CHAPTER 7 PRELIMINARY DESIGN ARRANGEMENT BY PROJECT COMPONENT

7.1 General Description

7.1.1 Basic Preliminary Design Concepts

This chapter deals with the preliminary design of the major port facilities proposed in the Master Plan, as described in the previous Chapter 6 and its related sections. The main purpose of the preliminary design is to start technical feasibility of these Master Plan components, as well considering the environmental conditions and providing required data for the cost estimation.

Costing data is essential to roughly verify the viability of the Master Plan components, whereas the global evaluation will show up in the economic analysis. Outline of economic evaluation of the selected components is given in Chapter 9, however no financial study was carried out.

Taking into account the above, the technical essence of the port design was reviewed using past design records and on-going projects at Constantza as key elements to accomplish the preliminary design for the Feasibility Study.

7.1.2 Work Flow Diagram

Proposed Master Plan is used to identify the required works to be implemented by 2020. The plan includes not only newly proposed woks by the Study Team but also the ones already scheduled by MOT.
The Short Term Development Plan is arranged for selecting priority works to be conducted by 2010. Several project components will be selected from the works which were newly proposed by the Study Team. Refer to PART III Chapter 2 and Chapter 3.

Among these, components identified further as the First Priority Project Group, will be evaluated through feasibility study.

Work flow diagram is presented below:

Step1	Master Plan for 2020
	Selecting the Candidate Project Components
Step 2	Short Term Development Plan for 2010
	Selecting the Candidate Project Component
	Priority Selection: First Priority and Second Priority

Step 3 Undertaking of Feasibility Study
Only for the First Priority Project Components

For the design aspects in Steps 2 & 3, refer to PART III Chapters 2, 3 and 7.

7.1.3 Selection of Candidate Project Components

Selection of master plan components was proposed in Chapter 6, and its conclusion is used to start this chapter.

Preliminary design elements for the possible project components are shown below. The proposed project components by terminal and common facilities of the port will be the following:

Terminals:

1) **Container Terminal**
2) **Grain Terminal**
3) **Edible Oil Terminal (Supplemental)**
4) **Steel Product Terminal (Multipurpose General Cargo Terminal)**
5) **Timber Terminal (Multipurpose General Cargo Terminal)**
6) **Barge Terminal**

Common Facilities:

1) **Navigation channel and Turning basin**
2) **Breakwaters Extension**
3) **Inland Transport Facilities: Inner Road Access**
4) **Environmental related Facilities**

Among these ten components, the Study Team newly proposed six project components as follows:

a) **Container Terminal (Phase 2 and Phase 3)**
b) **Grain Terminal (Phase 1 and Phase 2)**
c) **Steel Product Terminal (Multipurpose General Cargo Terminal)**
d) **Timber Terminal (Multipurpose General Cargo Terminal)**
e) **Barge Terminal**
f) **Inland Transport Facilities: Inner Road Access**

Other than these, the following components are items scheduled by MOT and others.

a) **Navigation channel and Turning basin**
b) **Breakwaters Extension**
c) **Environmental related Facilities**
d) **Edible Oil Terminal (Supplemental)**
e) **Others**

7.1.4 Approach to the Preliminary Design

Based on study concepts shown in Chapter 6 , this Chapter firstly provides the general technical outlines and with the basic design conditions which are typically needed for the Port Project. Following this, the chapter covers preliminary discussion on design of the required works by proposed terminal and as well for the specified common facilities, that is regarding the proposed Master Plan for 2020. This study is to be only a preliminary one, that is intended to verify and realise the technical feasibility. Preliminary design presented in PART III Chapter 9 will provide the selected priority projects with more detailed discussion.

Compliance with the port facilities scale is determined in Chapter 6, but the scale and type of the facilities for the specified project components has been planned here from the technical point of view as well considering the following ten related aspects :

a) **Natural conditions,**
b) **Past design records at Constantza and so on.**
c) **Size and type of ships,**
d) **Type and volume of cargoes,**
e) **Type of cargo handling system,**
f) **Inland transport modes**
g) **Construction Economy,**
h) **Current Land Availability,**
i) **Cost for maintenance and operations,**
j) **Environmental Considerations,**

7.2 Design Conditions

As described in Part I - Chapter 6, the required design should be based on the regulations specified in STAS, that is the Romanian standards. Some of the STAS design conditions and other parameters that have been obtained by field measurements, or other, are shown here. In this section are repeated some of the design parameters used for the preliminary design.

7.2.1 Site Conditions

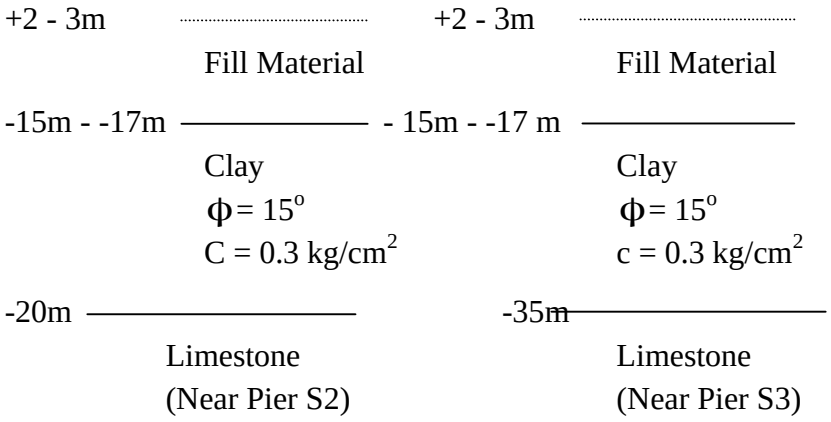
The site conditions as related to the marine environment and especially to the oceanographic and seismic conditions are listed below:

a) Water Level
HWL: +0.60m
MSL: +0.00m
LWL -0.30m

b) Offshore Wave
H_0' = 10.8 m
T = 9 -12 sec

Note: Wave characteristics in the port area will be affected by the seabed configuration. The waves propagated near the shore will change their shape and characters by touching with the seabed (friction). Such equivalent offshore wave will be estimated from a place to another, also according to the general layout.

c) Sub-Soil
Based on the results of the soil investigation, the soil conditions are listed in the two profiles below.



d) Seismic Conditions kh = 0.10

This means that the maximum horizontal acceleration is assumed to be about 10% of the gravity acceleration. It is assumed that structures will have to be decided to represent serious conditions, that is somewhere between the normal conditions and the seismic conditions.

7.2.2 Objective Vessels and Berth Dimensions

The size of the future calling vessels is studied and described in Chapter 6. Based on the results, the objective vessels and the relevant berth dimensions, as used for the preliminary design, are summarized in Table 7.2.1.
Covering terminals are container terminal, grain terminal, barge terminal, steel terminal and timber terminal.

Table 7.2.1 Objective Vessels and Berth Dimensions

Terminals	No	Ship Size				Berth		Remarks
		DWT	LOA (m)	Beam (m)	Full Draft (m)	Length (m)	Depth (m)	
Container Terminal	(1)	20,000	201	27.1	10.6	230	-12.0	Berths already exist
	(2)	40,000	263	33.5	12.4	300	-14.0	
	(3)	62.000	270-310	33.5	13.5	300	-14.5	
	(4)	81,000	310 - 340	40.0	14.0	350	-14.5	
	(5)							
Grain Terminal	(1)	2906	88.9	11.0	3.8	125	-5.0	Unloading (Barge)
	(2)	65,000	253.9	32.2	12.4	300	-16.5	Loading
Steel Product Terminal	(1)	10,000	137	19.9	8.5	160	-10.0	Loading
	(2)	50,000	216	31.5	12.4	250	-13.5	
Timber Terminal;	(1)	3,000	92	14.2	5.7	110	-7.0	Loading
	(2)	15,000	153	22.3	9.3	180	-10.5	
Barge Terminal	(1)	2,906	88.9	11.0	3.8	125	-4.5	Preparation and waiting
	(2)	490	34.6	11.0	2.0	50	-3.0	
Edible Oil Terminal	-	3,000	87	14.3	5.5	150	-6.5	Loading

7.2.3 Loading Conditions

A) Facilities near the Existing Port Facilities

When considering the design load used for the existing quay-walls, the following loading conditions are to be used for the preliminary design.

1) Surcharge Load : 10 t/m^2

2) Quay Crane : as required

B) Independent Facilities from Existing

The following loading conditions will be adopted for the preliminary design.

1) Surcharge Load : 5 t/m^2
2) Quay Crane : as required

C) Basic Formation

The formation level will vary according to each terminal and as well to the land use. However it is assumed that the standard formation will be +2,5m to +3.0m above the datum line. MSL.

7.3 Container Terminal (Phase 2 and 3)

Currently, the end of 2001, the Container Terminal (Phase 1) at Pier S2 is under tender processing in preparation of construction (See Figure 7.3.1). The Romanian Government and JBIC of Japan have financed this project and now, in Phase 1, its development will provide a annual terminal capacity of about 375,000 TEUs.

Target year for completing this terminal is 2004 and it is assumed that this terminal has enough capacity even though the all the existing container handling facilities are not working for any reasons whatsoever.

However it is also assumed that the existing container handling facilities at the North port work together with the on-going S2" Terminal.

According to this Master Plan, the Container Terminal (Phase 2 and 3) is planned adjacent to the on-going the terminal - Phase 1- at the Pier S2. In addition to this on-going project, a new container terminal will be constructed as a part of Master Plan on the same pier but the East Face as a combined scale of the Phases 2/3 after having developed the present (on-going) (Phase 1) container terminal. This further development aims to provide the port users with an incremental annual terminal capacity of about 375,000 TEUs.

The berth Structure and landfill works for Phases 2 & 3 have already been executed. The major work components of the Phases 2 and 3 are the following:

- Site Development (Grading and minor land reclamation)
- Terminal Yard
- Yard Utilities

- Road Access and extension of substation
- Equipment (Quay Gantry Crane: Post-Panamax type, RTG, RMG, etc)

As shown above, the works will consist of civil works and provision of cargo handling equipment. The first session will cover the pavement work, railway laying, supplemental quay strengthening, and others. The second will include the mounting of the quayside cranes (3 or 4) and transferring the cranes in the yard required.

Development plans were prepared for the two cargo forecast scenarios, namely Case 1: High and Case 2: Medium. Estimated Cargo volumes by each scenario are as follows:

Unit: 1,000 TEUs

Year	**Case 1: High Scenario**	Case 2: Medium Scenario
2005	**217.6**	196.8
2008	**307.6**	257.0
2010	**383.7**	308.0
2015	**559.1**	409.5
2020	**790.0**	580.1

Notes: (1) These include the trade containers and transit containers.
(2) These also include both the laden containers and empty containers.
(3) Phase 1 development will provide an annual terminal capacity of about 375,000 TEUs start operation in 2004.

Development Plans by two traffic demand cases are shown in Figures as follows:

Figure 7.3.1 Plan of Container Terminal (Phase 1), Case 1 & 2
Figure 7.3.2a Plan of Container Terminal (Phase 1 & 2), Case 1
Figure 7.3.2b Plan of Container Terminal (Phase 1,2 & 3), Case 1
Figure 7.3.3a Plan of Container Terminal (Phase 1 & 2), Case 2
Figure 7.3.3c Plan of Container Terminal (Phase 1,2 & 3), Case 2

A cross section of the existing quay wall structures at the Phase 1 development site is shown in Figure 7.3.4 .

It is proposed to install two terminals, and different operators will operate each. This two terminal system is recommended to be a basic criterion of terminal design. In order to implement this idea and policy, it is recommended to develop parallel terminal installation, both at the West and East faces of Pier S2, also within the Master Plan framework.

As a result, two container terminals will be constructed during the Master Plan stage. The first one is the so-called Phase 1 development and the facilities are to be installed along the

West face by the S2 Pier. The second one will be Phase 2/3 to be placed at the East face.

The required Phase 2 works for the West terminal will mainly be provisioned by additional equipment including one quay gantry crane with certain number of RTG to be undertaken by 2010 as a part of short-term development. On the other hand, the second one is a completely new container terminal to be installed by 2015. Thus completely new facilities should be provided for it.

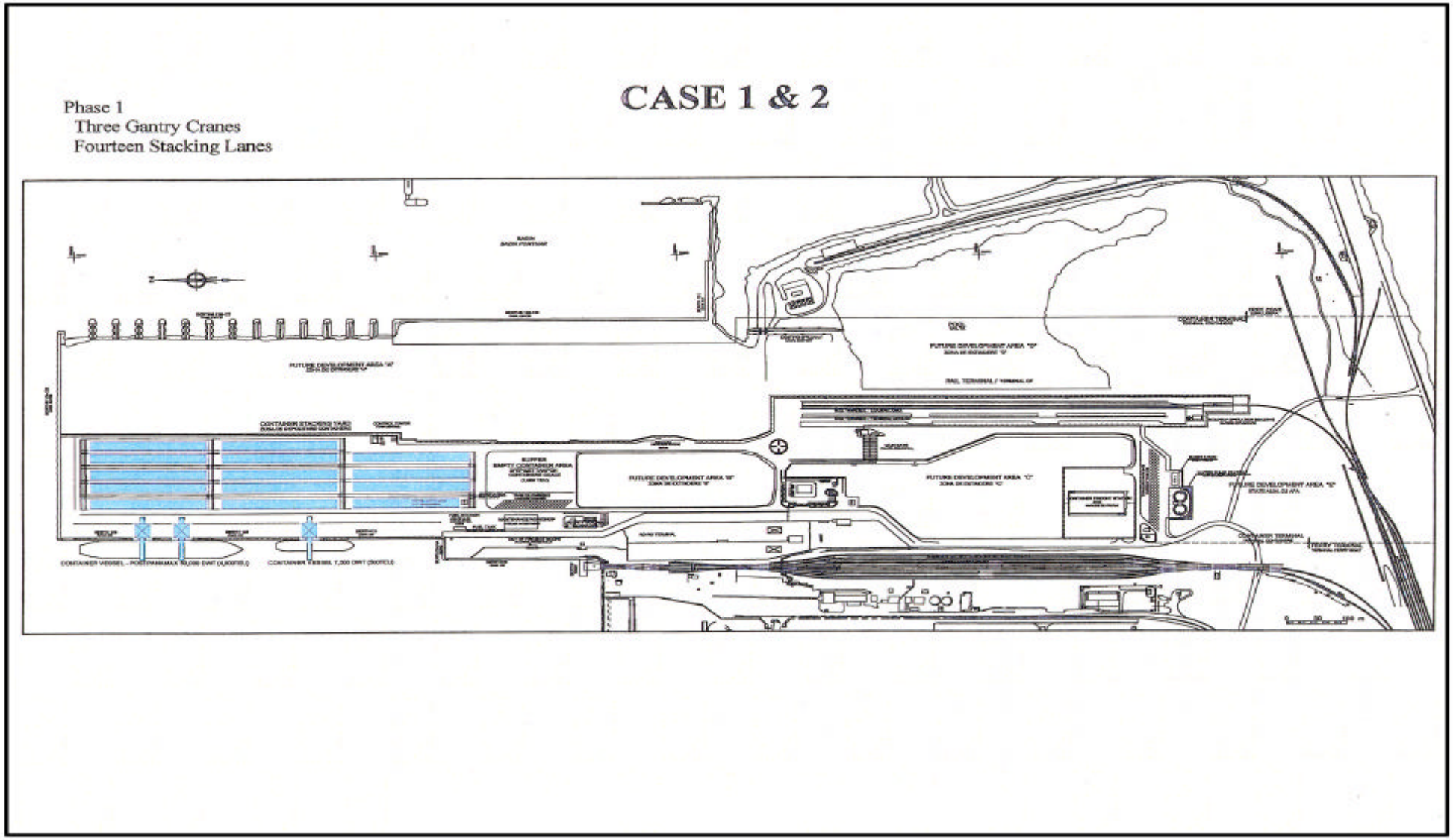
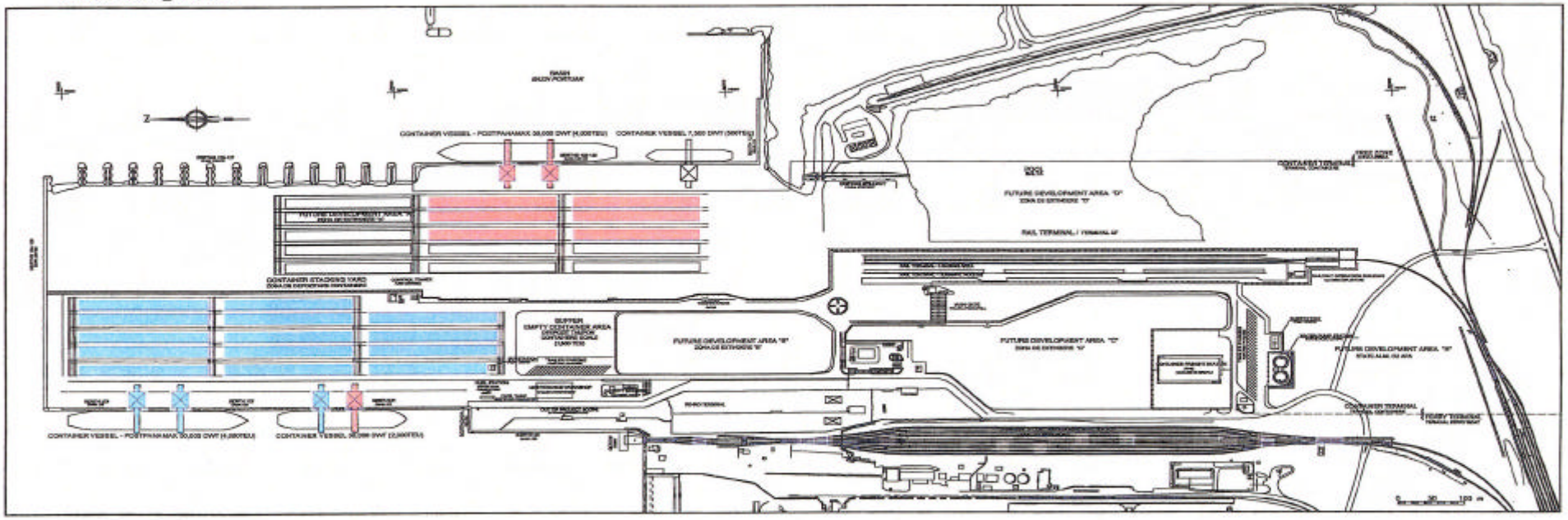


Figure 7.3.1 Plan of Container Terminal (Phase 1), Case 1&2

CASE 1

East Terminal:
Phase 2
Two Gantry Cranes
Six Stacking Lanes



West Terminal:

Phase 1	Phase 2
Three Gantry Cranes	Four Gantry Cranes
Fourteen Stacking Lanes	Fourteen Stacking Lanes

Figure 7.3.2a Plan of Container Terminal (Phase 1 and 2), Case 1

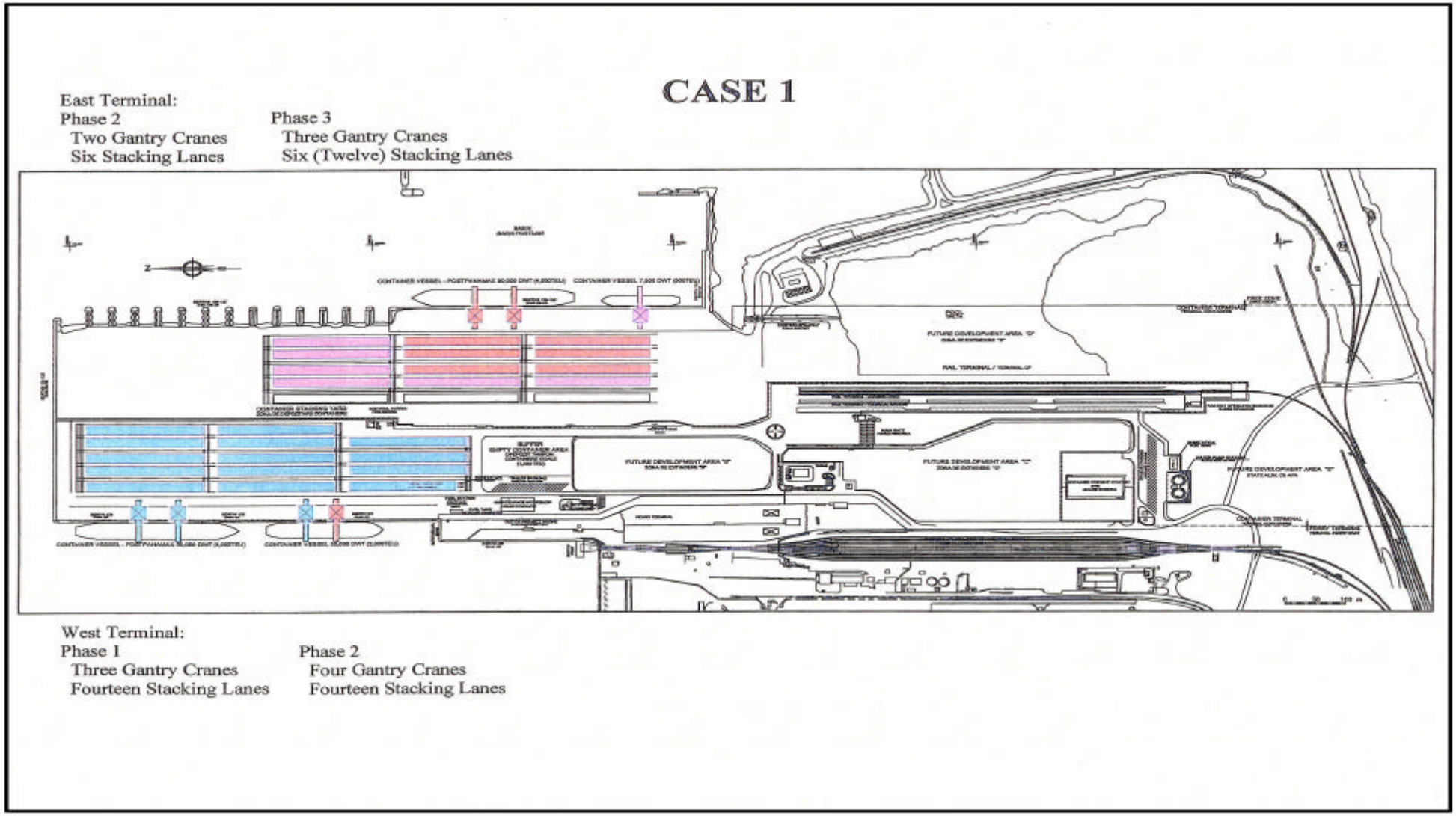


Figure 7.3.2b Plan of Container Terminal (Phase1, 2 and 3), Case 1

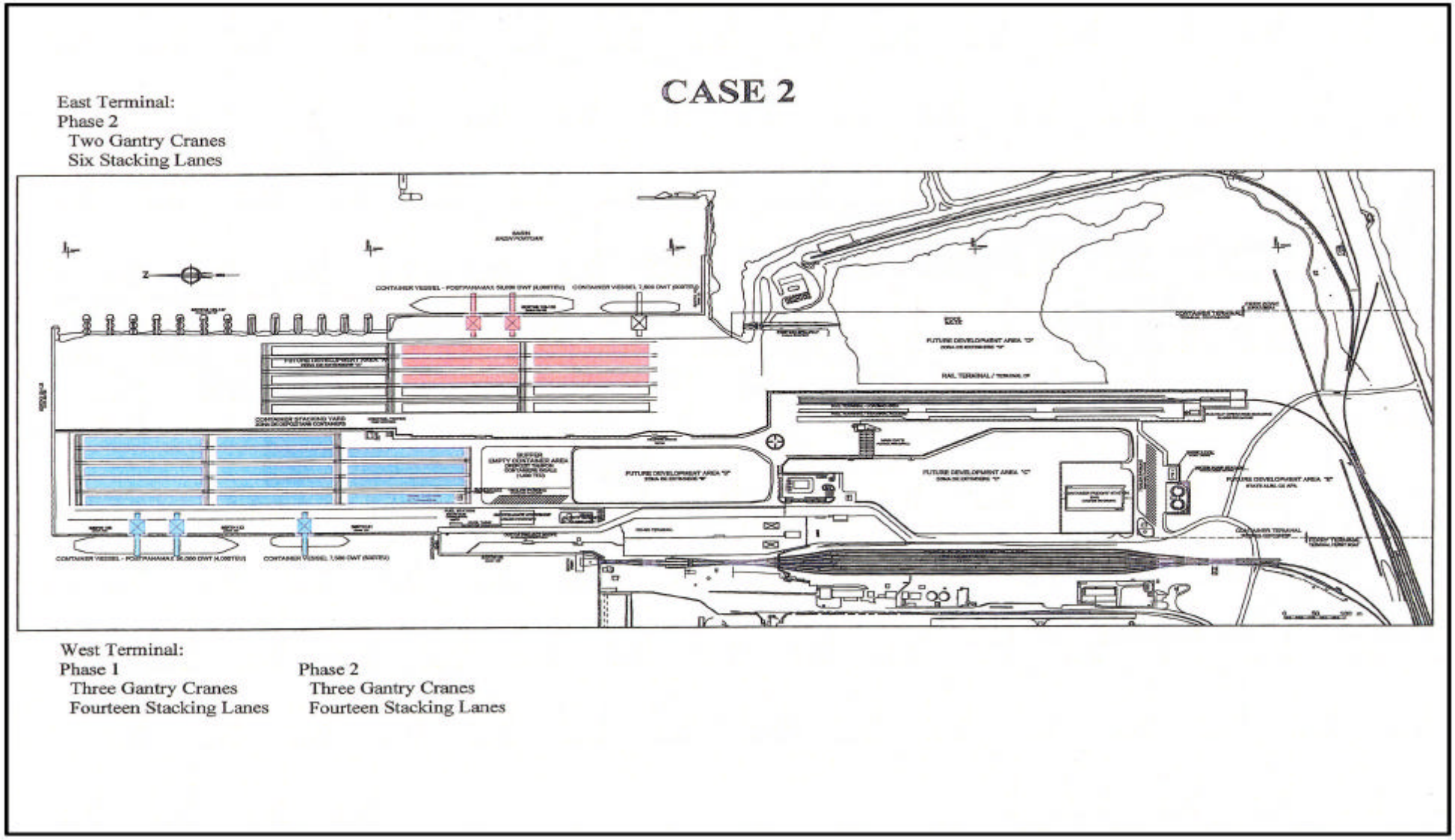


Figure 7.3.3a Plan of Container Terminal (Phase1 and 2), Case 2

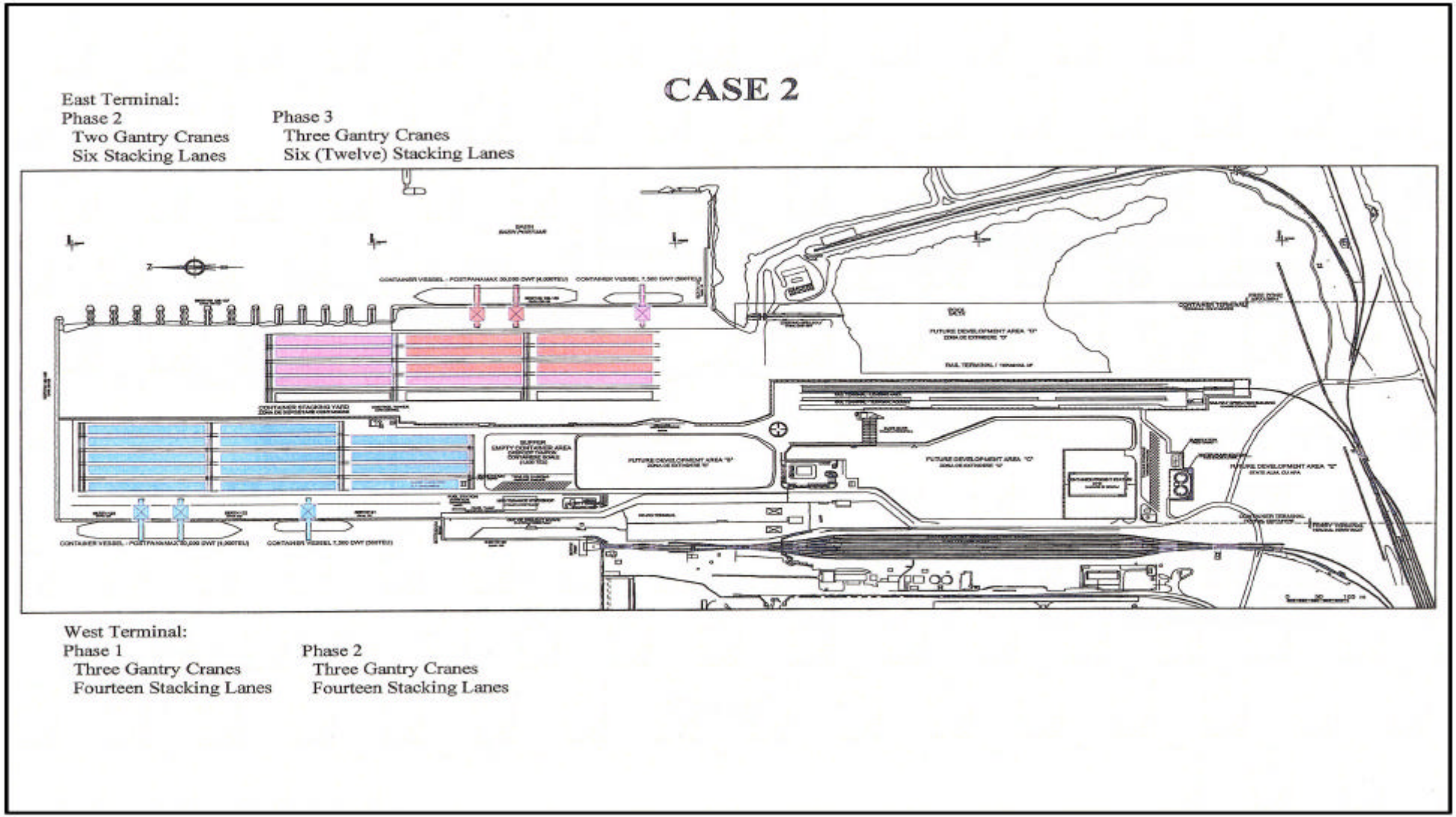


Figure 7.3.3b Plan of Container Terminal (Phase1, 2 and 3), Case 2

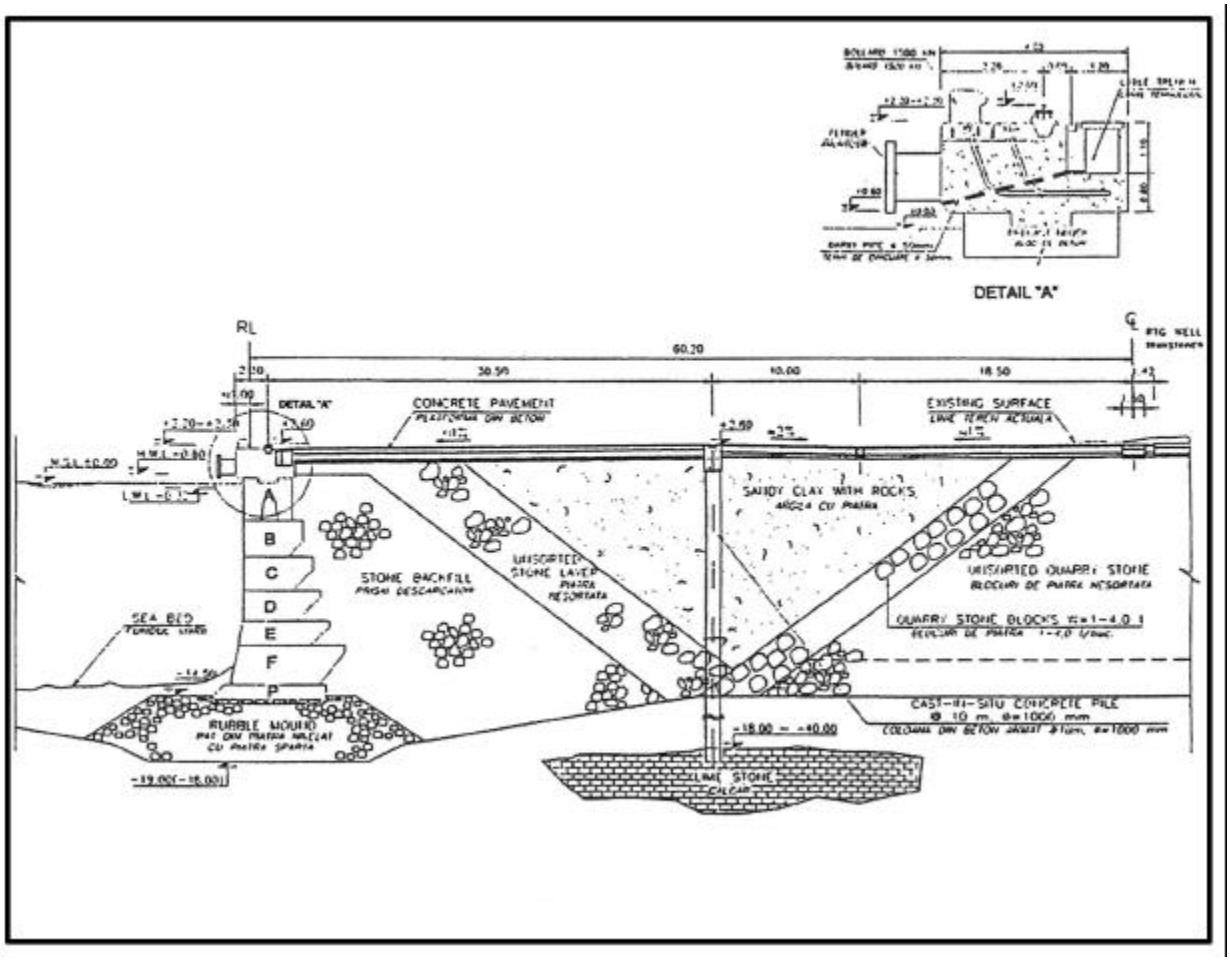


Figure 7.3.4 Cross Section of Container Terminal (Phase 1)

7.3.1 Site Development

Currently the S2 ground formation is assumed to be between +1m and +4m and therefore site development works are needed, including reclamation filling and grading to obtain the required elevation (about + 2.5m). The filling materials will be transported from the spoil deposits resulting from maintenance dredging works of the Danube – Black Sea Canal, material which is piled and stored along the banks thereto, as well from the maintenance dredging and capital dredging works of the port basins. These materials will be carried to the site and placed in order to obtain the required strength needed to carry the specified surcharge loads, as well as the scheduled formation.

7.3.2 Terminal Yard

(A) General Considerations

The graded ground or the existing surface that is supposed to be used as terminal area will basically be paved. If the present pavement is to some extent useful, it will be kept as a part of the permanent pavement by means of an overlay pavement, in order to minimize capital costs.

The pavement area will be divided into five categories, namely:

a) Terminal inner access
b) Terminal minor access
c) Container stacking basement in the marshalling yard
d) Light pavement in the marshalling yard without loading
e) Others

The yard will be provided with the appropriate pavement needed to support the heavy traffic load and the container stacked load, and as well as be provided with a drainage system. In the project of the on-going Container Terminal Phase 1, the asphalt paving system was mainly provided [except Items c) and e)] in the perspective of the predicted settlement.

(B) Container stacking basement in the marshalling yard

In order to support container heavy loads of about 35 tons per box, a sound and firm foundation should be provided. The pavement method will use the pre-stressed concrete planks in order to meet the heavy concentrated loads amounting to 35 tons per corner of a four-tier stack.

According to the soil investigation records, as investigated by PCI for the Phase 1 Project, there is no serious soft soil layer on site. However the excess pavement settlement may reduce the maximum stacking height down to less than 4 tiers. In the event that this happens, the expected capacity of terminal will necessarily shrink.

The yard loading point pavement will be located as scheduled, namely;

a) to meet the Twenty footers and Forty footers
b) to meet the yard crane, recommending of RTG, 6 lanes with 4+1 tiers
c) to provide reefers, as required

Thus planks will be provided every 6 and 12 m. The remaining ground surface will be paved with thin asphalt or with a gravel layer.

7.3.3 Yard Utilities

As discussed earlier, two container terminals will be constructed during the Master Plan stage including the on-going project. Thus separate utilities systems will be provided for each terminal.

The additional yard utilities such as power, water, sewage, telephone, etc for the West terminal will be rather minor and will be supplied or distributed through the networks that would have been provided during Phase 1. However, some additional substations and new pump stations will be needed due to the increased power consumption.

When it comes to the East terminal, a completely new utility system should be provided. The most important element thereof being the power supply system.

7.3.4 Extension of Substation

The power, generated in the national network, is transformed at Port IV station, which is located at the entrance of South Port. This substation will support the on-going container terminal.

On the other hand, in order to obtain a smooth operation flow at the proposed Container Terminal (Phase 2 and 3), about 4 MW of power will be needed, an so the existing capacity of the Port IV Station needs to be extended.

7.3.5 Road and Rail Access

A) Main Access

An independent plan exists to connect the South Port to the Romanian national road network, DN 39, with a four-lane elevated road, a project which is not included in this Master Plan. In the existing grain terminal project, a fly-over extension is provided together with an access road between the fly-over and the terminal yard and berths, based on the assumption that the construction of the four-lane road between DN 39 and Container Terminal is completed beforehand.

In the South Port, a railway network already exists that is connected to the national railways, CFR. In order to facilitate railway access and the operation of freight trains, a marshalling yard and a dedicated unloading tracks for the wagons should be provided here.
The road access will be basically made by using the existing road network.

B) Connection to Inner Port access

By utilizing both road and railway access modes connection to the inner port areas can be made. It is assumed that most of the containers will be transported by railway. And that the existing railway network in Romania will be maintained. However the truck transport traffic will increase in the near the future as a convenient so-called " Door to Door Service ". This may be achieved if Romania would turn into an industrialized country, as well enjoy the export of manufacturing industries.
Thus, the road access should be carefully planned in order to meet the increased demand.

7.3.6 Equipment

The investment in equipment will be executed separately as additional procurement to the on-going West terminal in order to increase the terminal capacity.

Following to this investment over a five years period, new investment in equipment will be undertaken for the East terminal. The major pieces of equipment to the east terminal would be the following:

a) Quay gantry cranes (41t, Post-Panamax type)
b) RTG (41t, 6lanes 4+1 tiers)
c) RMG (41t, 2+1 tiers)
d) Trailers
e) Forklift Trucks
f) Reach stackers
g) Side Spreader lift trucks

As shown above, Post-Panamax-type Quay Gantry Cranes and relevant yard equipment will be provided. For more detail, refer to Chapter 6, Section 6.4.