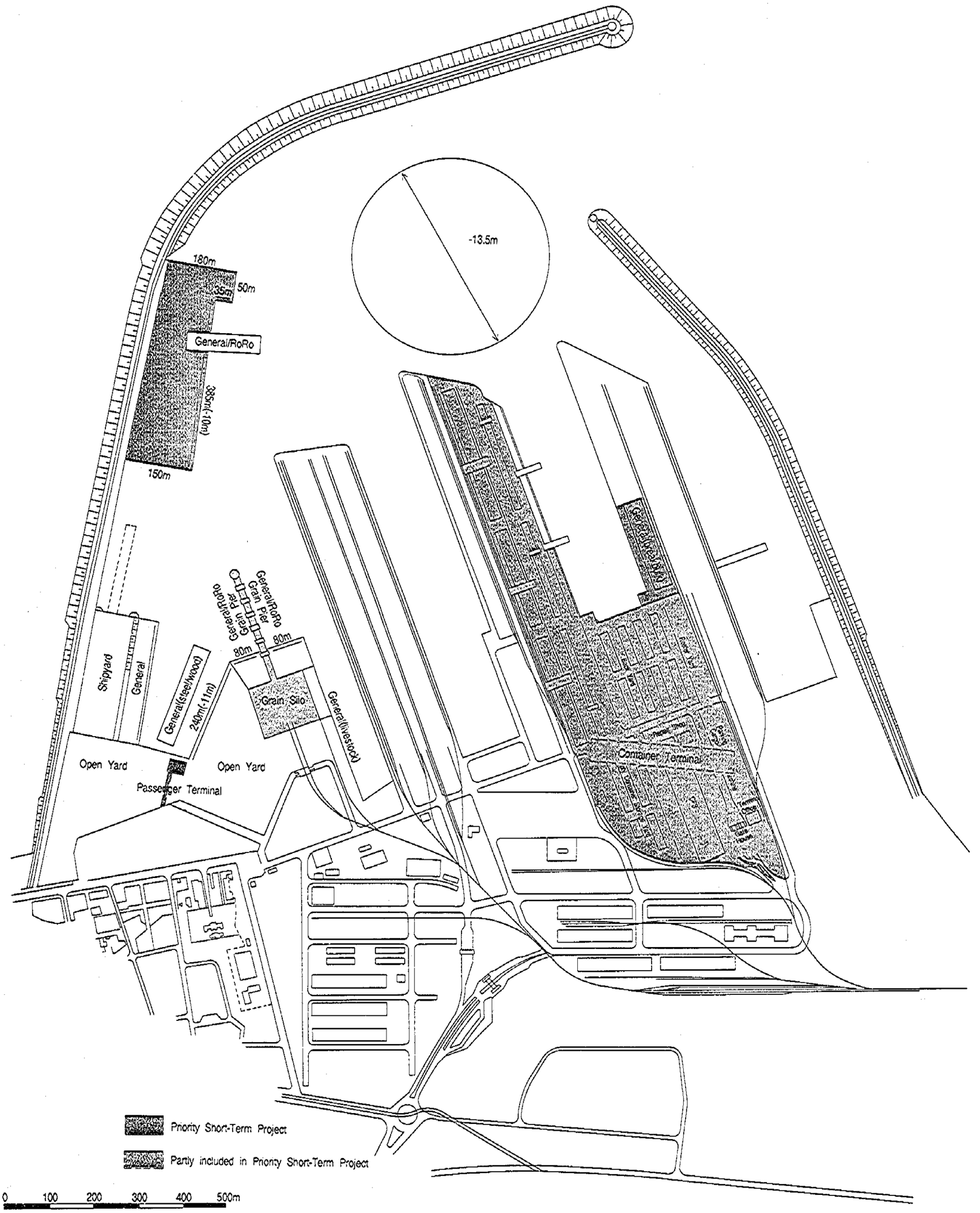


Figure 2.4.6-1 Master Plan of TARTOUS PORT

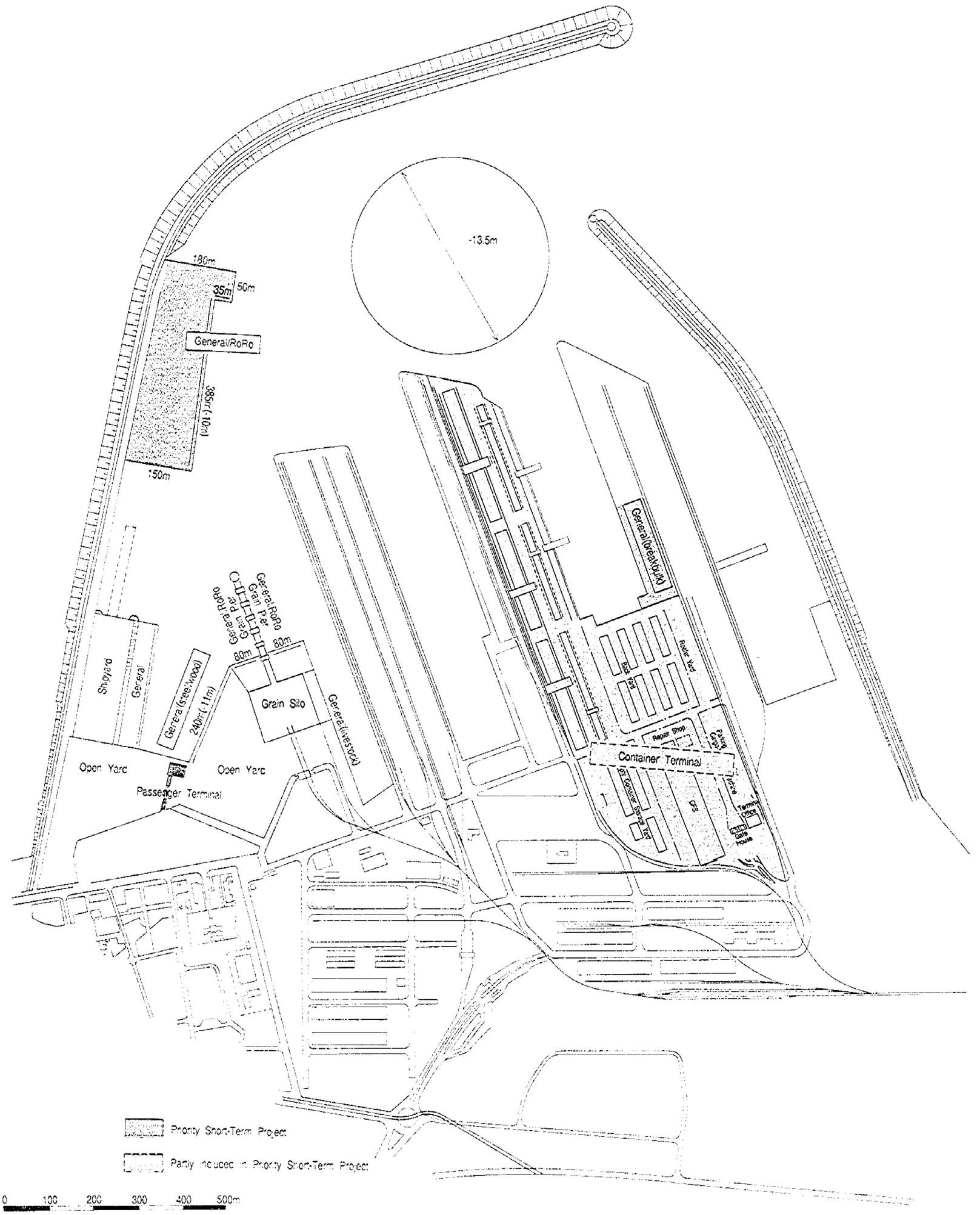


Figure 2.4.6-1 Master Plan of TARTOUS PORT

2.4.7 Initial Environmental Examination

The existing water quality, sediment quality, and air quality were assessed by the site survey. Not all of these parameters are covered by standards but those which are subject to guidelines have been examined. In general the water quality is acceptable for a port activity. In Tartous sewage from the town does not enter the port harbour but is discharged to the sea outside the harbour. Therefore the water quality is not receiving a large organic load. Areas of concern are the high COD and sulphides although the dissolved oxygen is acceptable. Phosphorus, phosphates and oil/grease are high but this also applies to water outside the harbour. Heavy metals in the sediments are high, particularly mercury and arsenic although this applies to sediments outside the harbour. Disturbance of the seabed should be avoided, if possible, and if not possible the disposal of the dredged material must be done in a very careful way.

The air quality in the port area is poor due partly to phosphate dust and dust from other sources. There are no environmental reasons why the planned activities should not proceed and a full EIA and remedial measures are not considered necessary. The intended relocation of the phosphate plant should cause an environmental improvement in the area around the port. Monitoring of seawater for heavy metals during dredging by the contractor is recommended as a precaution.

2.4.8 Facility Design

In Tartous Port, two additional berths for general cargo are planned at the root of the main breakwater in the Master Plan.
In this section, the standard cross sections of the berth and pavements are proposed.

(1) Berths

The quay walls have been constructed by using precast concrete blocks. As the sufficient bearing capacity can be expected at the sea bed, this gravity type are recommended for the newly planned general cargo berths. The construction materials for these type of berths are available locally. The standard cross section of the berths is referred to Fig. 2.3.12-2.

(2) Apron, Open Yard, Road

Apron, open yard and road behind the planned berths should be paved by using asphalt concrete from the view points of workability and maintenance. The design load are assumed as follows.

Truck	T-14
Tractor trailer	20 ft, 40 ft

The standard cross section is referred to Fig. 2.3.12-4.

2.4.9 Cost Estimation

(1) Condition of Cost Estimate

Cost estimate is carried out based on the general condition of estimate which is mentioned in Chapter 1.6.

(2) Total Cost

As the result, total cost of Master-Poan is shown in Table 2.4.9-1.

Table 2.4.9-1 Total Cost of Master-Plan

VARIOUS(Master-Plan)

No.	Facilities	Unit	Q'ty	Unit Cost(Unit:S.P)			Cost(Unit: 1,000 S.P)		
				F.C	L.C	Total	F.C	L.C	Total
A	Civil Works								
1	General Berth Terminal(1)								
	Wharf(-10m)	m	365	200,000	700,000	900,000	77,000	269,500	346,500
	Ro/Ro Berth(-10m)	m	35	200,000	700,000	900,000	7,000	24,500	31,500
	Revetment(1)	m	50	0	250,000	250,000	0	12,500	12,500
	Revetment(2)	m	330	0	210,000	210,000	0	69,300	69,300
	Road/Open Space	m2	60,000	0	720	720	0	43,200	43,200
	Reclamation	m3	1,150,000	0	300	300	0	345,000	345,000
	Sub-Total						84,000	765,000	849,000
2	General Cargo Terminal(2)								
	Wharf(-10m)	m	160	200,000	700,000	900,000	32,000	112,000	144,000
	Revetment	m	70	200,000	700,000	900,000	14,000	49,000	63,000
	Road/Open Space	m2	14,400	0	720	720	0	10,368	10,368
	Reclamation	m3	187,200	0	300	300	0	56,160	56,160
	Sub-Total						46,000	227,528	273,528
	Total of Civil Works						130,000	992,728	1,122,728
B	Building								
1	Terminal Office	m2	3,000	0	12,000	12,000	0	36,000	36,000
2	Work Shop/Cleaning	m2	3,000	0	12,000	12,000	0	36,000	36,000
3	Passenger Terminal &	m2	2,300	0	9,130	9,130		21,000	21,000
	Total of Building						0	93,000	93,000
C	Utilities	LS	1				0	32,463	32,463
D	Cargo Handling Equipment								
	Total fo Handling Eq.	LS	1				1,493,848	0	1,493,848
E	Physical Conti/Engineering Fee	LS	1				66,000	31,000	97,000
F	Grand Total						1,689,848	1,147,191	2,836,231

2.4.10 Preliminary Economic Analysis

(1) Costs of the Projects

The items that should be considered as costs of the projects are construction costs and maintenance costs.

(2) Benefits of the Projects

In order to calculate the substantial benefits of Tartous Port, only the cargoes which are planned to be handled in Tartous Port are set as objects of economic analysis. In the "Without" case of the container terminal project, the working efficiency of cargo handling are not the same as "With" case.
The items that should be considered as benefits of the projects are savings in waiting costs of ships.

Table 2.4.10-1 Costs and Benefits of the Projects

Items of Cost	Cost (Million SP)	Items of Benefit	Benefit (Million SP)
Construction	2,836.2	Waiting Costs	740.6
Maintenance	68.1		

(3) Evaluation of the Projects

Economic evaluation of a project is carried out by calculating EIRR. The EIRR of the master plan is calculated as 18.0%. As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR exceeds 10 %. Therefore, this master plan development project is feasible from the viewpoint of the national economy.

2.5 Master Plan of the New Port

2.5.1 The Basic Concept of the Port Development

The purpose of the Master Plan (target year 2010) is to serve as a target and guideline for phase plans including the Short-Term Plan (target year 2003). In making the Master Plan for the New Port, the following aspects are recognized:

(1) Limited space for port expansion in Tartous port

It is necessary to create a new port at an adequate place to receive the considerable amount of bulk cargoes forecast to be generated in the future as Tartous Port, adjacent to densely-populated residential areas, is not suitable for these cargoes.

(2) Problem of phosphate dust emission in Tartous Port

The new port is required to resolve the current problem of phosphate dust emission in Tartous by shifting the current phosphate-handling to the new port.

(3) The necessity of the New Port to back up the manufacturing and mining industries in the southern part of Syria.

Spread throughout the southern part of Syria are port-related heavy industries including phosphate mines, cement-making factories and a iron and steel making factory. In addition to the present operations of the industries, several projects of the industries are on-going or on the verge of being materialized. Hence, the New Port is indispensable to back up the industries through importing raw or intermediate materials or exporting their final products.

(4) The necessity of the New Port to promote transit traffic of bulk cargo from/to neighboring arab countries.

In Iraq, phosphate mines are situated in Akashat near the border between Iraq and Syria. On the other hand, sulfur mines are situated in Mosul which is near the above border as well. Sulfur is also produced as a by-product of petroleum refineries. There are several major petroleum refineries in Kirkuk and Baiji in north-west part of Iraq. Sulfur and phosphate rock are major exports of Iraq. Before the close of the border in 1981, Iraq intended to ship those bulk cargoes through Tartous Port. Instead of Tartous Port, the New Port could be a gateway for those transit cargoes in the foreseeable future.

Based on the above, the following terminals are proposed to be prepared in the New Port.

(1) Phosphate terminal
(2) Cement clinker terminal

(3) Pellet terminal
(4) Scrap terminal
(5) Sulfur terminal
(6) Fertilizer terminal
(7) Public berths

2.5.2 Facility Plan of Each Terminal

The following types of cargoes are handled at the new port.

1) Cargoes that will shift from the existing port: Phosphate
2) Cargoes that will be used as materials for the new steelfactory: Pellet, Scrap, others(bricks,ferro-alloys)
3) Cargoes that will newly exported from Syria:
   Cement Clinker, Oil Coke, Fertilizer
4) Cargoes exported from Iraq through the port:
   Phosphate, Sulphur
5) Others: Imported Fertilizer

In order to determine appropriate scale, depth and length of the berth, Transportation Costs and Construction Cost of some alternatives are compared. The scale of each berth is as follows:

	Depth	Max Vessel Size	Length
Phosphate	: -14 m	65,000 DWT	280 m
Pellet	: -14 m	65,000 DWT	280 m
Clinker	: -14 m	65,000 DWT	280 m
Scrap	: -10 m	10,000 DWT	185 m
Fertilizer	: -12 m	40,000 DWT	240 m
Sulphur	: -12 m	40,000 DWT	240 m

Scale of berths for other cargoes(Imported Fertilizer, Coke, Bricks) is -10 m depth and 185 m length, because these cargoes are carried to/from neighboring countries and the volume is limited.

Number of berth is determined using simulation method shown in the following table.

Table 2.5.2-1 Usage Plan of the Berths by Vessel Type

Vessel Type	Vol.	Max.Cap	No Ve.	H Prod.	NoB	W/T
Phosphate	4,100	65,000	137	672	2	6.5
Pellet	1,250	65,000	26	455	1	36.7
Clinker	1,000	65,000	26	392	1	8.0
Scrap	200	10,000	23	73	1	30.3
Fertilizer	480	40,000	21	220	1	26.4
Sulphur	500	40,000	17	189	1	21.8
Other Steel	150	10,000	17	67	1	18.5
Coke	200	15,000	17	126	1	36.3
Import Fertilz	210	15,000	18	67	1	4.0

Note : Vol.: Cargo Volume(Thousand tons), Max.Cap.:Maximum Vessel Capacity(tons), No Ve.:Number of Vessels, H Prod.:Cargo Handling Productivity(ton/hr), N o B:Number of Berth, W/T:Average Waiting Time(hours)

2.5.3 Cargo Handling System

At New Port, all handling cargoes should be stored in the port area for the following reasons:

1. Reducing the number of trucks and wagons of train for delivery.
2. Stabilizing cargo handling productivity
3. Reducing the inland transportation cost

For effective port operations, cargo handling time at New Port should be 24 hours a day.

2.5.3.1 Cargo Handling System for Each Commodity in The Master Plan

(1) Phosphate

Transportation of phosphate from phosphate plant to silo facility in the port is done by wagons of train.

The receiving facility is enclosed by reinforced wall with roof. At the entrance for wagon, a curtain which is composed of long narrow strips of skin is installed to prevent air-pollution.

After transportation from receiving facility to elevators, the phosphate is elevated to chain conveyors for dumping to silo bins.

The phosphate is brought out from exit of silo bins which is located at the bottom of silo bins. Then, the phosphate is elevated to belt conveyors on loading bridge. Finally, the phosphate is moved to ship-loaders by sealed belt conveyors.

Dust collectors are installed at receiving facility and loading bridge.

(2) Cement Clinker

Cement clinker is sent from the cement facility by train. Cement clinkers are dumped from wagon to hopper at receiving facility. System of the receiving facility is the same as the receiving facility for phosphate.

When the clinkers are loaded onto ship, the clinkers are dropped onto belt conveyor under the floor, then moved to elevators for elevation to belt conveyors at loading bridge.

(3) Pellet

Import pellet is unloaded from ship to belt conveyor by grab bucket unloader. The pellet is moved to stacker by belt conveyor. After moving the pellet to stacker, the pellet is dropped to storage yard.

After loaded to belt conveyor at storage yard by reclaimer, the pellet is moved from storage yard to loading equipment. Then, the pellet is loaded to wagon of train.

(4) Scrap

Iron scrap is directly unloaded from ship onto trailers by quay cranes with special attachment for iron scrap, such as lifting magnet. Then, these cargoes are moved to open storage area.

At open storage yard, iron scrap is loaded/unloaded to/from trailers and marshalling by mobile crane.

(5) Oil Coke

Oil Coke is sent from the oil refineries by train. The style of wagon of train is the same as the wagon for phosphate.

After leading wagon into elevated railway station which is constructed in suitable height for dumping oil coke to truck, the oil coke is dumped to trucks for transporting to open storage yard. At open storage yard, the oil coke is handled by shovel loader.

When a vessel to transport oil coak arrives, the coke is transported to apron of quay by trucks. Then, the oil coke is loaded to the ship by portable loaders.

(6) Sulphur

Transportation of flake sulphur is done by bottom door type wagons.

The sulphur is dumped from the wagons to hopper underground at receiving facility. Then, the sulphur is transported to sheds. The sulphur is elevated to overhead chain conveyors by elevator for sending to shed. Finally, sulphur is dumped for storing in the shed.

The loading sulphur is transported to apron by trucks. Cargo handling at the shed is done by shovel loader. The sulphur is loaded to the ship at the quay by portable loaders.

(7) Fertilizer(Export)

Export fertilizer is sent from the fertilizer factories to New Port by train. The style of wagon of train is the same as the wagon for sulphur.

The fertilizer is dumped from the wagons of train to hopper under ground. Then, it is transported to sheds by belt conveyor. After transportation, the fertilizer is elevated to overhead chain conveyors for sending to shed by elevators. Then, the fertilizer is dumped for storing in the shed. Cargo handling at the shed is done by shovel loader.

The export fertilizer is transported to apron by trucks. Finally, the fertilizer is loaded to the ship by portable loaders.

(8) Fire Brick and Others(General Cargo)

Import fire bricks and related products for steel industry are transported by general cargo ships.

They are unloaded from ship to apron by ship's crane. Then, the cargoes are transported to the shed for storing by fork-lift trucks.

After storing, these cargoes are loaded to trailer by fork-lift trucks. These cargoes are then transported to loading area for railway by trailers, after which they are transported to consignee by open type wagon.

(9) Import Bagged Fertilizer(General Cargo)

Import bagged fertilizer is transported by general cargo ships.

These cargoes are unloaded from the ship to apron by ship's crane. Then, the cargoes are transported to shed for storing by fork-lift trucks.

After storing, these cargoes are loaded to trucks for delivering to consignees by fork-lift trucks.

2.5.3.2 Scale of Storage Facilities for Each Commodity

The major commodities of cargoes at New Port in 2010 are phosphate, cement clinker, iron pellet, iron scrap, oil coke, sulphur, export fertilizer, fire brick and others(general cargo) and import fertilizer(general cargo).

The estimation procedure of the scale of storage facilities for each commodity is shown in Figure 2.5.3.1 for export and Figure 2.5.3.2 for import.
Results of the scale estimation of storage facilities for each commodity are shown in Table 2.5.3.1.

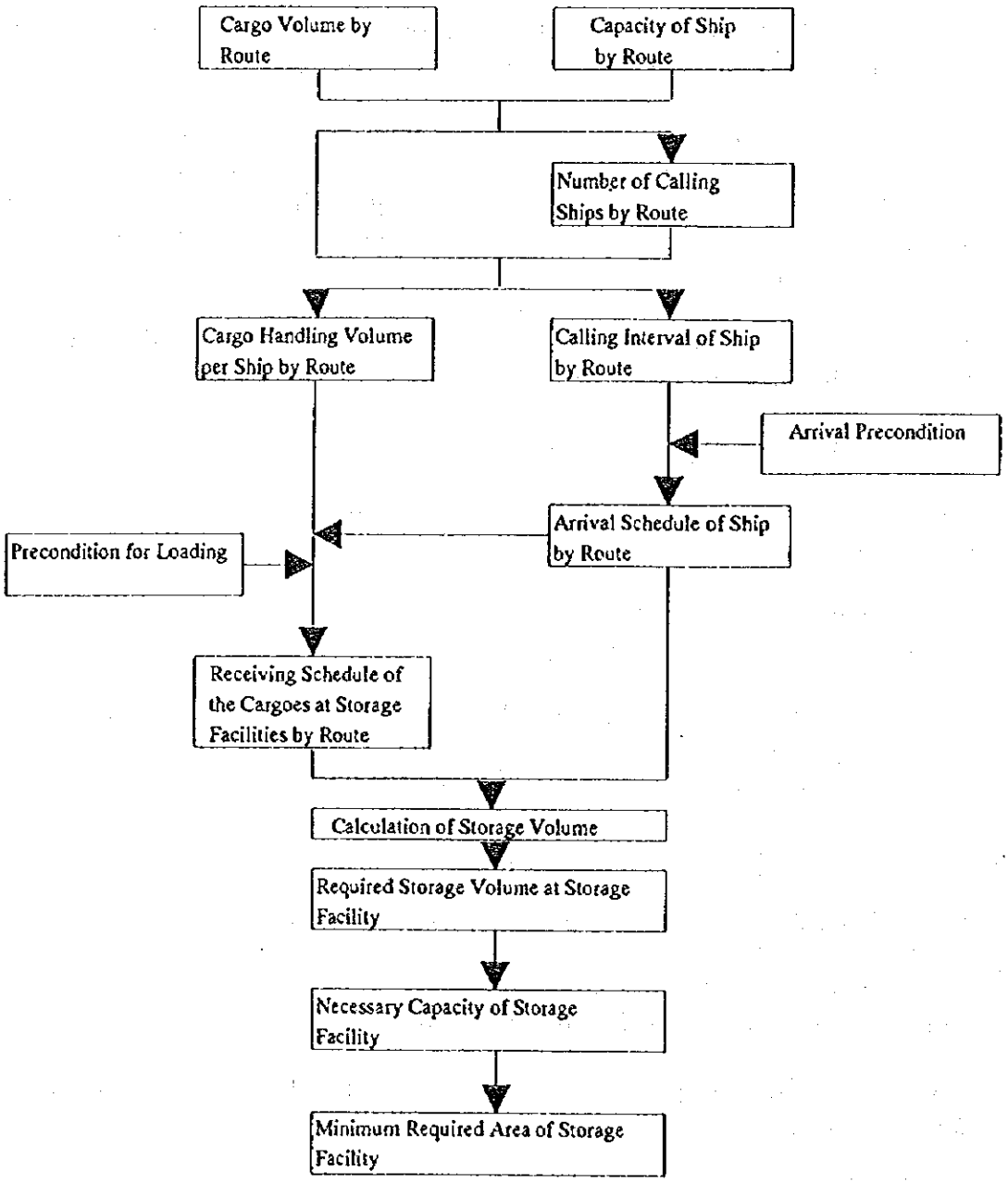


Figure 2.5.3.1 Flow Chart for Estimation of Minimum Required Area of Storage Facilities for Export Cargo

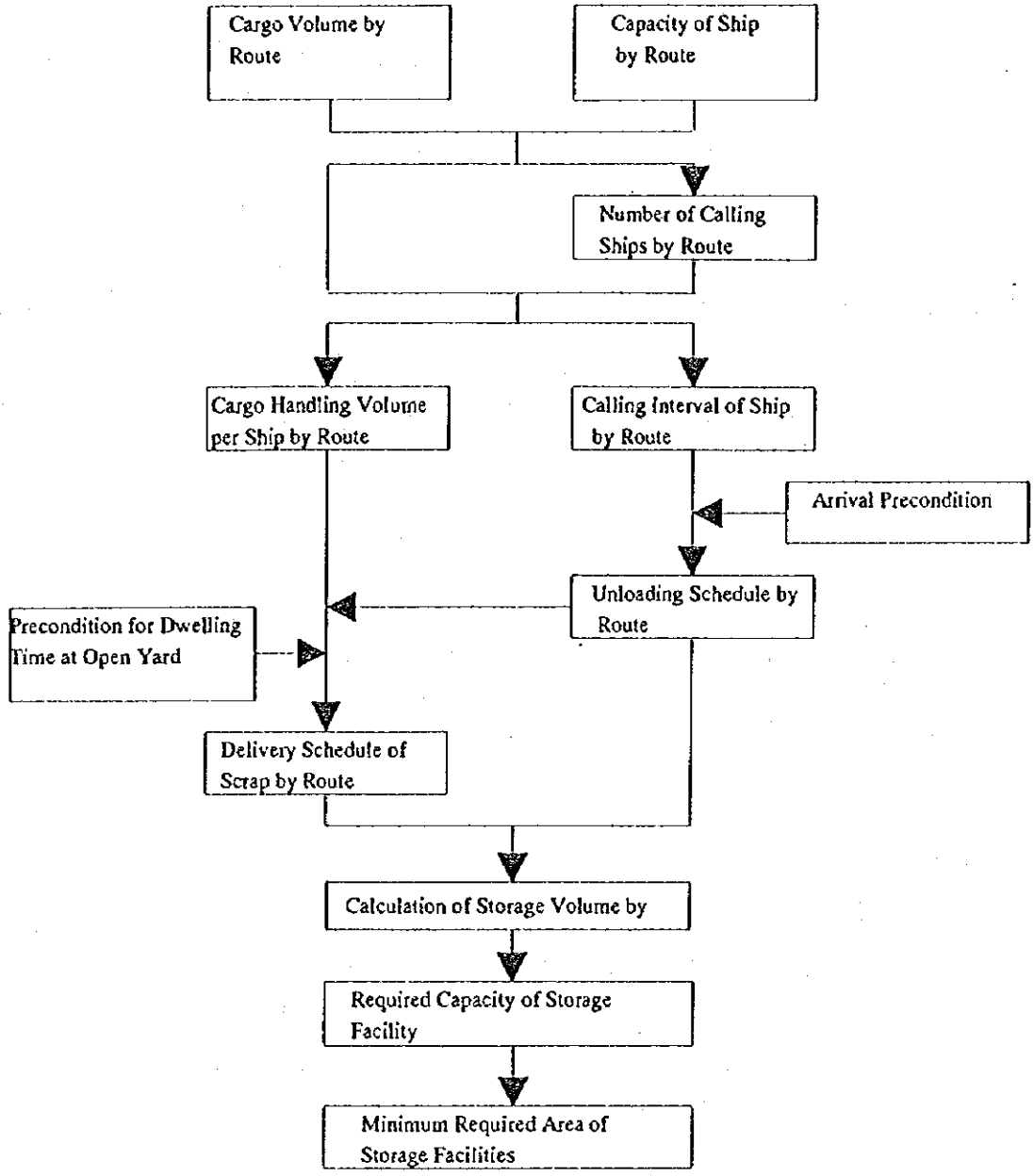


Figure 2.5.3.2 Flow Chart for Estimation for Area of Storage Facilities for Import Cargo

Table 2.5.3.1 Minimum Required capacity of Storage facility at New Port

Commodity	Unit	Phosphate	Clinker	Pellet	Scrap	Oil Coke	Sulphur	Export Fertilizer	Import Fertilizer	Fire Brick & Others
Cargo Volume	1,000tons/year	4,100	1,000	1,250	200	200	500	510	210	150
Capacity of Storage Facility	1,000tons	167	87	152	17.6	19.5	45	55	28	20
Minimum Required Area of Storage Facility	m^2	-	28,600	28,500	21,500	15,000	34,000	21,000	10,000	6,500

2.5.4 Access Channel and Basins

The largest vessel that moors at the New Port is pellet carrier phosphate carrier and clinker carrier. The dimensions of the vessel are as follows:

- Capacity : 65,000 DWT
- Draft : 12.3 m
- LOA (Length Over All) : 235 m
- Breadth : 33.3 m

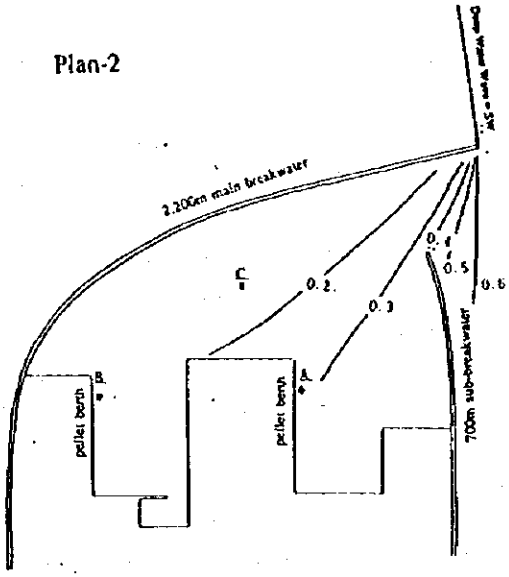
The width of the channel is determined as 250 m, (over 1 LOA of a vessel). The depth of the access channel is -15 m. Turning basin has a diameter of 470 m(double the LOA) and a water depth of -14 m.

2.5.5 Breakwaters

To determine th elength of the breakwater to be constructed, calmness at phosphate berth, pellet berth and turning basin is examined in the following 3 cases.

Plan-1 Without breakwater
Plan-2 2,200 m main breakwater and 700 m sub-breakwater
Plan-3 1,950 m main breakwater and 700 m sub-breakwater

Figure 2.5.5-1 shows the diffraction from SW-deep water wave. Taking into account the construction cost and calmness, Plan-2 is the most preferable plan.



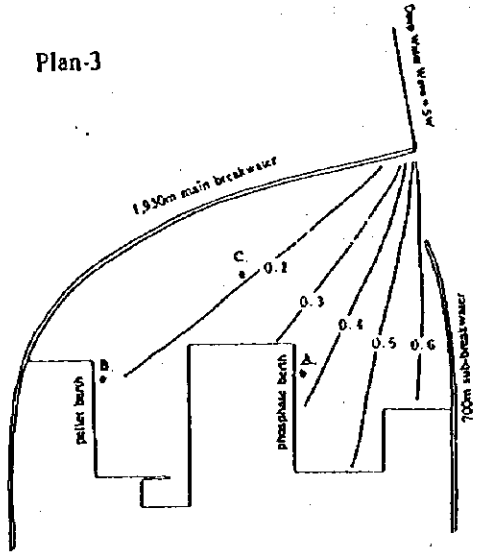


Figure 2.5.5-1 Wave Diffraction from SW Deep Water Wave

2.5.6 Access Roads and Railways

The traffic volume of vehicles originating from or destined to the port in the year 2010 during peak time is estimated to be 385 vehicles per day and the hourly traffic corresponding to that daily traffic is estimated to be 49 vehicles. Even if the port related vehicles for operation, maintenance are included, two lane road is sufficient for the road transport. The access road overpasses the siding railway in front of the new port. Since the width of the access road is around 5 m, the width should be enlarged to 7 m. During the construction work, a temporary road should be built in order to separate construction vehicles from the city traffic.

Six items, phosphate, pellet, cement clinker, oil coke, sulphur and fertilizer, are mainly carried by railway. Total volume carried by railway is 7 million tons per year. Cargo to/from the new port is carried through branch line that connect to the main line. Present capacity of the line between Homs and Tartous, through which most of the cargo relative to the new port is transported, is three million tons. In order to accommodate additional cargoes, the line should be doubled.

2.5.7 Site Selection

Eight alternatives around the Syrian coast described in Fig.2.5.7-1 are chosen and evaluated using the following factors:

(1) Navigational Accessibility
(2) Maneuverability of Vessels in the Possible Basins
(3) Accessibility by Land Transport
(4) Economical Transport from/to the Possible Hinterland of the New Port
(5) Possibility of Economical Construction
(6) Certainty of Land Acquisition
(7) Possibility of Acquiring the Future Expansion Space
(8) Environmental Impact Caused by the New Port Project

Table 2.5.7-1 summarizes and Table 2.5.7-2 describes conditions of each site by eight factors to be considered for port construction.
South of Hamidieh (location longitude 34° 39'425N latitude 35° 57'974E ① in the Fig. 2.5.7-1) seems to be suitable for a new port, because the land around the sites is hardly utilized for agriculture and residential areas. Transportation condition is good both from inland and from the sea.

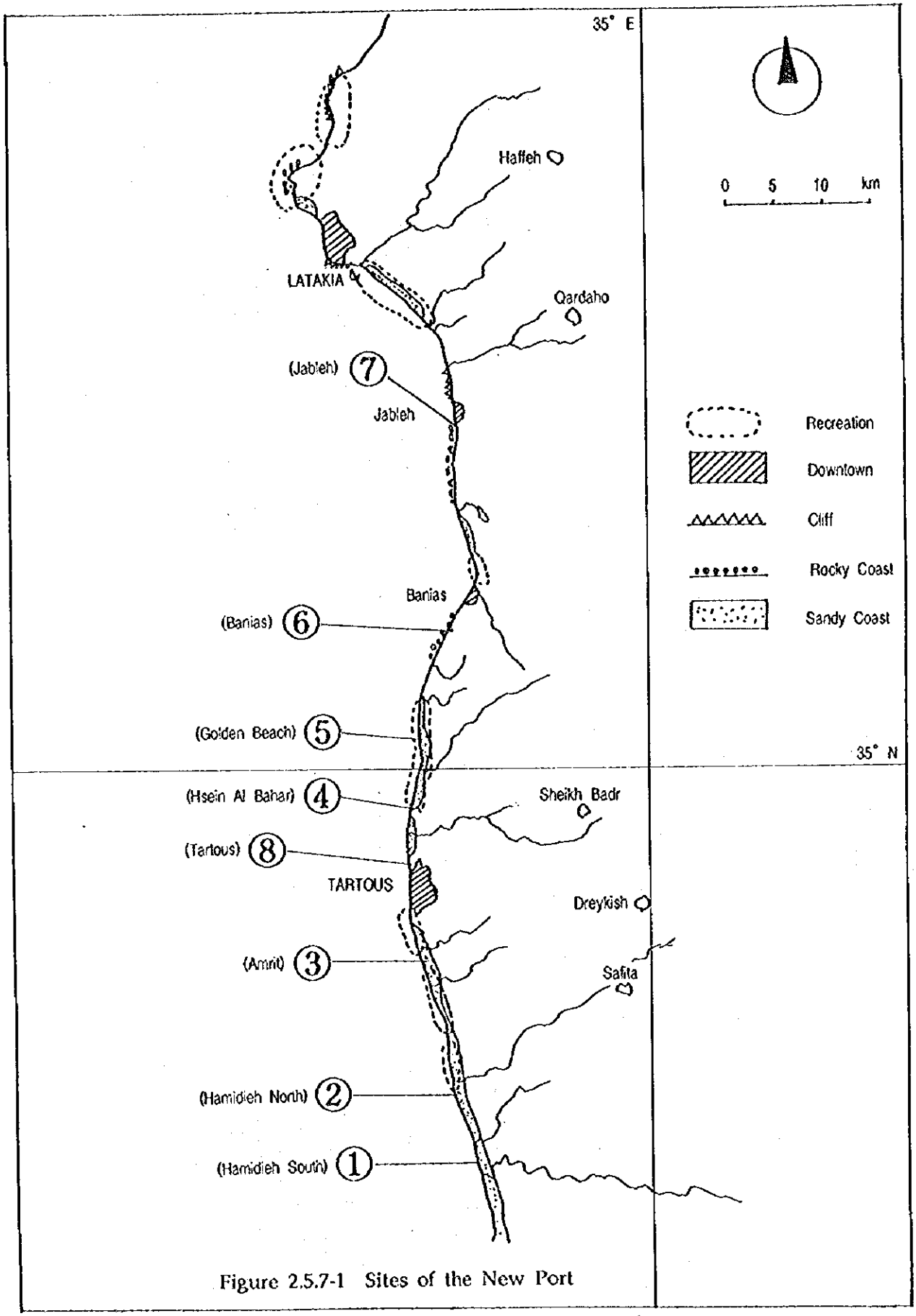


Figure 2.5.7-1 Sites of the New Port

Table 2.5.7-1 Summary of Site Conditions

	① Hamidieh South	② Hamidieh North	③ Amrit	④ Hsein Al Bahar
1)	Open to the sea No Fishery, Recreation area	Small Inlets Fishery area	Access limited Recreation/protected area	Anchoring basin for tankers Access channel limited
2)	Shallow water Sand/stone mixture	Shallow water Reeves offshore	Shallow water Rock bed	Shallow rock seabed
3)	Adjacent to the national road 7 km from the railway	800 m from the national road 4 km from the railway	More than 1 km from the national Road, 4 km from the railway	Access road to the cement factory available, 1km to railway
4)	Nearest from the phosphate mine and new steel factory	Nearer from the phosphate mine and the steel factory	Nearer from the phosphate mine and the steel factory	Longer railway distance from phosphate mine/steel factory
5)	Mainly sand/flat land Medium dredging cost Low reclamation cost	Higher dredging cost Medium land excavation	Higher dredging cost Medium land excavation	Medium dredging cost High land excavation cost
6)	50 ha acquired by the government	Small villages spread behind land owned privately	Land owned by upper class residents or rich farmers	Fixed land owning condition (oil terminal, cement factory)
7)	Similar beach extend north and south direction Poor agricultural field	Difficult inland expansion	Recreation area in the north Archaeological ruins south	Surrounded by the oil terminal residential area and factory
8)	Scattered population No rare species	Need to resettle villages	Impact on tourism area and historical area is possible	Resettlement of workers' house oil terminal concentration merit of pollutant Reflection wave of tankers

Table 2.5.7-1 Summary of Site Condition(Continued)

	⑤ Golden Beach	⑥ Banias	⑦ Jableh	⑧ Tartous Expansion
1)	Open to the sea Recreation area in front	Existing channel available Traffic congestion	Open to the sea Direction is limited	Share existing channel Direction is limited
2)	Shallow water Sand seabed	Water area used for tankers Reeves offshore	Shallow water Rock bed	Shallow rock/sand seabed
3)	1.5 km from the trunk road 2 km from the railway	Close to the national road and railway	7-800m from the national road 1.5 km from the railway	Share access road and railway of the existing port, Isolation by military facilities
4)	Longer distance to the phosphate mine/steel factory	Longer railway distance from phosphate mine/steel factory	Longest railway distance from phosphate mine/steel factory	Same distance from the phosphate mine, Close to the steel factory
5)	Mainly sand/flat land, Low dredging cost, Low reclamation cost	Low dredging cost High land excavation cost	High dredging cost Medium land excavation	Low dredging cost Low land reclamation cost
6)	Privately owned for cottage residential use	Land owned by oil company and city residents	Land mainly owned by the nation as protected area	Land owned by public sector
7)	Similar beach extended in north and south direction	Limited usable land Land use fixed	Recreation area in the north Densely populated area south	Expansion direction and space is limited
8)	Developed and developing as tourism area	Concentration merit of pollutants Impact on air quality of large city	Impact on tourism area possible	Resettlement public facilities Air pollution to the city

Table 2.5.7-2 Evaluation of Sites

	①Hamidieh-S	②Hamidieh-N	③ Amrit	④ Al-Bahar	⑤ G-Beach	⑥ Banyas	⑦ Jableh	⑧ Tartous
(1)	A	B	C	B	A	A	B	A
(2)	A	B	B	B	A	B	B	A
(3)	A	A	B	A	A	A	B	A
(4)	A	A	A	A	B	B	C	A
(5)	A	A	B	B	A	C	C	A
(6)	A	B	B	B	C	C	C	C
(7)	A	B	C	C	C	C	B	A
(8)	A	B	D	B	D	C	C	B
total	A	B	C	B	B	C	C	B

A: Excellent Condition
B: Good Condition
C: Fair Condition
D: Unacceptably Bad Condition

2.5.8 Alternative Layout Plans

The new port consists of cargo terminals(phosphate, pellet, cement clinker, scrap, fertilizer, sulphur, general cargo for steel factory, oil coke and bagged fertilizer), small vessel terminal, access channel, turning basin, breakwaters, railway yard, road and other facilities.

Terminals where cargoes that have a high impact on the environment - sulphur, coke or phosphate- are handled, will be concentrated on the northern edge of the port. Since the prevailing wind blows from the south-west, the dust from the cargo is blown into the north-east direction where land use is very small. And terminals for steel related cargo - pellet, scrap and general cargo- will be concentrated in the south of the port, because pellet tends to be influenced by sulphur and phosphate.

Headquarter building, maintenance shop, small vessel terminals are located in the south of the port, where the impact from bulk cargo is small.

The location of the new port is decided comparing total cost, including dredging and reclamation cost. The following alternatives are proposed in relation to the distance from the shore.(See Fig 2.5.8-1, 2.5.8-2)

Alternative 1 : Least Reclamation Volume
Alternative 2 : Shift Off-shore by 150 m
Alternative 3 : Shift Off-shore by 300 m
Alternative 4 : Shift Off-shore by 450 m
Alternative 5 : Shift Off-shore by 600 m

Consequently, Alternative 3 is selected as the most economical plan.

(billion SP)

Alternative No.	1	2	3	4	5
Civil Works	7.13	7.23	7.15	6.86	6.82
Dredging	5.18	3.88	2.87	2.67	2.47
Reclamation	0.28	1.49	2.50	3.63	4.52
Other Facilities	3.20	3.20	3.20	3.20	3.20
Others	3.87	3.87	3.87	3.87	3.87
Grand Total	19.66	19.67	19.59	20.23	20.88
INDEX	101	101	100	103	107

(1,000m^3)

Dredging Volume	6,532	5,254	4,303	3,906	3,508
Reclamation Volume	933	5,008	8,445	12,278	15,328

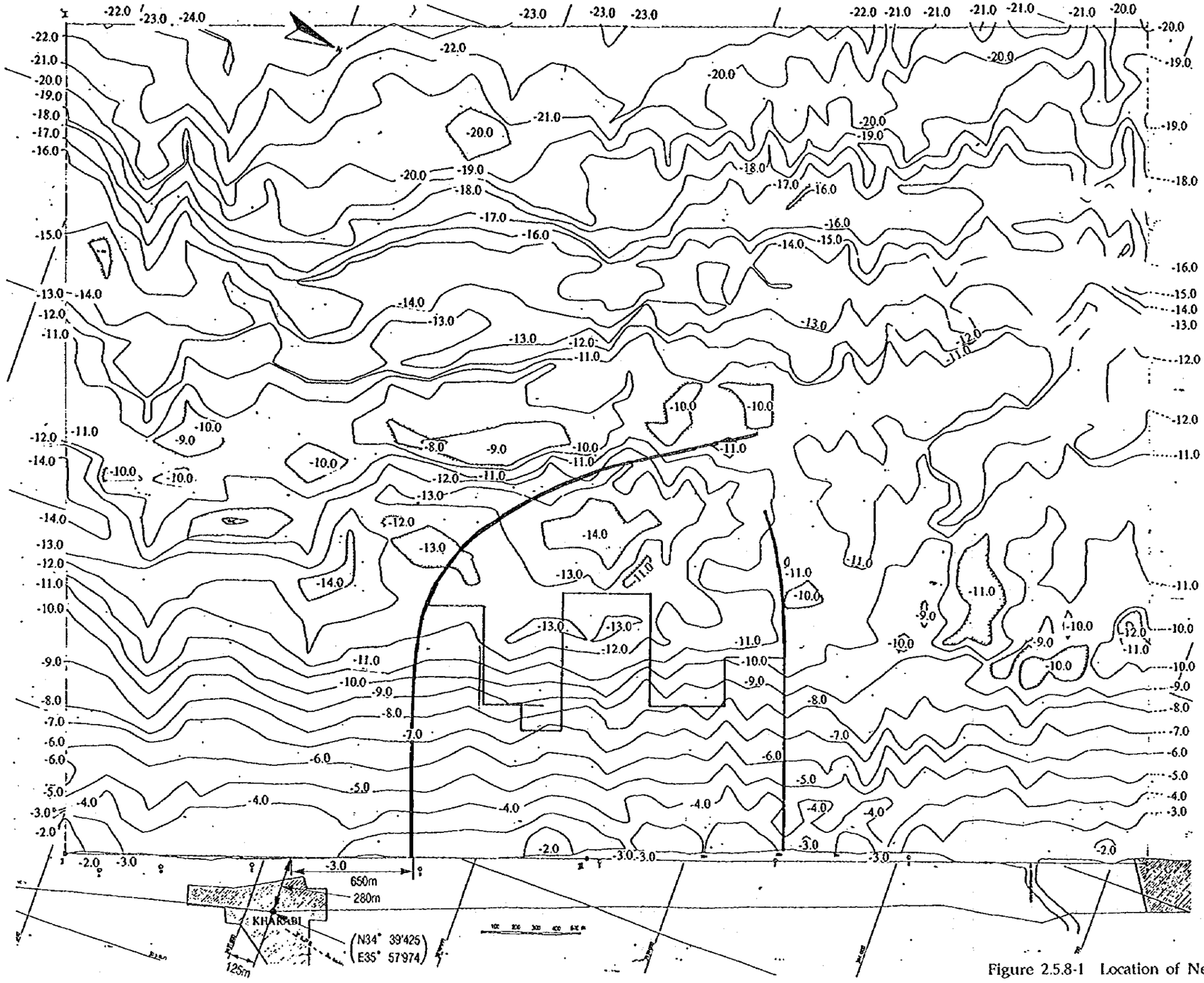


Figure 2.5.8-1 Location of New Port

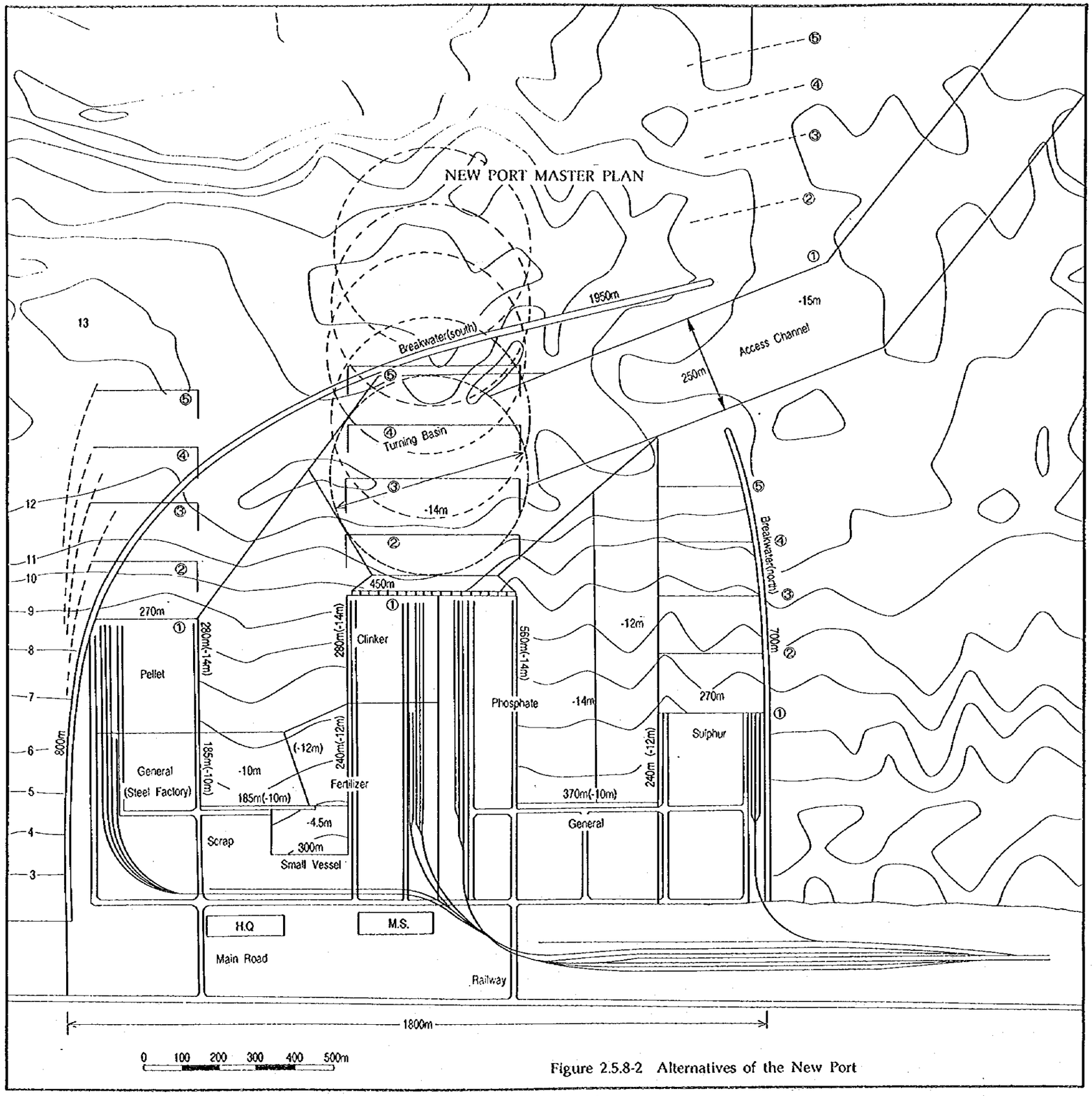


Figure 2.5.8-2 Alternatives of the New Port

2.5.9 Initial Environmental Examination

The area under consideration for the location of the new port is composed of a sand and rock foreshore with extensive low sand dunes. The hinterland is mainly agricultural land under intensive farming for vegetables and cereals. The main north south road to Lebanon forms a boundary between the coastal strip and the agricultural area. The main areas of residential occupation are Hamidie and Shatalarab to the north and Al Kharabeh to the south. The population density is low. To the east is a small wetlands area.

Existing environmental data was reviewed. In general the water quality can be classed as moderate to good. No other data on water quality parameters or sediments was available but is necessary for an EIA. Consequently site surveys were made.

The planned activities at the new port that may have a significant impact are dust generation, dredging, quarrying of material for reclamation, taking of agricultural land for the transportation infrastructure, and the construction activities. The degree of these impacts is not yet quantitatively established but as each can be controlled by appropriate mitigation measures they should not prevent the port proceeding.

There are several environmental impacts associated with the planned development which require further investigation, and an EIA was considered necessary.

2.5.10 Facility Design

The port facilities needed for the Master Plan of the new port are planned in the previous chapter. In this section, the preliminary designs for the main facilities are proposed.

(1) Breakwaters

The layout of the breakwaters and revetments is governed by the requirements of maximum protection of the water area of the new port. The overall length of the planned breakwaters will be around 2,650 m with maximum depth up to -13m. Based on the technical and economical assessment, the design of the breakwaters shall be analogous to that of the existing breakwaters of Latakia and Tartous which are the rubble mound type with outer slopes armored by concrete blocks.
The main dimensions of breakwater are summarized in the Table 2.5.10-1.
The standard cross section of the breakwater is shown in Fig.2.5.10-1.

Table 2.5.10-1 Main Dimensions of Breakwater

Depth (m)	$H_{1/3}$ (m)	Drown Height (m)	Weight of Armored Block (tons) Gradient of Slope 1/4/3
-15	6.1	+4.2	29
-12	5.8	+4.0	25
-10	5.4	+3.9	20
-8	4.7	+3.3	13
-6	3.9	+2.8	8
-4	2.7	+2.1	2.5
-2	1.7	+1.5	0.6

(2) Berths

The berths for bulk cargoes designed with water depths of -12m and -14m deep enough to accommodate 40,000 DWT ships and 65,000 DWT ships respectively. The water depth of berths in the inner port is -5.0m which can accommodate small size ships such as service boats.

Table 2.5.10-2 Design Conditions of Berths

Items	Planned Ship Size		
	65,000 DWT	40,000 DWT	under 1,000 DWT
Planned Water Depth (m)	-14	-12.0	-5.0
Berth Length (m)	280	240	70
Crown Height (m)	+2.8	+2.8	+2.8
Tidal Plane: H.W.L. (m)	+0.5	+0.5	+0.5
M.S.L. (m)	0.0	0.0	0.0
Surcharge: Ordinary (t/m_2)	2.0	2.0	1.0
Extra (t/m_2)	1.0	1.0	0.5
Geological Condition	Rock	Rock	Rock
Seismicity	0.03	0.03	0.03

Structural type of berthing facilities at the new port are proposed to be the gravity type because of hard sub-soil condition.
The standard cross section of the berth is shown in Fig.2.5.10-2.

(3) Revetment

At the end of the reclaimed area, a revetment is planned. The revetment will absorb the invading wave energy and also protect the land area from the slope failure.
The revetment will be armored with around 3,200 kg stones to protect the surface from the wave attacks.
The wave overtopping quantity can be estimated below by the data obtained from the hydraulic experiments carried out in Japan.

Table 2.5.10-3 Overtopping Quantity

Items	Planned Depth of Revetment		
	-10m	-6m	-4m
H.W.L.(m)	+0.5	+0.5	+0.5
$H_{1/3}$ (m)	5.4	3.9	2.7
Design Depth (m)	-10.5	-6.5	-4.5
Crown Level (m)	+3.5	+3.0	+2.5
Overtopping Quantity ($m^3/m/sec$)	$2 \times 10_{-4}$	$3 \times 10_{-3}$	$2 \times 10_{-2}$

Table 2.5.10-4 Standard of Overtopping Quantity

Area	Overtopping Quantity ($m^3/m/sec$)
Densely Inhabited District	0.01
Important Area	0.02
Others	0.02-0.06

The standard cross section is shown in Fig.2.5.10-3.

(4) Pavement

The standard cross section of the yard and apron are assumed for the master Plan as follows.

1) Open Yard, Apron

Open yard and apron are planned to be paved by asphalt concrete. The design loads are set as follows.

Truck	T-14
Tractor trailer	20 ft, 40 ft

The composition of the bituminous pavement is referred to Fig.2.3.12-4.

2) Road

Road is paved by asphalt concrete. The composition of the bituminous pavement is assumed as the same as open yard and apron.

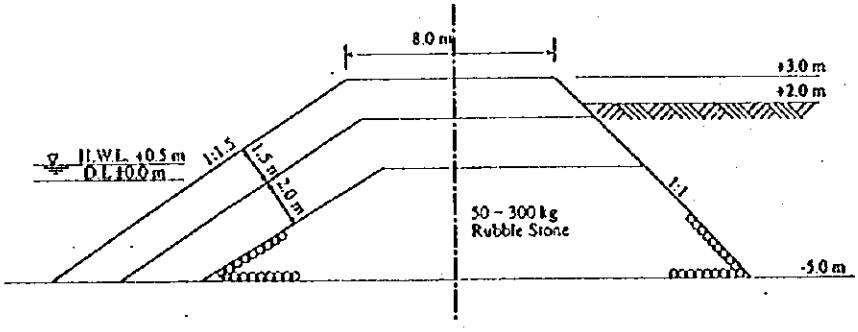


Figure 2.5.10-3 Standard Cross Section of Revetment

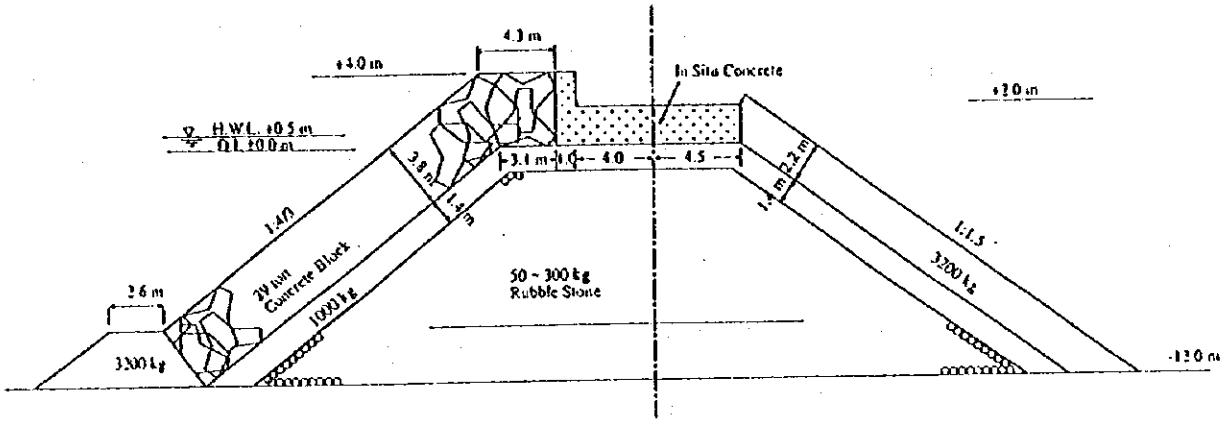


Figure 2.5.10-1 Standard Cross Section of Breakwater Rubble Mound Type (-12.0m)

CONCRETE BLOCK QUAY (-12.0m) S 1:200

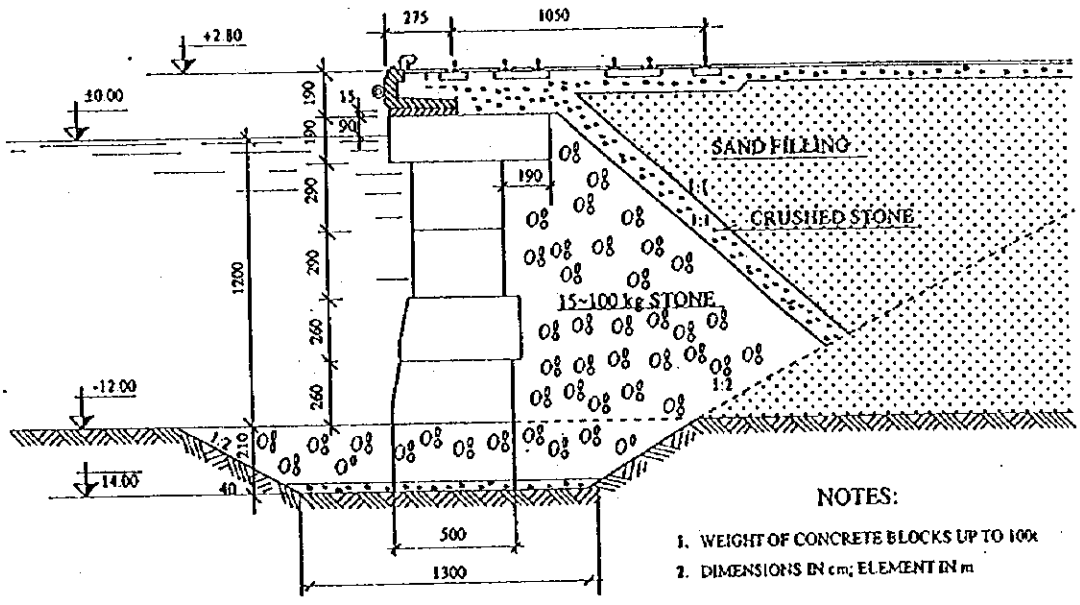


Figure 2.5.10-2 Standard Cross Section of Quay Block Type (-12.0m)

2.5.11 Cost Estimation

(1) Condition of Cost Estimate

Cost estimate is carried out based on the general condition of estimate which is mentioned in Chapter 1.6.

(2) Total Cost

As the result, total cost of Master-Plan is shown in Table 2.5.11-1.

Table 2.5.11-1 Total Cost of Master-Plan

NEW PORT

No.	Facilities	Unit	Q'ty	Unit Cost (S.P)			Cost (Unit: 1,000 S.P)		
				F.C	L.C	Total	F.C	L.C	Total
A	Civil Works				19,345,112				
1	Breakwater								
	Main Breakwater	m	1,950	0	1,225,000	1,225,000	0	2,388,750	2,388,750
	Sub Breakwater	m	700	0	980,000	980,000	0	686,000	686,000
	Breakwater (Small Vessel)	m	80	130,000	510,000	640,000	10,400	40,800	51,200
	Sub-Total						10,400	3,115,550	3,125,950
2	Dredging								
	(Rock)	m^3	2,111,105	1,000	0	1,000	2,111,105	0	2,111,105
	(Sand)	m^3	2,191,845	350	0	350	767,146	0	767,146
	Sub-Total						2,878,251	0	2,878,251
3	Reclamation								
	(Reclamation)	m^3	7,870,000	0	300	300	0	2,361,000	2,361,000
	(Add. Recla)	m^3	575,000	0	250	250	0	143,750	143,750
	Sub-Total							2,504,750	2,504,750
4	Wharf								
	Pellet(-14m)	m	280	350,000	898,000	1,248,000	98,000	251,440	349,440
	General Berth(-10m)	m	185	170,000	690,000	868,000	31,450	127,650	159,100
	Scrap(-10m)	m	185	170,000	690,000	868,000	31,450	127,650	159,100
	Clinker(-14m)	m	280	350,000	898,000	1,248,000	98,000	251,440	349,440
	Fertilizer(-12m)	m	240	380,000	800,000	1,180,000	91,200	192,000	283,200
	Phosphate(-14m)	m	560	350,000	898,000	1,248,000	196,000	502,888	698,888
	General/Coke(-10m)	m	370	170,000	690,000	860,000	62,900	255,300	318,200
	Sulphur(-12m)	m	240	380,000	800,000	1,180,000	91,200	192,000	283,200
	Small Vessel(-4.5m)	m	300	136,000	474,000	610,000	40,800	142,200	183,000
	Sub-Total						741,008	2,042,560	2,783,560
5	Revetment								
	(1)	m	650	0	800,000	800,000	0	520,000	520,000
	(2)	m	270	0	200,000	200,000	0	54,000	54,000
	(3)	m	450	350,000	898,000	1,248,000	157,500	404,100	561,6000
	(4)	m	270	0	160,000	160,000	0	43,200	43,2000
	(5)	m	450	0	128,000	128,000	0	57,600	57,6000
	Total of Revetment						157,500	1,078,900	1,236,4000
6	Apron/Yard/Open Space								
	(Pavement)	m^2	1,343,050	0	750	750	0	1,007,287	1,007,287
	(Add. Pave)	m^2	810,000	0	750	750	0	607,500	607,500
	Sub-Total						0	1,614,788	1,614,788
7	Railway	m	12,550	0	1,664	1,664	0	20,883	20,883
8	Road	m	4,100	0	1,200	1,200	0	4,920	4,920
9	Mobilization	LS	1	5,000,000	0	5,000,000	5,000	0	5,000
	Total of Civil Works						3,542,251	10,382,351	13,924,601
B	Building								
1	Storage	m^2	66,300	0	10,000	10,000	0	663,000	663,000
2	Phosphate Silo (Concrete)	LS	1	0	420,000,000	420,000,000	0	420,000	420,000
3	Machinery Tower	LS	1	0	115,500,000	115,500,000	0	115,500	1115,5000
	Total of Build						0	1,198,500	1,198,500
C	Utilities	LS	1				0	272,011	272,011
D	Cargo handling Equipment								
	Total of I.E	LS	1				3,200,000	0	3,200,000
E	Port Service Facilities	LS	1				130,000	20,000	150,000
F	Physical Conti/Engineering	LS	1				360,000	240,000	600,000
G	Grand Total						7,432,151	12,112,861	19,595,012

2.5.12 Preliminary Economic Analysis

(1) Costs of the Projects

The items that should be considered as costs of the projects are construction costs and maintenance costs.

(2) Benefits of the Projects

If the new port is not constructed, it is the most reasonable to assume that the cargoes which are planned to be handled in the new port would have to be handled in Tartous Port because those cargoes are handled there now. Therefore, in the "Without" case, the handling cargoes of Tartous Port combined with the cargoes handled in New Port are set as objects of economic analysis. After calculating the combined benefits, the benefits of New Port are estimated by subtracting the substantial benefits of Tartous Port from the Combined benefits.
In the "Without" case, transit cargoes in export are not handled and the size of vessels and the working efficiency of cargo handling are not the same as "With" case.
The items that should be considered as benefits of the projects are savings in waiting costs of ships, Savings in land transportation costs and Savings in water transportation costs by enlargement of ship size.

Table 2.5.12-1 Costs and Benefits of the projects

Items of Cost	Cost (Million SP)	Items of Benefit	Benefit (Million SP)
Construction	19,595.0	Waiting Costs	3,418.7
Maintenance	236.6	Land Transportation	260.7
		Ship Size	784.3
		Total	4,463.7

(3) Evaluation of the Projects

Economic evaluation of a project is carried out by calculating EIRR. The EIRR of the master plan is calculated as 15.6%. As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR exceeds 10 %. Therefore, this master plan development project is feasible from the viewpoint of the national economy.

2.6 Port Management and Operation

2.6.1 Existing Two Ports

2.6.1.1 Basic Concept on Management and Operation

In adequate management and operations, it is essential to modify organization, to improve operational procedures and systems, and to develop human resources so as to resolve the present problems and meet the future demand which are represented as a considerable increase in the volume of port cargo including the New Port and introduction of the new container terminal operation system in the existing two Ports

2.6.1.2 The present problems in the existing two ports

(1) Imbalanced personnel-arrangement of the organization

(2) Time - consuming documentation procedures

(3) Insufficient maintenance of cargo-handling machines

1) Latakia Port
The preventive maintenance system is not introduced yet at the port and repair periods are very long in some equipment. Further more the statistics for maintenance is not sufficient.

2) Tartous Port
The preventive maintenance is carried out but the level of the maintenance is insufficient because of many brokendown days. For mobile cranes and forklift trucks,the average working hours are same as staying hours in the maintenance shop.

(4) In sufficient computerization in the port field.

(5) Insufficient training system

2.6.1.3 Countermeasures

(1) Organization

Bureaucratic formalism makes it difficult to rationalize operations.
Therefore both port companies should check the number of workers and it is advisable that a task force consisting a few experts will be established to pursue a rational organization.

1) Number of Employees for the Operation

A) Cargo Handling at Latakia Port

a) Basic Concept on Organization of Cargo Handling

i) Conventional Break Bulk Cargo

- Present Organization for cargo handling of conventional break bulk cargo is not drastically revised in the Master Plan Stage.

- Number of cargo handling workers including drivers of cargo handling equipment at present should be adjusted to coincide with the Master Plan.

ii) Grain Terminal

- Management and operation system at present is not drastically changed in the Master Plan stage.

- Present organization and number of employees at the grain terminal should be adjusted to coincide with the Master Plan.

iii) Container Terminal

- In the Master Plan stage, the container terminal is operated by Container Terminal Division which is established in exploitation directorate.

- Closed terminal operation system should be adopted for container terminal operation.

- Major functions of container terminal in the Master Plan stage are as follows:

1. Cargo handling between vessel and marshalling yard.
2. Sorting and storing of containers.
3. Delivery/receiving of container/container cargo between the terminal and consignee.
4. Simple maintenance and repair of container and container handling equipment.
5. Making the stowage plan for loading and the storage plan at marshalling yard for unloading.
6. Necessary document work for execution of the above items.
7. Receiving charges for loading and unloading containers, storage, repairing etc..

b) Number of Cargo Handling Workers

i) Number of Cargo Handling Workers for Conventional Break Bulk Berths and Grain Terminals during the Master Plan Stage at Latakia Port.

The number of cargo handling workers for conventional break bulk ships and

employees at the grain terminals for operation are 60 shown in Table 2.6.2.1-1 and 2.6.2.1-2.

ii) Number of Employees at Container Terminal during the Master Plan Stage
The number of cargo handling workers for for container terminal for performing their functions is shown Table 2.6.2.1-3.

Table 2.6.2.1-1 Number of Workers for Break Bulk Cargo at Latakia Port in the Master Plan

Commodity	Worker
Food stuffs or agriculture products	About 240
Steel	About 480
Wood	About 230
Car, machine & equipment	About 100
Chemical	About 190
Various	About 770
Driver	About 940
Total	About 2,750

Table 2.6.2.1-2 Number of Employees at Grain Terminal

Organization		Employees
Director of silo		1
Old port	Assistant Director	1
	Mechanical Section	11
	Electricity Section	8
	Control Section	3 or4
	Fumigation Section	4 or 5
New Poct	Assistant Director	1
	Mechanical Section	11
	Electricity Section	8
	Control Section	3 or 4
	Fumigation Section	4 or 5
Total		56 or 60

Table 2.6.2.1-3 Required Number of Employees at Container Terminal in the Master Plan

unit:persons

Sectioin	Employees
Maneger of Container Terminal Division	1
Administration Department	10
Operation Department	311
Maintenance Department	54
C. F. S. Department	29
Total	405

B) Cargo Handling at Tartous Port

a) Basic Concept on Organization of Cargo Handling

i) Conventional Break Bulk Cargo
Present Organization for cargo handling of conventional break bulk cargo is not drastically revised in the Master Plan Stage.

Number of cargo handling workers including drivers of cargo handling equipments at present should be adjusted to coincide with the Master Plan.

ii) Grain Terminal
In the Master Plan stage, management and operation is conducted by the same company as at present.

Present organization and number of employees at the grain terminal should be adjusted to coincide with the Master Plan.

iii) Container Terminal
In the Master Plan stage, the container terminal is operated by Container Terminal Section which is established under the Storage Division in Exploitation Directorate.

Closed terminal operation system should be adopted for container terminal operation in the Master Plan stage.

Major functions of container terminal in the Master Plan stage are as follows:

1. Cargo handling between vessel and marshalling yard.
2. Sorting and storing of containers.
3. Delivery/receiving of container/container cargo between the terminal and consignee.
4. Simple maintenance and repair of container and container handling equipment.
5. Making the stowage plan for loading and the storage plan at marshalling yard for unloading.
6. Necessary document work for execution of the above items.

b) Number of Cargo Handling Workers.
The number of cargo handling workers for conventional break bulk cargo, employees at the additional grain terminals and the container terminal is shown Table 2.6.2.1-4, 2.6.2.1-5 and 2.6.2.1-6.

Table 2.6.2.1-4 Number of Workers for Break Bulk Cargo at Tartous Port

Commodity	Worker(person)
Food stuffs or agriculture products	About 220
Steel	About 370
Wood	About 240
Car, machine & equipment	About 70
Chemical	About 290
Various	About 600
Driver	About 940
Total	About 2,730

Table 2.6.2.1-5 Required Number of Employees at New Grain Terminal in Tartous Port

Section	Number of employees
Assistant Director	1 (persons)
Mechanical Section	4
Electricity Section	3
Control Section	3
Fumigation Section	4
Operation Section	45-50
Total	60-65

Table 2.6.2.1-6 Required Number of Employees of Container Terminal Department at Tartous Port in the Master Plan

unit:persons

Section	Employees
Manager of Container Terminal Department	1
Administration Section	9
Operation Section	126
Maintenance Section	26
C.F.S. Section	14
Total	176

(2) Operational Procedures

Ooperations must be safe, reliable and systematic. If there is even one inefficient sector, a bottleneck in the cargo flow is created and this will have a detrimental effect on the entire operation.

It is thus a good chance for the two Ports to promote streamlined documentation in accordance with building up the port system. This reexamination of documentation should be done on the basis of international standards and the forms of applications should be unified.

(3) Information System

To complement systematic operations, accurate and prompt information needs to be available at all times. Therefore administrative bodies of the ports in Syria should introduce a port information system in the long run to give information services to the bodies concerned.

1) Main components of the system

Examples are illustrated as follows;

A) Cargo System
① Documentation System
② Cargo Inventory System
-Loading System
-Delivery System

B) Port System
① Ship Movement Information
② Pilotage and Tug Boats Information
③ Piers' and Sheds' Information

C) Labor System
① Workers' registration
② Information of wages
③ Worker's Arrangement Information

Outside support of experts will be needed in case of the two Port Companies because there are few internal specialists and experience in port systems is limited. However outside experts have little knowledge and information about the actual port affairs such as container and cargo flow, billing system, handling system etc.. Tie-up and collaboration between the outside and the inside staffs are required just like the entrustment contract in Latakia.

2) Computerized Operation in the Container Terminal

Generally speaking, 60000TEU/a year is the limit to handle containers accurately, safely and quickly by manual procedure. Latakia port has already handled 134000TEU in the year 1994, and Tartous Port will surpass 60000TEU in the year 2002. Many ports in the world firstly introduced small computer system for the purposes of tally and statistics. However many of the ports which handle more than 120000TEU/ a year introduced the computer system mainly for the purposes of the following 8 categories.

1) Stacking plan
2) Vessel calling schedule
3) Receiving of gate-in container
4) Delivery of gate-out
5) Vessel loading planning
6) Discharging planning
7) Loading operation
8) In-yard movement and CFS container control

(4) Maintenance Organization

To propose maintenance organization in the target year,the following items must be considered

i. Establishment of the effective maintenance system for the equipment
ii. The role of maintenance engineers of the port
iii. The role of maintenance shop of the port

The study team recommend that the following organizations will be established in the target year.

For Latakia Port

i. Maintenance shop for container handling equipment at container terminal
ii. New section of Machinery Division under Operation Department for making the maintenance schedule and statistics of all handling equipment
iii. New division under Technical Affairs The work items are as follows:

To study and develop on more effective maintenance technique on existing equipment,
To establish the maintenance technique on new equipment and to make or review the maintenance manual.

For Tartous Port

i. New division under Technical Affairs. The work items are same as Latakia Port.

(5) Human Resources Development in the Master Plan

Judging from the current situation of Syrian ports, it is advisable that skill acquisition training and computer system training should be firstly pursued for the proposed components. To assist in training and skill acquisition, the followig methods might be employed.

1) Overseas Training
Special intensive training on computer and handling equipment for the short-term plan could be done abroad. Graduates of these courses could in turn become instructors.

2) Inviting Specialists from Abroad
OJT is very useful to the skill acquisition. Therefore invitation of technical supporting specialist or engineers on the port activities make it possible to accelerate technology transfer.

3) Basic Training in the Field of Port
The Port Company should provide a basic training course of lectures for new or transferred employees to get basic and comprehensive knowledge concerning port operations.

2.6.2 The New Port

2.6.2.1 Basic Concept on Management and Operation

(1) Land Ownership

The land of the new port to be created by reclamation should be kept as state-owned land.

(2) Construction of the new port infrastructure

In the new port, it is proposed that infrastructure should be constructed by the port corporation to be newly established including the infrastructures of terminals for exclusive use.

(3) Operations of the Exclusive Terminals for bulk cargoes

One option of operation for the New Port is for each state-owned company which represents not only the consignor and consignee of the port cargoes but also the producers at their factories or mines inland to operate the marine terminal directly. Bbecause operations at each terminal will be done consistently under a state-owned company which can control the process from start to finish, from production at their factories or mines inland to loading/ unloading their cargoes in the marine terminals.

(4) Procurement of Cargo-handling Machinery and Construction of Storage Facilities for Exclusive Terminal

It is advisable that construction of the storage facilities and procurement of cargo-handling equipment are done by the port corporation and that facilities are then leased to the state-owned companies to unify the different opinions and achieve smooth implementation.

(5) Proper Financial Support

Considering that the cargoes handled in the new port are mainly bulk and primary products, it might be necessary to lower port charge so as to keep international competitiveness of Syrian exporters.Thus suitable countermeasures for the expected shortage of funds, for instance, introduction of subsidy from the central government, must be considered.

2.6.2.2 Number of Employees at New Port

1.Basic Concept

-Iron pellet, iron scrap, phosphate, Cement clinker, export fertilizer and flake sulphur are handled at exclusive terminals for each commodity.

-Terminal operations of Iron pellet and iron scrap are operated by the same operator.

-Major functions of exclusive terminals in the Master Plan stage are as follows:

1.Cargo handling between vessel and storage area.
2.Sorting and storing.
3.Delivery/receiving.
4.Simple maintenance and repair of cargo handling equipment.
5.Necessary document work for execution of the above items.

-General cargo berths(main commodities:bagged fertilizer, fire bricks and oil coke) are operated using public use system(open system) by General Port Company.

2.Number of employees at exclusive terminal

The number of employees at exclusive terminals(Iron pellet and iron scrap, phosphate, export fertilizer and flake sulphur) is shown in Table 2.6.2.2-1.

Table 2.6.2.2-1 Number of employees of Exclusive Terminal

Commodity	Worker(person)
Phosphate Terminal	About 210
Steel Terminal	200-210
Export Fertilizer Terminal	110-120
Cement Clinker Terminal	100-110
Sulphur Terminal	115-120
Total	735-770

3.Number of Cargo Handling Workers at Public Berths

The number of cargo handling workers at the public berths(General cargo, fire brick and oil coke) is shown in Table 2.6.2.2-2.

Table 2.6.2.2-2 Number of Cargo Handling Workers for General Cargo Berths at New Port in the Master Plan

Commodity	Worker(person)
Steel & others	45-50
Oil coak & others	70-75
Fertilizer & others	85-95
Driver	About 34
Total	234-254

Chapter 3 SHORT-TERM PLAN

3.1 Short-Term Plan of Latakia Port

3.1.1 The Basic Concept of the Port Development Plan

The Short-Term Plan is prepared as a first-phase plan with a target year of 2003 for the development of Latakia Port. The Short-Term Plan is made within the framework of the Master Plan. Investment for the projects proposed in the Master Plan will be needed at some stage by the target year of the Master Plan, and the timing of the investment for the above projects must be determined individually according to the respective conditions. The following are proposed as the short-term projects (first phase projects) to be implemented by the year of 2003:

(1) Modernization of the existing container terminal
(2) Introduction of a closed terminal system in the container terminals
(3) Construction of a new grain terminal
(4) Modernization of the existing grain terminal
(5) Preparation of required cargo-handling machines
(6) Construction of a new passenger terminal having a direct access to the outside of the port

3.1.2 Usage Plan for the Existing Port Facilities

In order to decide the appropriate number of berths in the target year, vessels are divided into ten types, then the estimated cargoes are distributed to each type of vessel. The vessels are distributed on the following premises considering the actual operations and records at similar ports.

Table 3.1.2-1 Usage Plan of the Berths by Vessel Type

Vessel Type	Vol.	Ve.Cap.	No Ve.	H Prod.	Quay No.
General(var.)	961	1,390	692	33	1,2,3,4,5,6,7,8,9,10,11,12
Foodstuff	394	1,950	202	35	1,2,3,4,5,6,7,8,9,
Steel	246	1,880	131	80	10,11,12
Wood	264	1,370	193	22	7,8,9,10,11,12
Car	221	340	651	15	2,3,4,5,7,8,9
Chemicals	120	2,550	48	37	1,2,3,4,7,8,9
Ro/Ro	129	990	131	36	5,13
Grain(import)	260	27,000	10	236	Existing,12A
Grain(export)	1,400	19,500	72	320	Existing,12A
Container*	316*	830	381	48	14,

Note:Vol.:Cargo Volume(Thousand tons), Ve.Cap.:Average Vessel Capacity(tons), No Ve.:Number of Vessels, H Prod.:Cargo Handling Productivity(ton/hr) *(Unit: TEUs)

The results of the simulation are as follows:

	Average Waiting Time(hours)
General(Var.):	9.3
Foodstuff:	10.6
Steel:	22.3
Wood:	18.2
Car:	11.8
Chemicals:	10.1
Ro/Ro:	9.9
Grain(Import):	9.0
Grain(Export):	4.2

3.1.3 Container Terminal Plan

To cope with 316,000 TEUs of containers passing through the existing container terminal at Latakia Port in 2003, it is necessary to increase container-handling capacity a much as possible by modernizing the existing container terminal (Terminal-1) through the installation of four units of dock-side gantry cranes, rearrangement of yard facilities and introduction of the closed terminal operation system.

3.1.4 Grain Terminal

Modernization of the Grain Terminal in the Old Port area is planned in the stage of the Short-Term Plan as well as construction of a new grain terminal after which the grain handling capacity will reach 1.6 million tons. The following terminal at the Old Port area will start operation by the year 2003.

Terminal (1) :

Location	:	Old Port
Berth capacity	:	Depth -12m, Length 210m
Loader	:	400 ton/hour
Unloader	:	200 ton/hour
Silo capacity	:	35,000 ton (existing silo)

In order to avoid a stoppage in grain handling, the new terminal must be completed by the time improvement work in the Old Port area starts. The following terminal will be completed by the year 2003.

Terminal (2) :

Location	:	New Port (behind Berth No.12A)
Berth capacity	:	Depth -13m (existing berth)
Loader	:	400 ton/hour
Unloader	:	400 ton/hour
Silo capacity	:	65,000 ton

3.1.5 Passenger Terminal

Since the existing passenger terminal is already superannuated and the accessibility is not good, the terminal will be completed in the short-term. Assuming the estimation condition is the same as that in the year 2010, the yearly passenger number in 2003 is 50,000, and peak passenger number is 1,000.

Referring to a similar passenger terminal plan in Japan, the terminal will consist of the following facilities.

- Terminal Building (2,300 m^2)

Passenger Waiting Room	: 1,000 m^2
Office, Custom, Quarantine	: 400 m^2
Operation,	200 m^2
Stairs, utilities, machine	: 400 m^2
Restaurant	200 m^2
Shops	100 m^2
Total	2,300 m^2

- Passenger Bridge

Bridge (berth-terminal bld.)	150 m
Bridge (bld.-parking)	5 m

- Parking Place

Small-medium car	80 lots
Bus	10 lots

Passengers can access terminal building from the vessel by passenger bridge. First floor of the building is used mainly for passengers, while ground floor is used for office, operation and machines. Facility lay out is shown in Fig.3.1.5-1, and layout of the terminal building is shown in Fig.3.1.5-2.

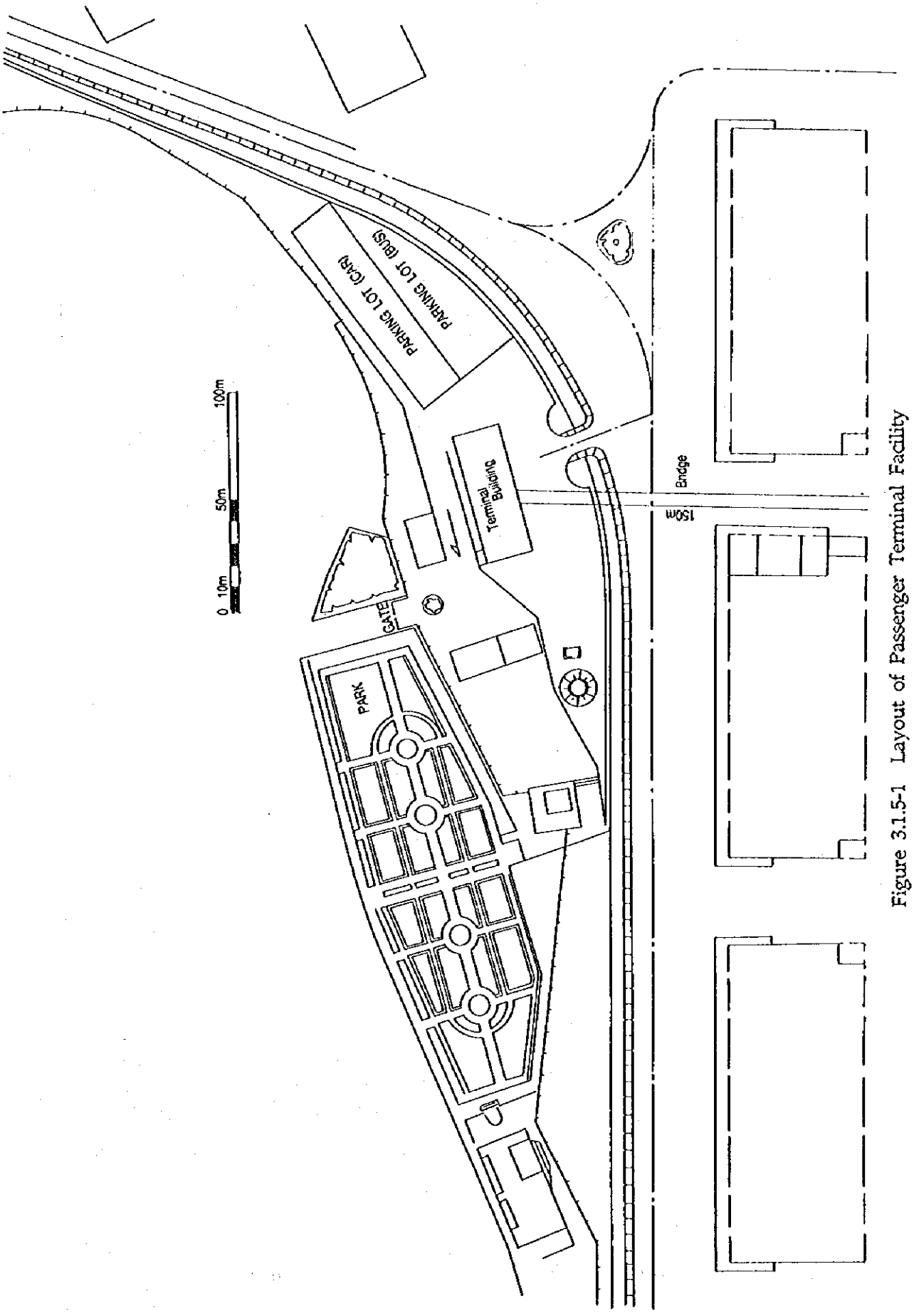
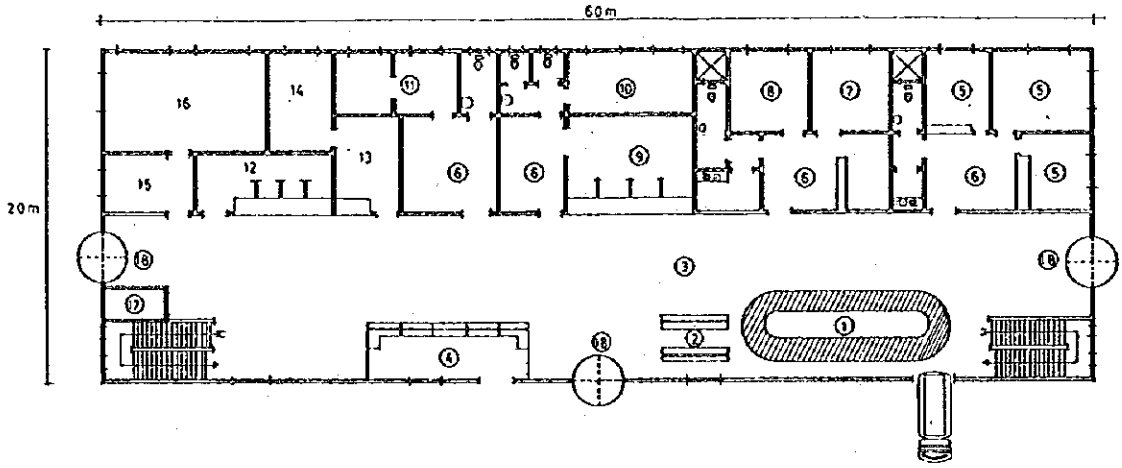


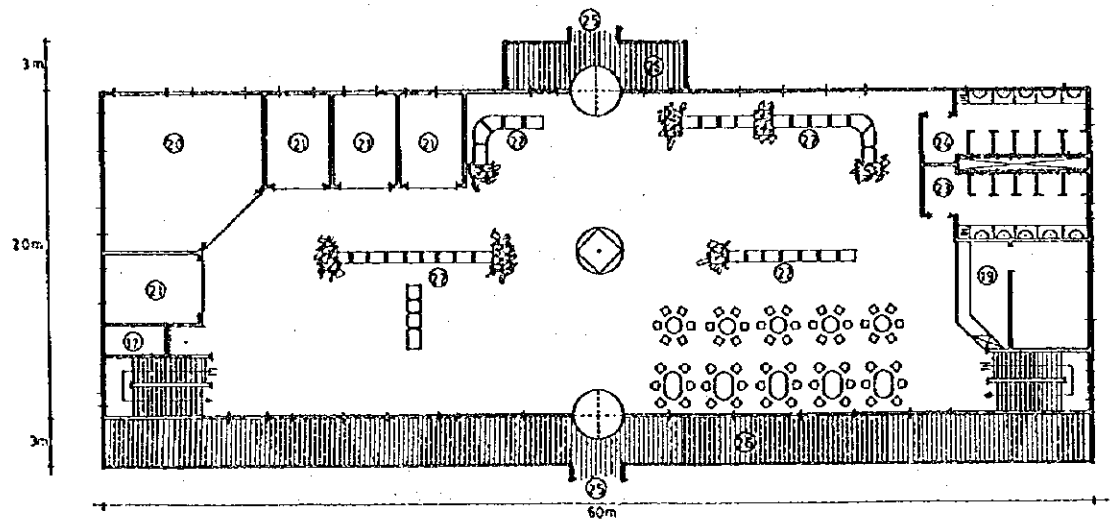
Figure 3.1.5-1 Layout of Passenger Terminal Facility

1 – LUGGAGE CONV BELT
2 – LUGGAGE CHECK
3 – PASSENGERS HALL
4 – WEIGHING DEPART LUGGAGE
5 – CUSTOM OFFICE
6 – HALL
7 – IMMIGIRATION DIRECTOR
8 – ASS. IMMIGIRATION DIRECTOR
9 – IMMIGIRATION OFFICE
10 – BED ROOM
11 – CLINIC
12 – TICKETS OFFICE
13 – SECURITY OFFICE
14 – SECURITY CHIEF
15 – DUMP CHIEF
16 – DUMP
17 – ELEVATOR
18 – ENTRANCE – EXIT



FIRST FLOOR PLAN

19 – COFEE SHOP – SNAK
20 – FREE SHOP
21 – SHOP
22 – SEATS
23 – WC.M
24 – WC.W
25 – DEPARTURE TUNNEL
26 – BALCONY



SECOND FLOOR PLAN

Figure 3.1.5-2 Layout of Terminal Building

3.1.6 Cargo Handling System

Modernization of cargo handling system at port is prompted by the following:

1. Shortage of facilities to meet the increasing cargo volume.

2. Worldwide trend of modernizing cargo transportation to reduce cargo handling cost at port and allow quick dispatch of calling vessels from port.

According to the cargo forecast, increase in the cargo handling volume at the Short-Term Plan stage will represent about half the total increase anticipated at the Master Plan stage of Latakia Port. Therefore, it is assumed that the existing major port facilities and equipment except those for handling containers and grains will be sufficient for the Short-Term Plan stage if old cargo handling equipment is replaced at the beginning of the Short-Term Plan stage and improvement of the actual cargo handling time (introduction of three shift system for cargo handling, namely, expansion of cargo handling time from 16 hours to 24 hours)is sought.

Therefore, the improvement of delivery/receiving system (abolishment of the direct delivery/receiving at quay side.) will not be strongly promoted during the Short-Term Plan stage.

The grain handling capacity will be increased with construction of the new grain terminal with grain berth and through repairing the present grain terminal with grain berth at the request from the Syrian government. As to container cargo handling at the existing terminal in the New Port area(Terminal-1), additional cargo handling equipment including straddle carriers and top lifters, together with quay side container cranes, will be introduced during the Short Term Plan stage.

Therefore, present condition of delivery/receiving system at Latakia Port will be continued in the Short-Term Plan stage.

3.1.7 Access Channel and Basins

The dimension of the largest vessel that uses the Grain Terminal(1) is as follows:

- Capacity : 30,000 DWT
- Draft : 10.9 m
- LOA(Length Over All) : 180 m
- Breadth : 26 m

Since the water depth in the Old Port area is around 9 m, dredging is necessary. Turning basin is planned in front of Berth No.1 where the dredging volume is smaller. Since the distance between breakwater and Berth No.4 is limited, the diameter of the basin is planned to be 270 m = 1.5 LOA under assistance of tug boats. The width of the access channel is planned to be 180 m = 1 LOA.

Total dredging volume for these basins is 300,000 m^3, while total reclamation volume is estimated to be 330,000 m^3. Both volumes are almost balanced.

3.1.8 Layout Plan

The layout of the major facilities is described in Fig.3.1.8-1.

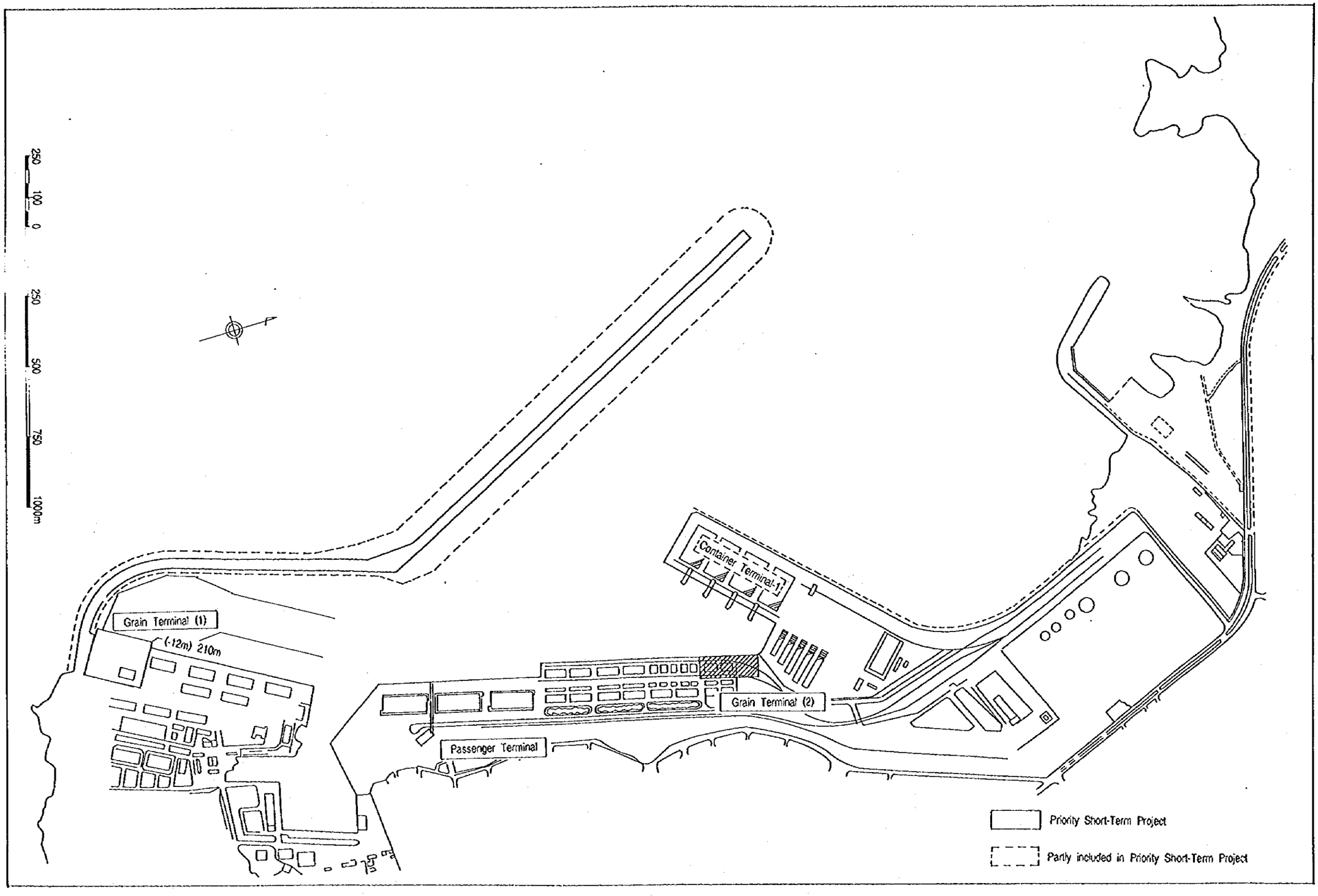


Figure 3.1.8-1 Layout Plan of Latakia Port

3.1.9 Design of Major Structure

In the Short-Term Plan of Latakia Port, the following facilities, building and equipment are planned by the year 2003. Among these, designs of grain terminal berth, open yard and road are described in this section.

Table 3.1.9-1 Planned Facilities in the Short-Term Plan of Latakia Port

Facilities	Unit	Master Plan	Short-Term Plan
Main Breakwater	m	600	
Sub Breakwater	m	900	
Grain Terminal (1):			
Wharf (-12m)	m	210	210
Water Basin (-12m)	m^3	579,400	579,400
Reclamation	m^3	22,770	22,770
Pavement	m^2	3,970	3,970
Grain Terminal (2):			
Silo	L.S.	1	1
Railway	L.S.	1	1
Container Terminal (2):			
Wharf (-14m)	m	700	
Water Basin (-14m)	m^3	1,643,000	
Backup Area	m^2	245,000	
General Cargo Terminal			
Wharf (-10m)	m	555	
Passenger Terminal:			
Terminal Building	m^2	2,400	2,400
Boarding Bridge	m	150	150

(1) Grain Terminal Berth

Design conditions for the grain terminal berth are set as follows.

Table 3.1.9-2 Design Conditions for Grain Berth

Items	Existing Berth	Improvement Plan
Planned Ship (DWT)	10,000	40,000
Water Depth of Berth (m)	-8.5	-12.0
Berth Length (m)	180	210
Crown Height (m)	+2.8	+2.8
Planned Surcharge (t/m^2) Ordinary Extra-ordinary	 not clear not clear	 2.0 1.0
H.W.L. (m)	0.5	0.5
Geological Condition	silty sand	silty sand
Seismicity	0.03	0.03

The standard cross section of the grain terminal berth is shown in Fig. 2.3.12-2. According to the design of this cross section, the safety factors for sliding ($S.F._1$) and the safety factors for overturning ($S.F._2$) result in the Table 3.1.9-3. These figures show the sufficient stability against sliding and overturning.

Table 3.1.9-3 Safety Factors of Grain Terminal Berth

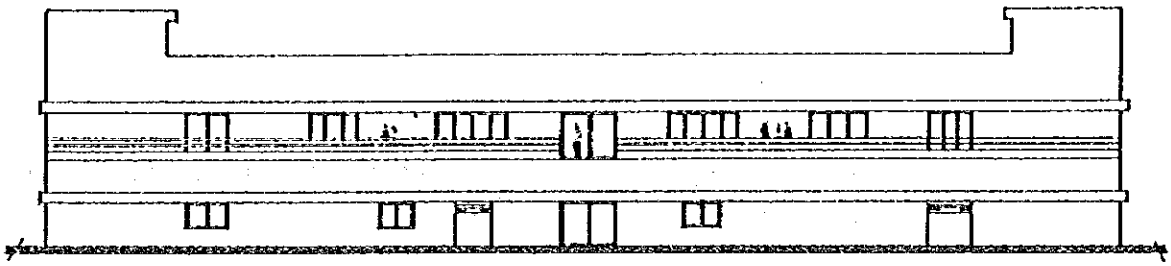
Case	$S.F._1$ for sliding	$S.F._2$ for Overturning
Ordinary Condition	1.31	1.30
Special Condition	1.25	1.19

(2) Open Yard, Apron, Road

Open yard, apron and road are planned to be paved by asphalt concrete. The composition of the bituminous pavement is shown in Fig. 2.3.12-4.

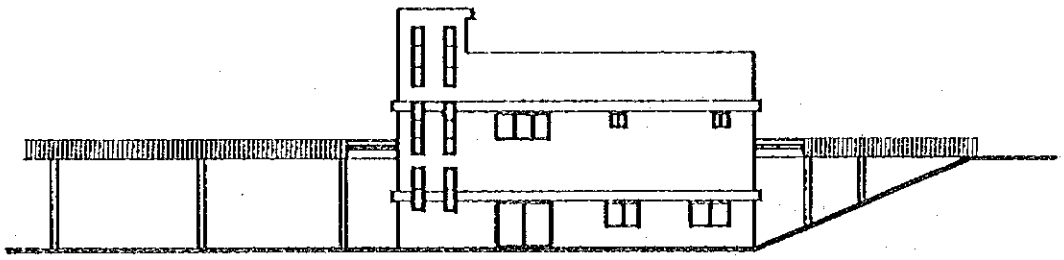
(3) Passenger Terminal

Passenger terminal is planned to be a reinforced concrete two storied building with boarding bridge connecting the building to passenger terminal berth. The building is also connected with the rear area by approach bridge. The total area of the building is around 2,400 m^2.
The conceptional plan is shown in Fig. 3.1.9-1.-2.



ELEVATION 1/200

Figure 3.1.9-1 Conceptional Plan of Passenger Terminal Elevation



SIDE ELEVATION 1/200

Figure 3.1.9-2 Conceptional Plan of Passenger Terminal Side Elevation

3.1.10 Design of Cargo Handling Equipment

(1) Container Handling

1) Container cranes
Two container cranes are installed at each berth,totalling four cranes in the target year and the ship size for the cranes is panamax type.

2) Straddle carrier for yard handling
Straddle carrier system is proposed by the study team and the require number of it are 14 units.
Three existing straddle carriers are used continuously and 11 units will be procured.

3) Minor handling equipment
Nine forklift trucks(3t), nine forklift trucks(2t) ,two tractors and nine trailers will be procured newly for container handling.

(2) Grain Terminal

1) Silo
New grain silo(capacity 65,000 t) will be constructed in the new port area and the existing silo(35,000 t) will be used continuously.

2) Loader cum Unloaders
Two sets of large capacity loader cum unloader (400/400 t/h each) will be installed at the new grain terminal and two sets of middle capacity loader cum unloader (400/200 each) will be installed at the existing grain terminal.

3) Machinery tower
New machinery tower will be constructed on each terminal respectively.

4) Related handling equipment and related equipment
Related handling equipment(belt conveyors,chain conveyors and bucket elevators) and related equipment (removal system of foreign materials ,weighing equipment,fumigation equipment,dust collection equipment, drier and fire fighting and safety equipment will be equipped at the each terminal respectively.

(3) Conventional berth

Twelve portal jib cranes will be replaced on berth 1st-4th.
Further more four mobile cranes(65 t), fifty forklift trucks(5t special type 5 units,5t 10 units and 3t 19 units) will be procured for general cargo handling.

3.1.11 Implementation Program

(1) Workable Days

An average wind speed over 10 m/sec and significant wave height over 1.0 m are experimentally assessed as critical for the marine construction works.
According to the data on the frequency of stormy winds over the eastern part of the Mediterranean Sea, the stormy days over 10 m/sec are recorded to be 4.19 % per year. Consequently, non-workable days caused by wind condition are approximately 15 days per year. Rough wave days are included in above stormy days. (Ref. Extension of the Port of Latakia, 1980, USSR State Design and Research Institute of Sea Transport)
As for holidays, there are 70 holidays totally, that is, 48 Fridays and national 22 national holidays. So, the net workable days per year are assumed to be 280 days or 23 days per month.

Fridays	48
National Holiday	22
Stormy Days	15
Total	85

(2) Working Efficiency

Working efficiency of main works is assumed as follows.

Table 3.1.11-1 Working Efficiency

Works	Working Efficiency
Dredging	744 m^3/day Grab dredger: 4 m^3 × 1
Dredging	1,408 m^3/day Grab dredger: 8 m^3 × 1
Core Stone	343 m^3/day
Armor Stone	242 m^3/day
Leveling	19.3 m^2/day
Concrete Block (Ave. 80ton)	1.8 Nos/day
Pavement	150 m^2/day

(3) Working Schedule

After the completion of the detailed design in 1998, the construction of the port facilities is to start in 1999 and be completed by the end of 2002.
The construction schedule is shown in Fig. 3.1.11-1.

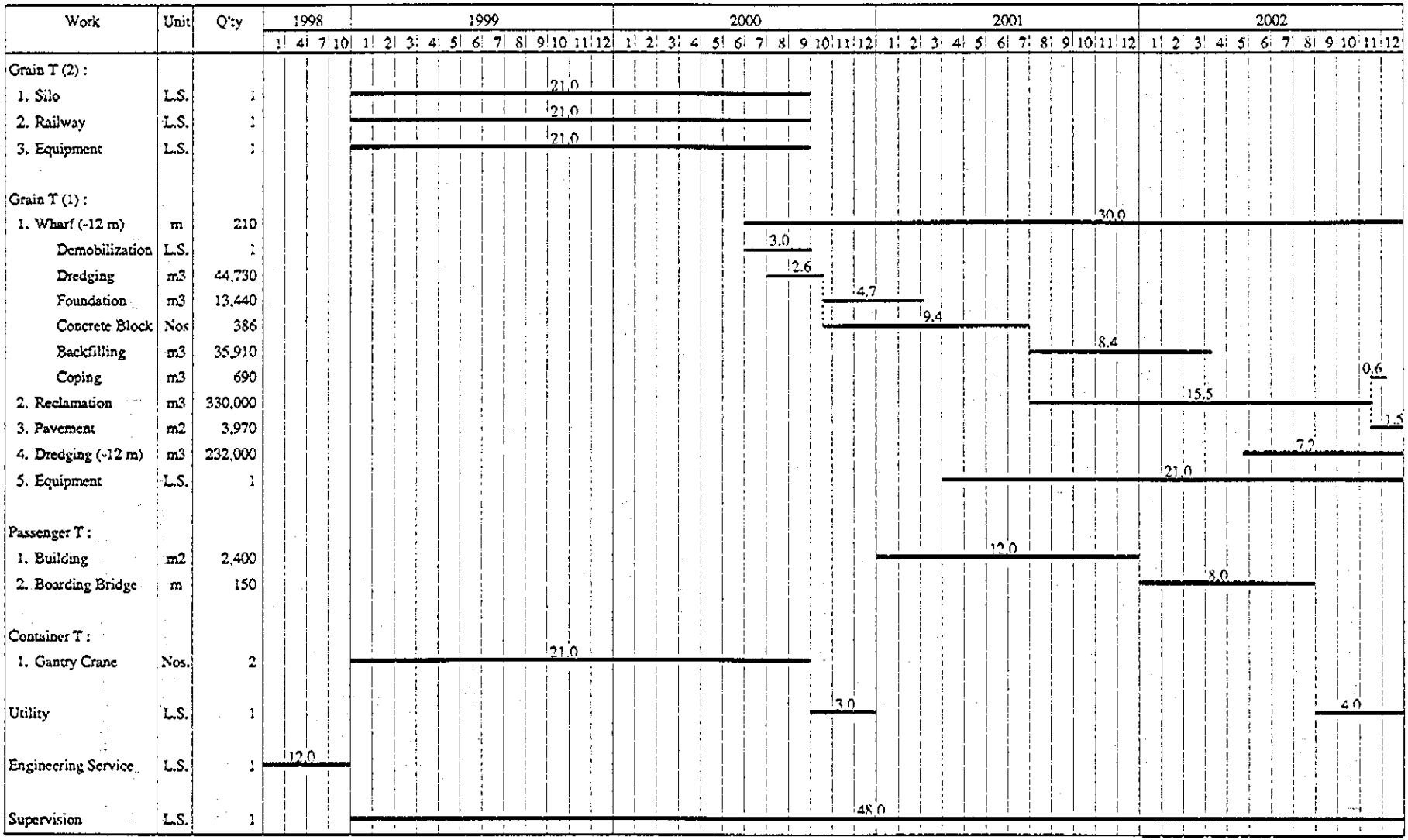


Figure 3.1.11-1 Construction Schedule for Latakia Port

3.1.12 Cost Estimation

(1) Unit Price of Main Facilities

The cost estimate is carried out, and the unit price of main facilities are shown as below:

(2) Total Cost

The total cost of Short-Term Plan is estimated as around 4,910 Millions S.P, and is tabulated in Table 3.1.12-1.

(3) Yearly Investment

The yearly investment based on the implementation program in Chapter 3.1.11 is shown Table 3.1.12-2.

Facilities	Unit	Unit Price		
		F.C	L.C	Total
Grain Terminal (1)				
Wharf(-12m)	S.P/m	235,000	800,000	1,035,000
Dredging(-12m)	S.P/m^3	600	0	600
Grain Terminal (2)				
Grain Silo(65,000t)	1,000 S.P/Unit	117,600	50,400	168,000
Machinery Tower(New)	1,000 S.P/Unit	0	105,000	105,000
Loader/Unloader	1,000 S.P/Unit	126,000	0	126,000
Container Terminal				
Container Crane	1,000 S.P/Unit	239,400	0	239,400
Straddle Carrier	1,000 S.P/Unit	39,860	0	39,860

Table 3.1.12-1 Total Cost of Short-Term

LATAKIA PORT(Short-Term)

No.	Facilities	Unit	Q'ty	Unit Cost (Unit:S.P)			Cost (Unit:1,000 S.P)		
				F.C	L.C	Total	F.C	L.C	Total
A	Civil Works								
1	Grain Terminal(1)								
	Dredging(-12m)	m3	300,000	600	0	600	180,000	0	180,000
	Wharf(-12m)	m	210	235,000	800,000	1,035,000	49,350	168,000	217,350
	Revetment	m	20	0	490,000	490,000	0	9,800	9,800
	Reclamation	m3	330,000	0	300	300	0	99,000	99,000
2	Mobilization	LS	1	2,500,000	0	2,500,000	2,500	0	2,500
	Total of Civil Works						231,850	276,800	508,650
B	Building								
1	Grain Silo(Metallic)	LS	1	117,600,000	50,400,000	168,000,000	117,600	50,400	168,000
2	Machinery Tower(new)	Nos	1	0	105,000,000	105,000,000	0	105,000	105,000
3	Machinery Tower(exist)	Nos	1	0	94,500,000	94,500,000	0	94,500	94,500
4	Passenger Terminal&	m2	2,300	0	9,130	9,130	0	21,000	21,000
	Total of Building						117,600	270,900	388,500
C	Utilities	LS	1				0	48,174	48,174
D	Cargo Handling Equipment								
	Total of Equipment	LS	1				3,815,200	0	3,815,200
E	Physical Cont+Engineering Fee	LS	1				130,000	20,000	150,000
F	Grand Total						4,294,650	615,874	4,910,524

Table 3.1.12-2 Yearly Investment Schedule

(Unit:1,000S.P)

Items	1998		1999		2000		2001		2002	
	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C
Civil Works	-	-	-	-	12,370	33,600	96,740	110,000	122,740	133,200
Buildings	-	-	67,200	133,800	50,400	21,600	0	12,600	0	102,900
Utilities	-	-	-	-	0	20,600	-	-	0	27,574
Cargo Handling Equip	-	-	1,349,860	0	959,490	0	752,925	0	752,925	0
Physical Contingency and Enginerring Fee	26,000	-	26,000	500	26,000	5,000	26,000	5,000	26,000	5,000
Grand Total	26,000	-	1,443,060	138,800	1,048,260	80,800	875,665	127,600	901,665	268,674

3.1.13 Economic Analysis

(1) Methodology

The purpose of economic analysis is to appraise the economic feasibility of the short-term plan for the study ports from the viewpoint of the national economy of Syria.

Short-term plan will be defined and compared to the "Without" case. All benefits and costs of it in market price for the difference from "With" case will be calculated and it will be converted to economic price. All benefits and costs are evaluated using economic prices in the economic analysis based on the border price concept. In this study, the economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project.

(2) Costs of the Projects

The items that should be considered as costs of the projects are construction costs, maintenance and operation costs and renewal investment costs.

(3) Benefits of the Projects

The item that should be considered as benefits of the projects is savings in waiting costs of ships. In the "Without" cases of the container and grain terminal projects, the size of vessels and the working efficiency of cargo handling are not the same as "With" case.

Table 3.1.13-1 Costs and Benefits by the projects

(Unit: Million SP)

Project	Cost		Bnefit		
	Item	Cost	Item	Year	Benefit
Container Terminal	Construction	1,489.0	Ship Waiting	2001	525.8
	Maintenance	79.7		2007 & over	663.2
	Renewal: 7years	486.6			
	17years	957.6			
Grain Terminal	Construction	2,903.1	Ship Waiting	2003	681.7
	Maintenance	89.2		2007 & over	967.7
	Renewal: 7years	0.0			
	17years	445.2			
Others	Construction	497.7			
	Maintenance	18.5			
	Renewal: 7years	191.5			
	17years	264.3			
Total	Construction	4,889.9	Ship Waiting	2003	1,344.9
	Maintenance	187.4		2007 & over	1,630.9
	Renewal: 7years	678.1			
	17years	1,667.1			

(4) Evaluation of the Projects

Economic evaluation of a project is carried out by calculating EIRR. Minimum value of EIRR in the short-term plan is 18.9% reported in Table 3.1.13-2. EIRRs of all projects greatly exceed 10 %, which is considered to be the general standard evaluation the project. Therefore, these projects in the short-term plan is feasible from the viewpoint of the national economy.

Table 3.1.13-2 Economic Internal Rate of Return (EIRR)

Project	Container Terminal	Grain Terminal	Total
EIRR(%)	29.2	19.8	18.9

3.1.14 Financial Analysis

3.1.14.1 Purpose of the Financial Analysis

The purpose of the financial analysis is to examine the viability of the project in the short-term plan and the financial soundness of the port management entity during the project life.

3.1.14.2 Methodology of the Financial Analysis

(1) Viability of the Project

The viability of the project is analyzed using the Financial internal Rate of Return (FIRR) by means of the discount cash flow method.

When the calculated FIRR exceeds the weighted average interest rate of the total funds for the investments of the project, the project is regarded as finacially feasible.

(2) Financial Soundness of the Port Management Entity

Financial soundness of the port management entity is appraised based on its projedted financial statements. The appraisal is made from the viewpoint of profitability, loan repayment capacity and operational efficiency.

3.1.14.3 Prerequisites of the Financial Analysis

(1) Scope of the Financial Analysis

The analysis of viability applies only to the project. The project means the construction work and the modernization work of existing port within the short-

term development plan for the Latakia Port. The passenger terminal's building cost is excluded in the financial analysis.

(2) Prerequisites of the Financial Analysis for the Container Terminal and the Grain Terminal

1) Project Life

Taking into account the conditions of the long-term loans and the service lives of the port facilities, the project life for the financial analysis is determined as 34 years from the beginning of the project including four years of detailed design and construction of the port facilities.

2) Base Year

For the estimate, all costs, expenditures and revenues analyzed quantitatively here are indicated in prices as of 1995, when the price survey was conducted. Neither price inflation nor increase in nominal wages are considered during the project life.

3) Fund Raising

Generally, fund raising is mainly divided into two kinds, that is, foreign and domestic funds. In this project, all the costs of foreign procurement are assumed to be raised by foreign fund (soft loan) and the remaining initial investment costs are assumed to be raised by internal resources of the Fund in principle. The required money for domestic funds is procured out of the General Monetary Fund of which interest rate is 9%.

① Foreign Funds

Loan period : 30 years
Grace period : 10 years
Interest rate : 2.7%

② Domestic Funds

Loan period : 40 years
Interest rate : 9%

③ Weighted Average Interest Rate

The following table shows the weighted average interest rate of the funds for investments when above funds are applied.

Average Interest Rate

Average Interest Rate	3.47 %

4) Cargo Handling Volume

The cargo volume that can be handled in the current container terminal and the grain terminal will reach its limit in 2000 and in 1996 respectively.

(3) Expenditure

1) Maintenance and Repair

The annual maintenance and repair costs for the port facilities are calculated as follows:

Infrastructure : 1% of the construction cost
Equipment : 4% of the procurement cost

Operation of the planned facilities will start as follows. (cf.Construction Schedule chapter 15.11.3)

Grain Terminal A : from the year 2001
Grain Terminal B : from the year 2003
Gantry Crane : from the year 2001

2) Personnel Cost and Administration Cost

The annual personnel cost is estimated based on the required number of workers and existing pay scales. Administration cost (material cost) is assumed as 25% of total personnel cost in propotion to the increase of the past administrative cost and the assumption of the modernized management system in the target year.

3) Depreciation

The annual depreciation costs are calculated by the straight line methods, based on their service lives. Residual values after all depreciations are estimated as zero. Annual depreciation costs are not retained inside the administrative body but collected as loan-repayment adding up to 9 % loan interests as a rule by the General Monetary Fund.

Depreciable assets excluding cargo handling equipment	: 40 years
Container Crane, Mobile Tower Crane, Grain Loader/Unloader	: 17 years
Cargo handling equipment excluding cantainer crane	: 7 years

(4) Revenue

The revenues from the port activities are calculated based on the tariff system issued Oct. 24th, 1995 and future cargo handling volume. The following charges are the sources of revenue generated from the operation of the container terminal and grain terminals.

-Anchorage Fee
-Berthing Fee
-Pilotage & Towage Fee
-Loading/Unloading and Cargo handling Fee
-Storage Fee

(5) Tax

The administrative body pays 45% of the annual net income as income tax to the

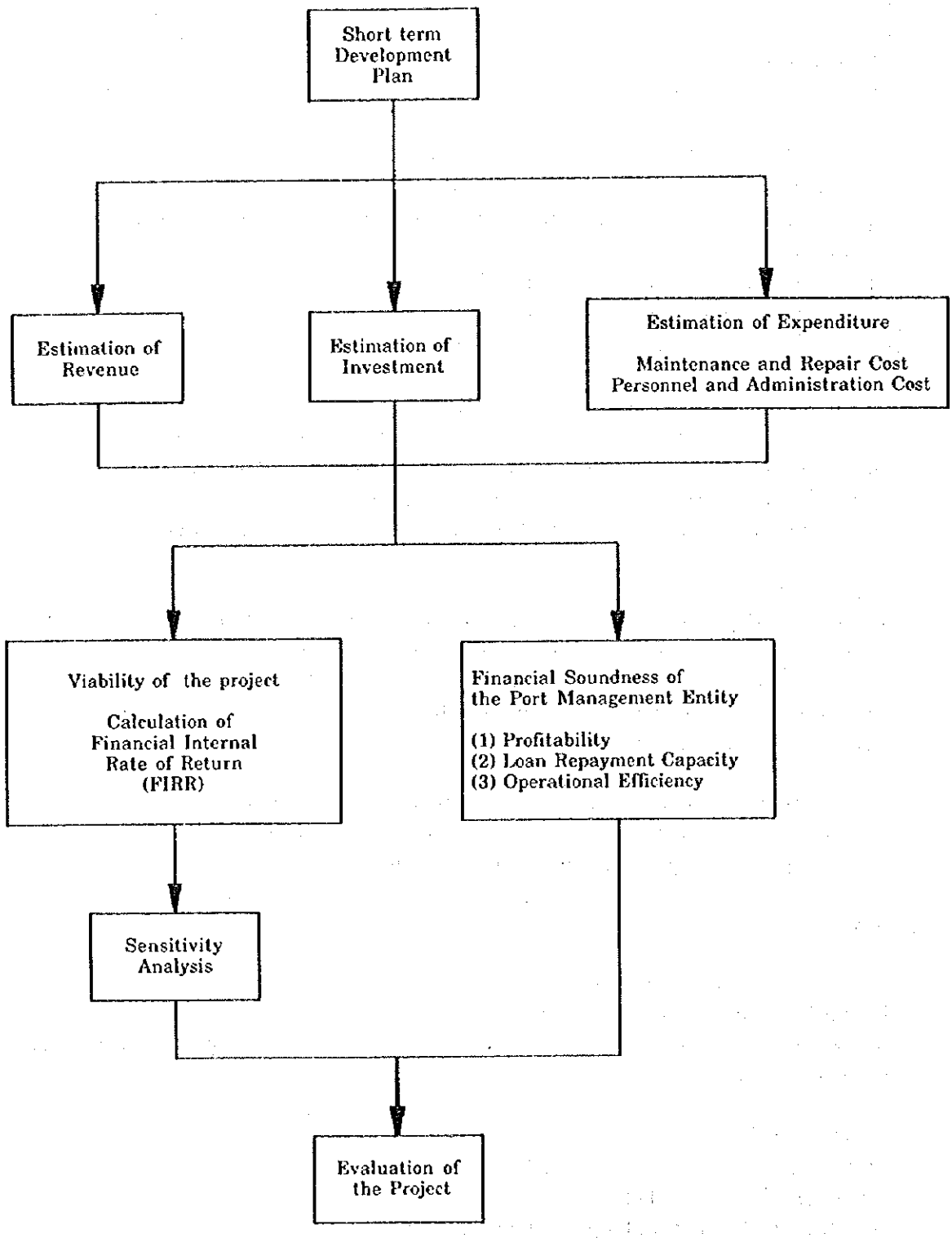


Figure 3.1.14-1 Flowchart of the Financial Analysis

government.

3.1.14.4 Appraisal of Project

3.1.14.4.1 Viability of Project

(1) Financial Internal Rate of Return (FIRR)

Both of them exceed the weighted average interest rate of funds.

W. Ave. Interest Rate	Container Terminal	Grain Terminal	Conventional Terminal(*)	Total
3.47 %	15.20 %	8.3 %	27.06%	14.07 %

* Replacement of cargo handling equipment

(2) Sensitivity Analysis

Sensitivity analysis is conducted to examine the impact of unexpected future changes. (For example, cargo volume or construction cost) The following three cases are envisioned:

1) Case 1 : The project costs increase by 10 %
2) Case 2 : The revenues decrease by 10 %
3) Case 3 : The project costs increase by 10 % and the revenues decrease by 10 %.

< Result of Sensitivity Analysis >

Case	Container Terminal	Grain Terminal	Conventional Terminal(*)	Total
Base Case	15.20 %	8.3 %	27.06 %	14.07 %
1) Cost +10 %	13.43 %	6.5 %	24.39 %	12.10 %
2) Revenue -10 %	12.73 %	5.9 %	23.70 %	11.60 %
3) Cost+10 % & Revenue-10 %	11.05 %	4.1 %	21.30 %	9.76 %

* Replacement of cargo handling equipment

< Prerequisites of Tariff >

Container Terminal	1)Handling fees all included US $ 38.16 / Box (Current tariff standard 20% up) 2)Charges from Vessels Current tariff standard
Grain Terminal	1)Handling fees and Storage fee 270 S.P. / ton (US$ 6.4) 2)Charges from Vessels Current tariff standard
Conventional Terminal	Crane usage fee US$39/hour

The above proposed tariff of container handling is lower than the neighboring container ports facing the east Mediterranean Sea, resulting in sufficient competitiveness.

(3) Evaluation

Judging from the above analysis, all the projects are regarded as financially feasible on the conditions of proposed tariff.

3.1.15 Environmental Impact Analysis

The IEE showed that an EIA was not necessary. All significant factors were identified at the IEE stage. Subject to careful handling of any dredged sediments and water quality monitoring for heavy metals there are no other major environmental concerns.

3.2 Short-Term Plan of Tartous Port

3.2.1 The Basic Concept of the Port Development Plan

The Short-Term Plan is prepared as a first-phase plan with a target year of 2003 for the development of Tartous Port. The Short-Term Plan is made within the framework of the Master Plan. Investment for the projects proposed in the Master Plan will be needed at some stage by the target year of the Master Plan, and the timing of the investment for the above projects must be determined individually according to the respective conditions. The following are proposed as the short-term projects (first phase projects) to be implemented by the year of 2003:

(1) Preparation of a multi-purpose terminal
(2) Construction of additional general cargo and Ro-Ro berths
(3) Preparation of required cargo-handling machines

3.2.2 Usage Plan for the Existing Port Facilities

In order to decide the appropriate number of berths in the target year, vessels are divided into eleven types, then the estimated cargoes are distributed to each type of vessel. The vessels are distributed on the following premises considering the actual operations and records at similar ports.

Table 3.2.2-1 Usage Plan of the Berths by Vessel Type

Vessel Type	Vol.	Ve.Cap.	No Ve.	H Prod.	Quay No.
General(var.)	907	1,710	531	33	4,5,9,10,11,12,13, 14,15,N1,N2,N3*
Foodstuff	497	3,560	140	44	9,12,13,14,N2,N3*
Livestock	191	260	735	12	4,5,16,17
Steel	546	2,240	244	80	4,7,9,21,N1
Wood	351	1,390	253	22	4,7,9,21,N1
Car	169	520	326	39	5,9,12,14
Chemicals	290	1,990	146	32	4,9,12
Ro/Ro	68	1,270	54	34	5,6,10
Grain(import)	390	16,640	24	168	12
Grain(export)	600	20,000	31	192	12
Container	72*	630	115	48	7,8

Note:Vol.:Cargo Volume(Thousand tons), Ve.Cap.:Average Vessel Capacity(tons), No Ve.:Number of Vessels, H Prod.:Cargo Handling Productivity(ton/hr) *(1000TEUs) *N1(Newly constructed next to the shipyard), N2,N3(New Berths behind the breakwater)

The results of the simulation are as follows:

	Average Waiting Time(hours)
General(Var.):	0.4
Foodstuff:	0.8
Livestock:	0.7
Steel:	2.0
Wood:	0.4
Car:	0.8
Chemicals:	4.2
Ro/Ro:	0.3
Grain(Import):	6.6
Grain(Export):	9.3

3.2.3 Multi-purpose Terminal Plan

It is proposed to prepare a multi-purpose terminal to handle both containers and long and heavy products such as iron and steel. The terminal is planned to be equipped with two units of rail-mounted dock-side gantry cranes which can lift both containers and heavy break-bulk cargoes by using a replaceable attachment of a spreader or a hook, respectively. The yard behind the two berths north of the pier B is divided into two parts for container-stacking and conventional cargo storage, respectively. It is also planned to introduce two units of rail-mounted transfer cranes so as to mainly stack laden containers. Empty containers are planned to be stacked mainly by toplifters. The existing straddle carriers could be used at the backyard of the Pier-B without interference with the operations using rail-mounted transfer cranes behind the dockside of the Pier-B.

3.2.4 Conventional Terminal Plan

Since the phosphate terminal will be converted to the grain/general cargo terminal after the year 2003 when the New Port will be completed, berths adjacent to the phosphate terminal are also used for working craft after the year 2003. In order to avoid congestion due to the lack of these berths, the new berths behind the breakwater (Berth No.24, 25) will start operation by the year 2003.

In order to decide the number of berths for general cargo, the total costs of waiting vessels and construction cost of Case 1(construct 2 berths), Case 2(construct 1 berth) and Case 3(construct 3 berths) are compared.

	Case 1	Case 2	Case 3
Construction	31.8	20.2	42.5
Waiting Cost	5.4	17.3	2.8
Total Cost	37.2	37.5	45.3
INDEX	100	101	122

Note : waiting cost is for 5,000 DWT conventional cargo vessel
unit : $ million Discount Rate:0.1 Project Life: 30 years

The total cost of Case 1 and Case 2 is almost the same.
Case 1 is the most economical among the alternatives.

3.2.5 Cargo Handling System

The improvement of delivery/receiving system should be performed for modernization of Tartouse Port, which is mentioned in Chapter 12.5. Therefore, at Latakia Port, the improvement of delivery/receiving system will not be performed during the Short- Term Plan stage, as mentioned in 15.5.

It is necessary that palletizable cargoes are palletized for improvement of delivery /receiving system because the number of times that cargo must be handled in direct delivery/receiving is much greater than indirect delivery/receiving. If palletizable cargoes are not palletized, losses will be created due to the excessive time spent in the indirect delivery/receiving system.

Initial investment and replacement of damaged pallets are necessary for palletization. Therefore, if the improvement of delivery/receiving system is not performed, palletization of palletizable cargo will not be strongly promoted.

About sixty percent of break bulk cargo(including container cargo) for sea trade in Syria is handled at Latakia Port in 2003. Present cargo handling facilities at Latakia Port will be sufficient during the Short-Term Plan stage.

Considering above situation, Palletization of palletizable cargo will not be largely realized during the Short-Term Plan stage.

As to container cargo handling, additional cargo handling equipment such as rail-mounted transfer cranes at container storage yard and Gantry cranes at quay side will be installed in the Short-Term Plan.

3.2.6 Layout Plan

Two new berths are located behind the south breakwater. Taking account of launch from the shipyard, the distance between the end of the slip-way must be at least 150 m.
Existing sulphur berth will be used for heavy and long cargo such as steel and wood after the main construction works for Tartous and the new port are completed. Open yard behind the sulphur berth will be paved to accommodate heavy and long cargo. The layout of the facilities is described in Fig.3.2.6-1.

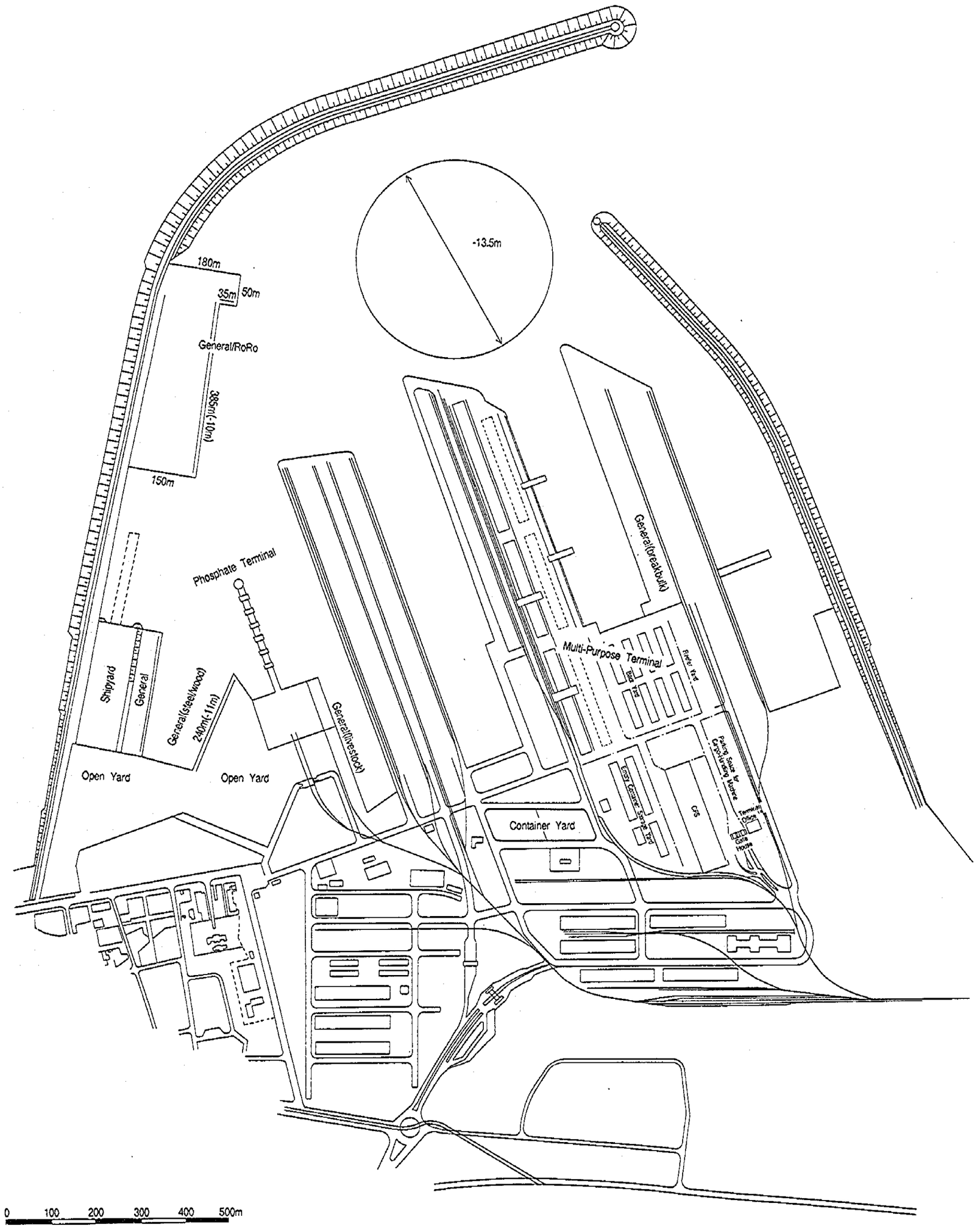


Figure 3.2.6-1 Short-Term Plan of Tartous Port

3.2.7 Design of the Major Structures

In the Short-Term Plan of Tartous Port, the following facilities are planned by the year 2003. Designs of general/RoRo terminal berth, revetment open yard and road are described in this section.

Table 3.2.7-1 Planned Facilities in the Short-Term Plan of Tartous Port

Facilities	Unit	Short-Term Plan
General/RoRo Terminal:		
Wharf (-10m)	m	385
Revetment	m	380
Reclamation	m^3	737,330
Pavement	m^2	65,250

(1) General/RoRo Terminal Berth

Design conditions for the general/RoRo berth are set as follows.

Table 3.2.7-2 Design Conditions for General/RoRo Berth (-10m)

Items	Design Conditions
Planned Ship (DWT)	15,000
Planned Water Depth (m)	-10.0
Berth Length (m)	385
Crown Height (m)	+2.8
Planned Surcharge (t/m^2) Ordinary Extra-ordinary	 2.0 1.0
H.W.T. (m)	0.5
Geological Condition	Silty sand
Seismicity	0.03

The planned site is located along the main breakwater and its soil condition is supposedly strong enough. So, the gravity type is chosen for this case.
The standard cross section of the grain terminal berth is referred to Fig. 2.5.10-2. According to the design of this cross section, the safety factors for sliding ($S.F._1$) and the safety factors for overturning ($S.F._2$) result in the Table 3.2.7-3. These figures show the sufficient stability against sliding and overturning.

Table 3.2.7-3 Safety Factors of General/RoRo Berth

Case	$S.F._1$ for Sliding	$S.F._2$ for Overturning
Ordinary Condition	1.33	1.52
Special Condition	1.29	1.42

(2) Revetment

Revetment next to the wharf (-10m) should be constructed by the same structure as the wharf considering the ship maneuvering. As for the remaining revetment water depths change from -2m to -11m.
The standard cross section of the revetment is shown in Fig. 2.5.10-3.

(3) Open Yard, Apron and Road

Open yard, apron and road are planned to be paved by asphalt concrete.
The composition of the bituminous pavement is shown in Fig. 2.3.12-4.

3.2.8 Design of Cargo Handling Equipment

(1) Container Handling

1) Container cranes
Two container cranes are installed on the container berth and the ship size for the cranes is panamax type.

2) Rail-mounted transfer cranes
Two rail-mounted transfer cranes are installed on the existing crane rail which are located behind of the container berth.

(2) Conventional berth

Three portal jib cranes will be replaced on the Pier A. Six mobile tower cranes will be procured and they are used for general cargo handling from/to ship and at apron and open yard.
Further more twenty six forklift trucks(10t six units, 5t special type six units, 5t eight units and 3t six units) and nine trailers will be procured for general cargo handling.

3.2.9 Implementation Program

(1) Workable Days

Workable days at Tartous Port is assumed to be same as Latakia Port. (see, 3.1.11) So, the net workable days per year are assumed to be 280 days or 23 days per month.

Fridays	48
National Holiday	22
Stormy Days	15
Total	85

(2) Working Efficiency

Working efficiency of main works is assumed as follows.

Table 3.2.9-1 Working Efficiency

Works	Working Efficiency
Dredging	744 m^3/day Grab dredger: 4m^3 × 1
Dredging	1,408 m^3/day Grab dredger: 8m^3 × 1
Core Stone	343 m^3/day
Armor Stone	242 m^3/day
Leveling	19.3 m^2/day
Concrete Block (Ave.80ton)	1.8 Nos/day
Pavement	150 m^2day

(3) Working Schedule

After the completion of the detailed design in 1998, the construction of the port facilities is to start in 1999 and be completed by the end of 2002.
The construction schedule is shown in Fig. 3.2.9-1.

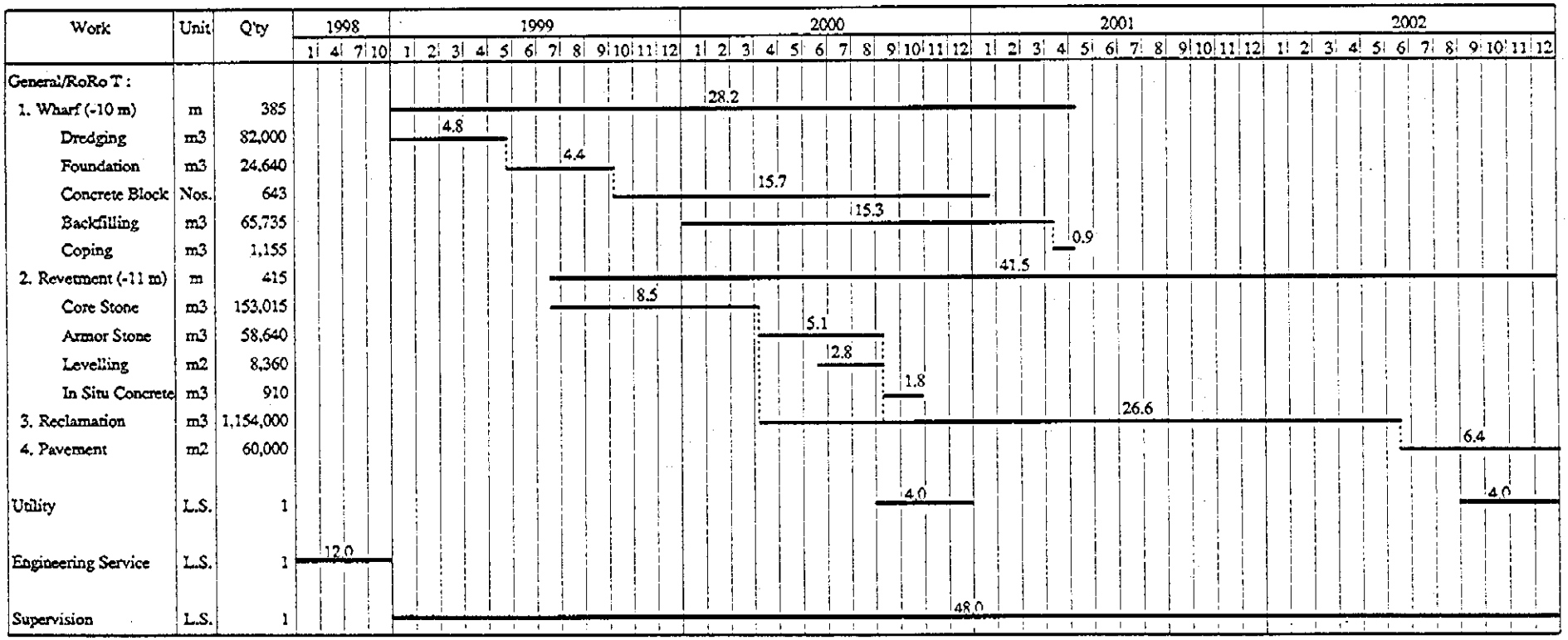


Figure 3.2.9-1 Construction Schedule for Tartous Port

3.2.10 Cost Estimation

(1) Unit Price of Main Facilities

The cost estimate is carried out, and the unit price of main facilities are shown as below:

(2) Total Cost

The total cost of Short-Term Plan is estimated as around 2,016 Millions S.P, and is tabulated in Table 3.2.10-1.

(3) Yearly Investment

The yearly investment based on the implementation program in Chapter 3.2.9 is shown Table 3.2.10-2.

Facilities	Unit	Unit Price		
		F.C	L.C	Total
General Berth Terminal (1)				
Wharf(-10m)	S.P/m^3	200,000	700,000	900,000
Container Terminal				
Container Crane	1,000 S.P/Unit	239,400	0	239,400
Rail-Mounted T. Crane	1,000 S.P/Unit	91,980	0	91,980

Table 3.2.10-1 Total Cost of Short-Term

TARTOUS PORT(Short-Term)

No.	Facilities	Unit	Q'ty	Unit Cost :$.P)			Cost(Unit:1,000 $.P)		
				F.C	L.C	Total	F.C	L.C	Total
A	Civil Work								
1	General Berth Terminal(1)								
	Wharf(-18m)	m	385	200,000	702,020	922,020	77,000	269,500	346,500
	Ro/Ro Berth(-10m)	m	35	222,000	700,000	922,020	7,000	24,500	31,500
	Revetment(1)	m	50	0	250,000	250,000	0	12,500	12,500
	Revetment(2)	m	330	0	210,000	210,000	0	69,300	69,300
	Road/Open Space	m2	60,000	0	720	720	0	43,200	43,200
	Reclamation	m3	1,154,000	0	300	300	0	346,200	346,200
	Total of Civil Work						84,000	765,200	849,200
B	Building								
1	Office etc	m2	2,000	0	12,000	12,000	0	24,000	24,000
	Total of Building						0	24,000	24,000
C	Utilities	LS	1				0	22,937	22,937
D	Cargo Handling Equipment								
	Total fo Handling Eq.	LS	1				1,050,000	0	1,050,000
E	Physical Conti/Engineering Fee	LS	1				48,000	22,000	70,000
F	Grand Total						1,182,000	834,137	2,016,137

Table 3.2.10-2 Yearly Investment Schedule

(Unit:1,000S.P)

Items	1998		1999		2000		2001		2002	
	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C
Civil Works	-	-	26,000	101,700	26,000	250,000	32,000	291,400	0	122,100
Buildings	-	-	0	24,000	-	-	-	-	-	-
Utilities	-	-	-	-	0	11,500	-	-	0	11,437
Cargo Handling Equip	-	-	331,380	0	331,380	0	193,620	0	193,620	0
Physical Contingency and Enginerring Fee	9,600	-	9,600	5,500	9,600	5,500	9,600	5,500	9,600	5,500
Grand Total	9,600	-	366,980	131,200	366,980	267,000	235,220	296,900	203,220	139,037

3.2.11 Economic Analysis

(1) Costs of the Projects

The items that should be considered as costs of the projects are construction costs, maintenance and operation costs and renewal investment costs.

(2) Benefits of the Projects

In order to calculate the substantial benefits of Tartous Port, only the cargoes which are planned to be handled in Tartous Port are set as objects of economic analysis. In the "Without" case of the container terminal project, the working efficiency of cargo handling are not the same as "With" case.
The item that should be considered as benefits of the projects is savings in waiting costs of ships.

Table 3.2.11-1 Costs and Benefits by the projects

(Unit: Million SP)

Project	Cost		Bnefit		
	Item	Cost	Item	Year	Benefit
Container Terminal	Construction	679.8	Ship Waiting	2001	231.6
	Maintenance	42.5		2004 & over	358.9
	Renewal: 7years	0.0			
	17years	662.8			
General C. Terminal	Construction	1,001.3	Ship Waiting	2003	124.9
	Maintenance	38.2		2004 & over	348.4
	Renewal: 7years	102.0			
	17years	0.0			
Others	Construction	315.3			
	Maintenance	11.6			
	Renewal: 7years	179.3			
	17years	106.0			
Total	Construction	1,996.4	Ship Waiting	2003	435.0
	Maintenance	92.3		2004 & over	707.3
	Renewal: 7years	281.3			
	17years	768.8			

(3) Evaluation of the Projects

Economic evaluation of a project is carried out by calculating EIRR. Minimum value of EIRR in the short-term plan is 19.8 % reported in Table 3.1.13-2. EIRRs of all projects greatly exceed 10 %, which is considered to be the general standard evaluating the project. Therefore, these projects in the short-term plan is feasible from the viewpoint of the national economy.

Table 3.2.11-2 Economic Internal Rate of Return (EIRR)

Project	Container Terminal	General C.T.	Total
EIRR(%)	32.8	20.2	19.8

3.2.12 Financial Analysis

3.2.12.1 Purpose of the Financial Analysis

See chapter 3.1.14.1.

3.2.12.2 Methodology of the Financial Analysis

See chapter 3.1.14.2

3.2.12.3 Prerequisites of the Financial Analysis for the Container Terminal and General Cargo Terminal

(1) Scope of the Financial Analysis

See chapter 3.1.14.3

(2) Prerequisites of the Financial Analysis for the Multi-purpose

Terminal and the Expanded General Berth

1) Project Life
See chapter 3.1.14.3.(2) 1)

2) Base Year
See chapter 3.1.14.3.(2) 2)

3) Fund Raising
See chapter 3.1.14.3.(2) 3)

③ Weighted Average Interest Rate

The following table shows the weighted average interest rate of the funds for investments when above funds are applied.

Average Interest Rate

Average Interest Rate	4.28 %

4) Cargo Handling Volume
The cargo volume of container that can be hadled in the current conventional terminal will reach its limit (83,000 TEU) in 2004 and the other cargoes' volume will reach their limit in 2009.

(3) Expenditure

1) Maintenance and Repair
The annual maintenance and repair costs for the port facilities are calculated as follows:

Infrastructure : 1 % of the construction cost
Equipment : 4 % of the procurement cost

The planned facilities will start to be operated as follows.
Container (Multi-purpose) Terminal : from the year 2000
General Berths : from the year 2003

2) Personnel Cost and Administration Cost
See chapter 3.1.14.3.(3) 2)

3) Depreciation
See chapter 3.1.14.3.(3) 3)

(4) Revenue

See chapter 3.1.14.3.(4)

(5) Tax

See chapter 3.1.14.3.(5)

3.2.12.4 Appraisal of Project

3.2.12.4.1 Viability of Project

(1) Financial Internal Rate of Return (FIRR)

All of them exceed the weighted average interest rate of funds.

W. Ave. Interest Rate	Multi-purpose Terminal	General Terminal	Conventional Terminal(*)	Total
4.28 %	9.53 %	5.95 %	12.72 %	7.76 %

* Replacement of cargo handling equipment

(2) Sensitivity Analysis

Sensitivity analysis is conducted to examine the impact of unexpected future changes. (For example, cargo volume or construction cost) The following cases are envisioned.

1) The project costs increase by 10%.
2) The revenue decrease by 10%.

3) The project costs increase by 10% and the revenue decrease by 10%.

< Result of Sensitivity Analysis >

Case	Container Terminal	General Terminal	Conventional Terminal(*)	Total
Base Case	9.53 %	5.95 %	12.72 %	7.76 %
1) Cost +10 %	8.46 %	5.21 %	11.10 %	6.77 %
2) Revenue -10 %	7.70 %	4.76 %	10.50 %	6.18 %
3)Cost +10 % & Revenue -10 %	6.70 %	4.06 %	8.97 %	5.24 %

* Replacement of cargo handling equipment

< Prerequisites of Tariff >

Container (Multi) Terminal	1)Handling fees all included US $ 38.16 / Box (Current tariff standard 20% up) 2)Charges from Vessels Current tariff standard
General Terminal	1)Cargo Handling Charge 20% up 2)All the charges based on the current tariff
Conventional Terminal	Crane usage fee US$59/Hour

Concerning the general terminal, if current tariff is kept intact, the investment to the terminal needs to be subsidized. Such subsidy is found worldwide different from very much profitable terminals such as container terminals.

(3) Evaluation

Judging from the above analysis, Container (Multi) Terminal and Conventional Terminal are regarded as financially feasible on the conditions of the proposed tariff and General Terminal is also financially feasible on the conditions of the subsidy for initial construction cost other than machines and equipment.

3.2.13 Environmental Impact Analysis

The IEE showed that an EIA was not necessary. All significant factors were identified at the IEE stage. Subject to careful handling of any dredged sediments and water quality monitoring for heavy metals there are no other major environmental concerns.

3.3 Short-Term Plan of the New Port

3.3.1 The Basic Concept of the Port Development Plan

The Short-Term Plan is prepared as a first-phase plan with a target year of 2003 for the development of the New Port. The Short-Term Plan is made within the framework of the Master Plan. According to the demand forecast of the New Port cargoes, there is not much difference in the forecast volumes of the respective bulk cargoes between the stages of the Short-Term Plan and the Master Plan except for phosphate rock. Even in the case of phosphate rock, the volume of phosphate rock exported by sea in the stage of the Short-Term Plan is expected to exceed the phosphate-handling capacity of the existing facility at Tartous Port. In addition to the limitation of the existing phosphate-handling capacity at Tartous Port, it is urgently required to shift the phosphate-handling from Tartous Port to the New Port to resolve the current dust emission problem at Tartous Port. Thus, as the short-term projects (first phase projects) to be implemented by the year of 2003, it is proposed to prepare the following terminals within the New Port the same as those proposed in the Master Plan:

(1) Phosphate terminal
(2) Cement clinker terminal
(3) Pellet terminal
(4) Scrap terminal
(5) Sulfur terminal
(6) Fertilizer terminal
(7) Public berths

3.3.2 Facility Plan of Each Terminal

The following types of cargoes are handled at the new port.

1) Cargoes that will shift from the existing port: Phosphate
2) Cargoes that will be used as materials for the new steel factory: Pellet, Scrap, others(bricks, ferro-alloys)
3) Cargoes that will newly exported from Syria: Cement Clinker, Oil Coke, Fertilizer
4) Cargoes exported from Iraq through the port: Phosphate, Sulphur
5) Others: Imported Fertilizer

In order to determine appropriate scale, depth and length, of the berth, Transportation Costs and Construction Cost of some alternatives are compared. The scale of each berth is as follows:

	Depth	Max Vessel Size	Length
Phosphate:	-14 m	65,000 DWT	280 m
Pellet:	-14 m	65,000 DWT	280 m
Clinker:	-14 m	65,000 DWT	280 m
Scrap:	-10 m	10,000 DWT	185 m
Fertilizer:	-12 m	40,000 DWT	240 m
Sulphur:	-12 m	40,000 DWT	240 m

Scale of berths for other cargoes(Imported Fertilizer, Coke, Bricks) is -10 m depth and 185 m length, because these cargoes are carried to/from neighboring countries and the volume is limited.

Number of berth is determined using simulation method as shown in following table.

Table 3.3.2-1 Usage Plan of the Berths by Vessel Type

Vessel Type	Vol.	Max.Cap.	No Ve.	H Prod.	N o B	W/T
Phosphate	3,200	65,000	107	672	2	2.2
Pellet	1,250	65,000	26	455	1	36.7
Clinker	1,100	65,000	28	392	1	8.8
Scrap	200	10,000	23	73	1	30.3
Fertilizer	510	40,000	23	220	1	38.4
Sulphur	500	40,000	17	189	1	21.8
Other Steel	150	10,000	17	67	1	18.5
Coke	100	15,000	9	126	1	16.3
Import Fertilz	170	15,000	15	67	1	16.3

Note:Vol.: Cargo Volume(Thousand tons), Max.Cap.:Maximum Vessel Capacity(tons), No Ve.:Number of Vessels, H Prod.:Cargo Handling Productivity(ton/hr), N o B:Number of Berth, W/T:Average Waiting Time(hours)

3.3.3 Cargo Handling System

Primary factors of deciding cargo handling system at a port in general are as follows:

1. Cargo style(or packing style of cargo).
2. Cargo handling volume at the port.
3. Transport mode.
4. Available area for handling and storing.
5. Environmental and natural condition around a port area.

Above primary factors do not largely differ between the Master Plan stage and the Short-term Plan stage. Therefore, the cargo handling system during the Short-term Plan stage is the same as during the Master Plan stage.

3.3.4 Access Roads and Railways

The traffic volume of vehicles originating from or destined to the port in the year 2003 during peak time is estimated to be 331 vehicles per day and the hourly traffic corresponding to that daily traffic is estimated to be 42 vehicles. Therefore, a two lane road is sufficient for the road transport. The access road overpasses the siding railway in front of the new port.

Since the construction of the railway takes a long time, the long-term cargo estimation should be considered in making the facility plan. The cargo volumes carried by railway and the number of trains in the long-term are as follows:

Table 3.3.4-1 Railway Related Cargoes

Cargo Item	Volume (1000ton)	Railway Share%	Railway Volume	No of Train
Phosphate	4,100	100	4,100	2,929
Pellet	1,250	100	1,250	893
Clinker	1,000	80	800	571
Scrap	200	20	40	29
Bricks	150	20	30	21
Coke	200	100	200	143
Sulphur	500	100	500	357
Fertilizer(Exp.)	480	80	380	274

The length of loading/unloading yard for these cargoes is decided considering total length of each train. The length of the train to carry the maximum traction load, length and track in the loading/unloading yard are as follows:

	Length of Train	Length of Yard	No of Track
Phosphate:	415 m	450 m	3
Pellet:	400 m	450 m	2
Cement Clinker:	400 m	450 m	2
Sulphur:	450 m	500 m	2
Fertilizer:	400 m	450 m	2

Unloading yard used for scrap and other materials of steel factory is planned with a length of 250 m and two tracks. Loading yard for oil coke is planned with a length of 250m and two tracks. The length is sufficient for divided train. Access railway approaches from the north between the existing road and the coast line. Since the branch line is used both for import and export cargoes, two tracks are recommended.

3.3.5 Layout Plan

Layout of the new port is the same as that of the Master Plan. Fig.3.3.5-1 describes the layout of the port.

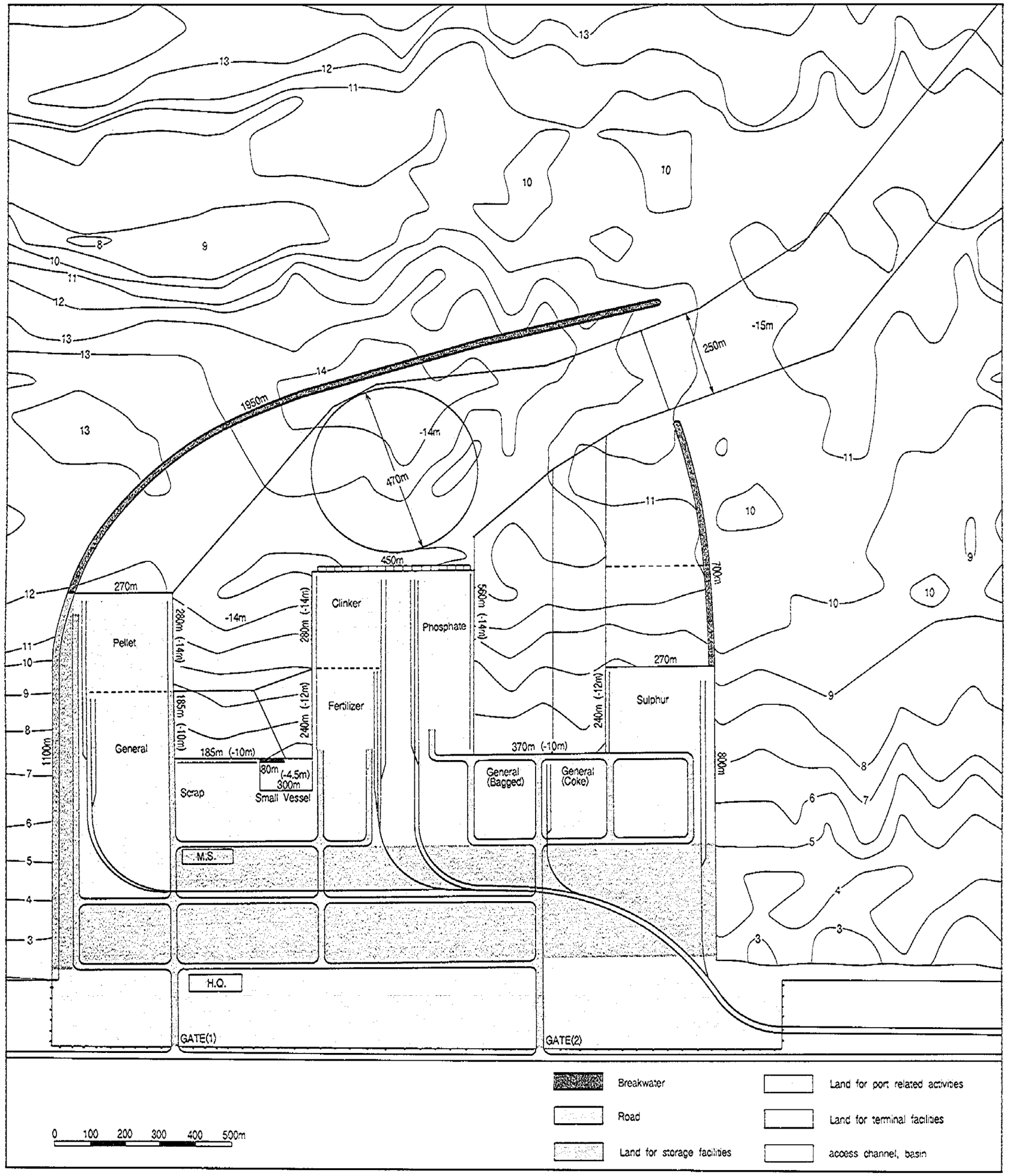


Figure 3.3.5-1 Short-Term Plan of the New Port