Japan International Cooperation Agency (JICA)
Ministry of Public Works, Transports and Housing, The Government of Romania

NO.

PART Ⅲ

Final report

The Feasibility Study on the Development Project of the Port of Constantza in Romania

February 2002

The Overseas Coastal Area Development Institute of Japan (OCDI)
Pacific Consultants International (PCI)

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Japan International Cooperation Agency (JICA)
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PART III

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PREFACE

In response to a request from the Government of the Republic of Romania, the Government of Japan decided to conduct "The Feasibility Study on the Development Project of the Port of Constantza in Romania" and entrusted the study to the Japan International Cooperation Agency (JICA).

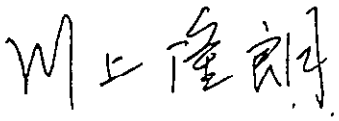
JICA selected and dispatched a study team headed by Mr. Fumio Kaneko of the Overseas Coastal Area Development Institute of Japan (OCDI) and consisting of OCDI and Pacific Consultants International Co., Ltd. (PCI) to Romania, three times between September 2000 and November 2001.

The team held discussions with the officials concerned of the Government of Romania and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Ministry of Public Works, Transports and Housing of the Romanian Government and other authorities concerned for their close cooperation extended to the study team.

February 2002



Takao Kawakami
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

February 2002

Mr. Takao Kawakami
President
Japan International Cooperation Agency

Dear Mr. Kawakami:

It is my great pleasure to submit herewith the Final Report of the Feasibility Study on the Development Project of the Port of Constantza in Romania.

The study team of the Overseas Coastal Area Development Institute of Japan (OCDI) and Pacific Consultants International (PCI) conducted surveys in the Republic of Romania over the period between September 2000 and November 2001 as per the contract with the Japan International Cooperation Agency.

The study team compiled this report, which includes the Master Plan, the Short-term Development Plan and the Feasibility Study of the Port of Constantza, through close consultations with officials of the Ministry of Public Works, Transports and Housing of the Romanian Government and other authorities concerned.

On behalf of the study team, I would like to express my heartfelt appreciation to the Ministry of Public Works, Transports and Housing and other authorities concerned for their cooperation, assistance and hospitality extended to the study team.

I am also greatly grateful to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Land, Infrastructure and Transport and the Embassy of Japan in Romania for valuable suggestions and assistance through this study.

Yours faithfully,

Fumio Kaneko

Fumio Kaneko
Team Leader for the Feasibility Study on the Development Project of the Port of Constantza in Romania

ABBREVIATIONS

ADB	Asian Development Bank
APDF	National Company Administration of the River Ports on the Danube
APDM	National Company Administration of River Sea Ports on the Danube
CEEC	Central and Eastern European Countries
CEFTA	Central European Free Trade Agreement
CFR	The National Company for Railway Transport
CIF	Cost, Insurance and Freight
CIS	Commonwealth of Independent States
CMPA	National Company Constantza Maritime Ports Administration
CMRC	Central Meteorologic Regional Constantsa
DFI	Direct Foreign Investment
DWT	Dead Weight Ton
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EU	European Union
FIRR	Financial Internal Rate of Return
FOB	Free On Board
GDP	Gross Domestic Product
ICN	Inspectrate of Civil Navigation
IEE	Initial Environmental Examination
IPTANA	Design Institute for Roads Water and Air Transport
ISPA	Instrument for Structural Policies for Pre-Accessions
IWT	Inland Water Transport
IWW	Inland Waterways
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
MPWTH	Ministry of Public Works, Transport and Housing
NPV	Net Present Value
PHARE	Poland and Hungary Aid for Restructuring of Economies
TEN	Trans European Transport Network
TEU	Twenty feet Equivalent Unit
TINA	Transport Infrastructure Needs Assessment
TRACECA	Transport Corridor Europe Caucasus Asia
WB	The World Bank

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PART A

SHORT TERM DEVELOPMENT PLAN (2010)

Chapter 1 Concept of the Short-Term Development Plan

1.1 Outline of the New Master Plan

Projects covered by the New Master Plan (proposed in Part II of the Draft Final Report) can be classified into three (3) major categories.

1.1.1 Projects to Meet Cargo Demand in the Future

The first category is represented by those projects dealing with the capacity constraints of the Port of Constantza and increasing cargo traffic in the future. The container terminal development project and the grain terminal development project are included in this category.

(1) Container terminal

Regarding the container terminal development project, the construction of two berths (600 m long west side of the pier), three gantry cranes, related yard facilities and railway facilities is being started on the west side of South Port Pier-2 as the Phase-I project based on JBIC's yen-denominated credit. When this project is completed, the Port of Constantza will have an annual handling capacity of 357,000 TEU. By adding one gantry crane to the above facilities, this terminal will be able to meet the demand in 2010 in the New Master Plan (384,000 TEU per annum in Case-1). To deal with the traffic demand in 2020 of the New Master Plan (790,000 TEU per annum), it is necessary to add another berth on the east side of Pier-2, this resulting in a total of three berths, eight gantry cranes and the necessary yard space for these facilities. The increase of the container terminal capacity is carried out mainly in South Port Pier S-2 by the consolidation of its facilities.

(2) Grain terminal

Regarding the grain terminal, the handling capacity of the grain terminal currently in operation is of about 2,700,000 tons per annum. When the grain terminals (handling capacity: 1,000,000 tons per annum) which are currently being planned by each operator are all developed, the Port of Constantza will have an annual handling capacity of 3,700,000 tons per annum. However, to deal with the traffic demand in 2010 in the New Master Plan (4,400,000 tons per annum in Case-1), further grain terminal expansion is necessary, and in consideration of annual fluctuation in grain production and shipment, it is necessary to construct grain terminals with a handling capacity of 2,000,000 tons per annum.

1.1.2 Projects to Improve Port Operation

The second category is represented by those projects for improving the present harbor operation. Cargoes that are currently handled by each operator in small scale on distributed moles are integrated in one or two places in a specialized and aggregated manner, thereby

raising the cargo handling efficiency and, at the same time, adapting it to the future marine transport trends (increase in ship size). The consolidation of steel product export terminals, consolidation of timber export terminals and a plan to shift general cargo from Old North Port to North Port fall under this category.

From the viewpoint of effective use of port facilities, the greatest problem in the Port of Constantza and, in particular, in the North Port, lies in the fact that operators stick to each berth and struggle for small lots of cargoes. As a result, little investment for modernization has been made over the past decade and thus the North Port facilities have continued to deteriorate. For the modernization of these facilities, it is necessary to make investments in maintenance, renewal of cargo handling equipment, etc. With an aim at easing the recovery of the funds invested for these purposes, it is necessary to aggregate cargoes of the same kind in one place to a maximum extent, thereby raising the utilization ratio of the facilities.

The question is what are the appropriate cargoes to be aggregated? Regarding bulk cargoes such as ferrous and nonferrous ores, crude oil and petroleum products, cement and fertilizers, each of these items is handled with the existing specialized cargo handling equipment, storage facilities and connections with the railways. It is therefore proposed that use of the berths currently handling each item should be continued. General cargo will be gradually containerized and shifted to South Port Pier S-2, as the containerization ratio will rise in the future (2010: 80%, 2020: 90%). Out of the remaining break bulk cargoes, large-lot cargoes which do not become bulk cargoes or container cargoes, i.e., steel products and timber, are the appropriate cargoes to be aggregated.

(1) Consolidation of steel product export terminals

Regarding the steel products which are at present handled in small lots by operators at their respective berths, it is necessary to achieve an efficient cargo handling efficiency by consolidating the handling berths as much as possible and introducing efficient cargo handling systems and machinery. Particularly, considering that 1) most steel products are hauled by barge from inland to the Port of Constantza (60%-70% of the export products), that 2) a sufficient yard space is necessary, also that 3) the possibility is high that in the future 50,000 DWT-class handy max type ships will be used, and that 4) a substantial quantity of products has already been exported through the terminal at South Port Pier S-1, it is desirable to locate the steel product export terminal at South Port Pier S-1 where a draft of 12 m can be accommodated.

(2) Consolidation of timber export terminals

Regarding timber, that operators currently handle in small lots at their respective berths, it is necessary to realize efficient cargo handling by consolidating the handling berths as much as possible and by introducing efficient cargo handling systems, that is, to use the quay side backup area for the timber yard with an aim at eliminating double handling of the export cargo,

and machinery. Mainly with respect to this export cargo, it is desirable to locate the terminal at North Port Mol 3 (Berth Nos. 46-50) where 1) a sufficient yard space will be available after the shifting of the container cargo to the South Port Pier S-2, and 2) a substantial quantity of timber has already been exported through the berths Nos. 47 to 50 of this terminal.

(3) Future Plan to shift general cargo from Old North Port to the North Port

In the future, the general cargo terminal will have to be able to accommodate 10,000 DWT (8.5 m draft)- to 15,000 DWT (9.5 m draft)-class ships. Most of the North Port terminals (Mol 2-4) currently handling general cargo meet this condition. In terms of quantity, almost all general cargo will be containerized in the future (the containerization ratio of general cargo is forecasted to be of 80% in 2010 and 90% in 2020 in the New Master Plan study) and timber and steel products will be shifted to the new terminal. Considering these conditions, the New Master Plan recommends that berths of Basin Nos.1-2 should not be used in the future for cargo handling, due to their insufficient depth and extremely limited space of the backup area.

1.1.3 Projects to Improve Port Transportation System

The third category is represented by those projects in the port which aim to improve the accessibility of the terminal to the inland transportation network in Romania. In order to achieve smooth and effective operation of the port, some of the transportation channels in the port need to be improved.

In the recent years, transit cargoes from the landlocked Eastern and Central European countries transported by inland water on the Danube have decreased due to the ethnical unrest in Yugoslavia. However, when the blockage of the Danube in the Yugoslavian district is removed in the future, there is a possibility that these transit cargoes will increase significantly. As a result, inland waterway transport, as a means of transporting port cargoes not only to the inland area in Romania but also to hinterland countries, will regain its importance. Furthermore, with the development of the Romanian economy, the traffic of general cargo and, in particular, that of the containerized cargo, will increase in the future. As a result, roads as means of transporting port cargoes to inland, will also increase in importance.

Against this background, the 1)barge basin improvement for setting up and breaking down convoys and barge mooring, 2)improvement of the roads in the port, and 3)improvement of connectivity with the railway transport operation are important elements for the development of the Port of Constantza. These projects or recommendations are included in the third category.

(1) Improvement of barge basins

The advantage of the Port of Constantza against its neighboring ports is the port's location at the river mouth of the Black Sea-Danube Canal, so that the port can provide economical

transportation services by water transport on the Danube to the landlocked Eastern and Central European countries in the hinterland, and making the most of its huge capacity of facilities with a great water depth. It is important to set the development direction of the Port of Constantza with an eye to ensuring that the port can make full use of this advantage.

The cargo transportation by river water transport on the Danube is carried out using barges. Main cargo categories are grains, iron ores, nonferrous ores, coal and coke, steel products and cement, mostly of which being dry bulk cargoes. All of these cargoes are transshipped at the Port of Constantza and are exported or imported by large ships. Both the transshipment to oceangoing ships with large draft and the use of river water transport on the Danube are services for which the potential of the Port of Constantza can be fully made use of. , which point it is necessary to note.

At present, the barge-mooring berths are located in the South Port (from Berth Nos. 91 to 103) and the water area preceding the barge-mooring berths is used to break down and set up barge convoys. The greatest part of the barge facilities at the Port of Constantza has suffered severe deterioration and the capacity of the part that can be actually available is insufficient for the future traffic demand. New facilities are needed with a view to meet the barge cargo demand in 2010 (17,000,000 tons per annum) in an appropriate manner.

At present, the barge berths at the Port of Constantza are lent to the main barge operators. There is a plan to make use of the hinterland area behind these barge berths as premises for an industrial district, in response to the establishment of a new law for turning the entire Port of Constantza a Free Port in the future. Therefore, it is not appropriate to use the berths No. 91 to No. 108 for the mooring of barges. Accordingly, new alternative barge berths are needed.

For the above reasons, it is necessary to construct barge-related facilities for barge mooring and for the breakdown and setup of barge convoys in still water areas inside and outside the Central Island.

(2) Improvement of roads in the Port

The South Port and North Port have different problems regarding the port traffic roads at the Port of Constantza. At present in the North Port, the means for transporting bulk cargoes to the inland are mainly pipelines, barges and railways, therefore the dependence on road transportation is not necessarily high. Furthermore, due to the progress in containerization, the general cargoes in the North Port will be shifted to the South Port in the future and will not increase abruptly. In the North Port, therefore, the main problems to be solved are the accessibility of the roads connecting the gates and the wharf and the insufficient specifications of the facilities. The curvatures radii of the roads near Gate 5, facing the heaviest traffic volumes of all gates in the North Port are small, and the gradients of these roads are also steep. It is, therefore, a possibility that traffic of vehicles for large-sized cargoes will jam in the future.

In order to solve this problem, it is necessary to improve the alignment of the roads near Gate 5.

In the South Port, there is a possibility that the capacity of roads will become insufficient, due to an increase in the cargo traffic, including containers, in the future. Particularly, inland transportation of containers has a high proportion of the road traffic compared with other bulk cargoes. Furthermore, the existing roads in the South Port have many crossing points with the railway and there is a possibility that this may represent an obstacle to an increase in traffic volume in the future. Therefore, in order to meet an increase of the cargo demand in the future for the roads in South Port, it is necessary to construct flyovers and increase the number of traffic lanes.

Regarding these projects to expand the capacity of the roads in the South Port, CMPA is at present formulating plans, and these are made part of the Existing Projects. The improvement of the road facilities of the North Port is made part of the short-term plans to be accomplished by 2010.

(3) Improvement of connectivity with railway transport operation

Traffic of railway cargo in the Port of Constantza reached a peak in 1989 and leveled off at approximately 10 million tons per annum for the three years between 1998 and 2000.

The railway station capacity for marshalling of wagons in the North Port at Constantza (16 million tons per annum) can sufficiently meet the future cargo demand in the New Master Plan. However, for the railway transportation in the North Port, under the present operation system, in which operators stick to each berth and are engaged in handling small lots of cargoes, the train-recomposing operations in each station (activities of the CFR cargo company) have become complicated and, in case of an increase in cargo in the future, there is a possibility that terminal operations will be hindered by this. Therefore, it is necessary to enhance the connectivity between the operations in each station of the CRF cargo company and the operations in the wharf terminal (for example, by introducing information system), thereby raising the efficiency of the whole North Port.

Considering that the container terminal project and free zone project, which are being formulated in South Port, include railway expansion plans necessary for standby, interchange, cargo handling and access in most facility plans, the capacity of the railway station in South Port can sufficiently meet the future cargo demand in the New Master Plan. Therefore, in the South Port, it is more important to secure expansion space after 2020 than to consider the railway expansion plan until 2020.

1.2 Short-Term Plans and Projects Covered by Feasibility Study

Master Plan projects and projects planned in the future (after 2020) were briefly described in the preceding section with respect to their necessity, outlines and implementation periods. Furthermore, among these projects, those that can be implemented by 2010 are categorized as projects to be covered by Short-term Plans and, among these projects to be covered by Short-term Plans, those that should be preferentially implemented are categorized as projects to be covered by the feasibility study (Feasibility Study Projects). Projects to be classified into Short-term Plans and Feasibility Study Projects are summarized in **Table 1.1.**

1.2.1 Projects of First Category

(1) Container terminal

The annual handling capacity of the container terminal will increase to 357,000 TEU after the completion of the Phase-1 projects based on JBIC's yen credit. In this container terminal, the demand in 2010 in the New Master Plan (384,000 TEU per annum in Case-1) can be met by adding one gantry crane. To meet the cargo traffic in 2020 (790,000 TEU per annum), an additional berth is necessary. Therefore, the container terminal development project is not included in the projects to be covered by Short-term Plans, although this container terminal development project belongs to the projects to be covered by the Master Plan.

(2) Grain terminal

When the handling capacity of the grain terminal currently in operation and that of the grain terminals being planned by each operator in their expansion plans are totaled, the annual handling capacity of the grain terminals at the Port of Constantza is of 3,700,000 tons. However, in order to meet the demand in 2010 in the New Master Plan (4,400,000 tons per annum in Case-1), it is necessary to further expand the grain terminal capacity. In consideration of the possibility that the blockage of the Danube by the Yugoslavian conflicts will be removed in the near future, it is appropriate to include this expansion project in the projects to be covered by Short-term Plans as well as the projects to be covered by the Feasibility Study.

1.2.2 Projects of Second Category

(1) Consolidation of steel product export terminals

For the improvement of the port operation by the consolidation of the steel product export terminals, there is no condition for schedules in terms of implementation of facility development. However, considering concession contract for land usage of Pier S-1 extends over the year 2010, implementation of this project is difficult by 2010. It is also necessary that a legal basis for the role of CMPA as a landlord is established by the enforcement of the concession law, and that institutional grounds for promoting the consolidation of terminals are improved, for example, by changing the tariff policy related to land lending. For these reasons, the improvement of port operation by the consolidation of the steel product export terminals will be implemented after 2010. Therefore, it is included in the Master Plan, not in the

Short-term Plans.

(2) Consolidation of timber export terminals

The container operation at the Port of Constantza will be gradually shifted to the South Port Pier-S2. In the New Master Plan, the North Port Mole 3 (Berths Nos. 46-52) is used as a timber export terminal by using the former premises of the container terminal as the core site for the timber export terminal. At this point in time, the operation of the South Port Pier-S2 is planned to start in 2004. The shift of the container operation to South Port is to be gradually carried out after 2004, and this core site will not be available earlier than 2010. Both for the timber export terminal, as well as for the steel product export terminal, it is necessary that institutional grounds for promoting the consolidation of terminals be improved. For these reasons, the improvement of port operation by the consolidation of the timber product export terminals will be implemented after 2010. This Project is included in the Master Plan, not in the Short-term Plans.

1.2.3 Projects of Third Category

(1) Improvement of barge basins

The improvement of the barge basin at the port of Constanta is a matter of strategic importance for the port, taking into account that a) the Danube blockade will be removed in short time and b) river transportation services on the Danube to the land-locked Eastern and Central European countries in the hinterland are remarkably economical transportation alternatives the Port of Constanta should receive advantage of. The present deteriorated condition of the barge-mooring berths in the South port and the western side of the Central Island makes the basin very unsuitable to meet the barge cargo demand in 2010 (17,000,000 tons per annum).

For the above reasons, the project for improving the barge basins is included in the projects to be covered by the Short-Term plans, as well as projects to be covered by the Feasibility Study.

(2) Improvement of roads in the Port

As described in the preceding section, in North Port, the main issue is to improve the accessibility of the roads that connect the gates and the wharf and the insufficient specifications of the facilities. As a short-term problem, because the small radii of curvatures of the roads near the No.5 gate that have the heaviest traffic volumes among the North Port gates and the steep gradients of these roads, there is a possibility that traffic jams of vehicles for large-sized cargoes will occur. In order to solve this problem, measures to improve the alignment of the roads near the No. 5 are included in the projects to be covered by Short-term Plans.

In the South Port, the future increase of container traffic and the large number of crossing points between roads and railways in the area are likely to result in an insufficiency of the existing road capacity. To meet the increase of the cargo demand in the future, the increase of

the number of traffic lanes and construction of flyovers are compulsory. MPAC is at present formulating plans to expand the capacity of the roads in the South Port, which are included in the Existing Projects.

(3) Improvement of connectivity with railway transport operation

The marshalling capacity of the railway station in North Port at Constantza can sufficiently meet the future cargo demand in the New Master Plan. Therefore, the problem to be solved as a short-term plan is to enhance the connectivity between the operations in each station of the CRF cargo company and the operations in the wharf, thereby raising the efficiency of the whole North Port.

The capacity of the railway station in South Port can sufficiently meet the future cargo demand in the New Master Plan. Therefore, in South Port at Constantza, it is more important to secure expansion room (space) after 2020.

Table 1.1. Summary of Possible Projects for Short Term Plan and Feasibility Study

Possible Projects		Short Term Plan	Feasibility Study	Remarks (Master Plan & Future Plan)
Traffic Demand Related	Container Terminal Expansion			○
	Grain Terminal Construction	○	○	
Improvement of Port Operation	Steel Product Terminal Consolidation			○
	Timber Terminal Consolidation			○
	Relocation of General Cargo Terminal			○
Inland transportation Accessibility improvement	Barge Terminal Improvement	○	○	
	Road Improvement	○		
	Railway Improvement			○

Chapter 2 Short Term Development Plan(F/S projects)

2.1 Formulation of the Short Term Development Plan

The Short Term Development Plan is formulated as a first-phase plan for the development and re-development of the Port of Constantza for the target year 2010 in the framework of the Master Plan.

The Short Term Development Plan includes 2 aspects of the projects as follows:

1) Traffic demand related ; Grain Terminal
2) Inland Transportation Access Improvement; Barge Terminal
Road Improvement

Among these projects, Grain Terminal and Barge Terminal were selected as the objectives of the Feasibility Study, because these projects had the highest priority. Therefore, a special focus was set on Grain Terminal and Barge Terminal (hereinafter referred to as " F/S projects").

2.2 Grain Terminal

2.2.1 Requirement for Grain Terminal

To meet the increasing demand for handling grains at the Port of Constantza, a Grain Terminal is required in order to accommodate larger vessels and increase the handling productivity for grains export.
The forecasted demand for grains in 2010 exceeds the handling capacity of the existing facilities. Taking into account the annual fluctuation of cereals products, it is necessary to construct a new Grain Terminal.

2.2.2 Required Dimensions of the Facilities

(1) Target Volume of Grains to be handled at the Port in 2010

Forecasted demand is described in PART II.

Forecasted export demand for the year 2010; 4.41 million tons
Trade export; 1.80 million tons
Transit export; 2.61 million tons
Taking the annual fluctuation into consideration, forecasted demand as peak case; 6.40 million tons
Trade export; 3.17 million tons
Transit export; 3.23 million tons

(2) Capacity of existing facilities of the Port

The existing handling and storage facilities for grains in the Port of Constantza are provided by several operators. By interviewing each operator and based on The Study Team's estimation, the capacity of existing facilities and ongoing/approved projects is summarized as follows:

- Agroexport ; 1.0 million tons per year
- Arts ; 0.25 million tons
- Chimpex ; 0.5 million tons
- Silotrans ; 1.5 to 2.0 million tons
- Total ; 3.25 to 3.75 million tons per year

(3) Required capacity of the new grain terminal

Total capacity of existing facilities for grain handling is estimated as 3.25 to 3.75 million tons per year. Forecasted demand in 2010 is 4.41 million tons, so a shortage of handling capacity of 0.66 million tons will likely occur. Moreover, taking into account the annual fluctuation of grain products, the shortage of the capacity will be 2.65 million tons at the peak case of 6.4 million tons. It is therefore necessary to develop a new Grain Terminal with a required handling capacity of 2 million tons per year to handle cargo as follows:

Trade export; 1 million tons
Transit export; 1 million tons

As for access mode of the grain transport, there are 3 modes, namely barge, railway and road. From chapter 2, the modal split of trade and transit is, on average, as follows:

	Barge	Railway	Road
Trade export	25%	67.5%	7.5%
Transit export	85%	15%	-

Traffic volume for each mode of the new grain terminal is calculated as follows:

Barge	1.10 million tons
Railway	0.83 million tons
Road	0 08 million tons

(4) Requirement for facilities

The new Grain Terminal is expected to accommodate fully loaded 50,000 DWT dry bulk carriers, namely LOA of 216 meters and moulded breath of 31.5 meters. Therefore the required berth length and depth are 300 meters and 14.0 meters respectively, taking the future vessel size into consideration.

To meet barge traffic of 1.10 million tons, required berth for barges should be 250 m long and – 4.5m deep, which can accommodate two barges at the same time.

Required storage capacity of the silo is calculated at 100000 tons.

Railway facilities, such as trucks for unloading, sidelines and connection to the railway station of the South Port, are required.

Requirements for facilities are summarized as follows:

- Berth for grain vessel; 300m long, -14m depth
- Berth for barges; 250m long , -4.5m depth
- Silo; 100000 tons
- Cargo handling Equipment (see details in chapter 6)
- Access (Railway, Road)

Road
Railway

- Utilities
- Land development

2.2.3 Preparing Alternative Terminal Plans and Evaluation of the Alternatives

Taking the above requirement into consideration, three development alternatives have been prepared as follows:

1) Alternative 1; Development of a new Pier 3S in South Port
2) Alternative 2; Development of the existing Pier 1S in South Port
3) Alternative 3; Development of the existing Berth 31 to 33 in North Port

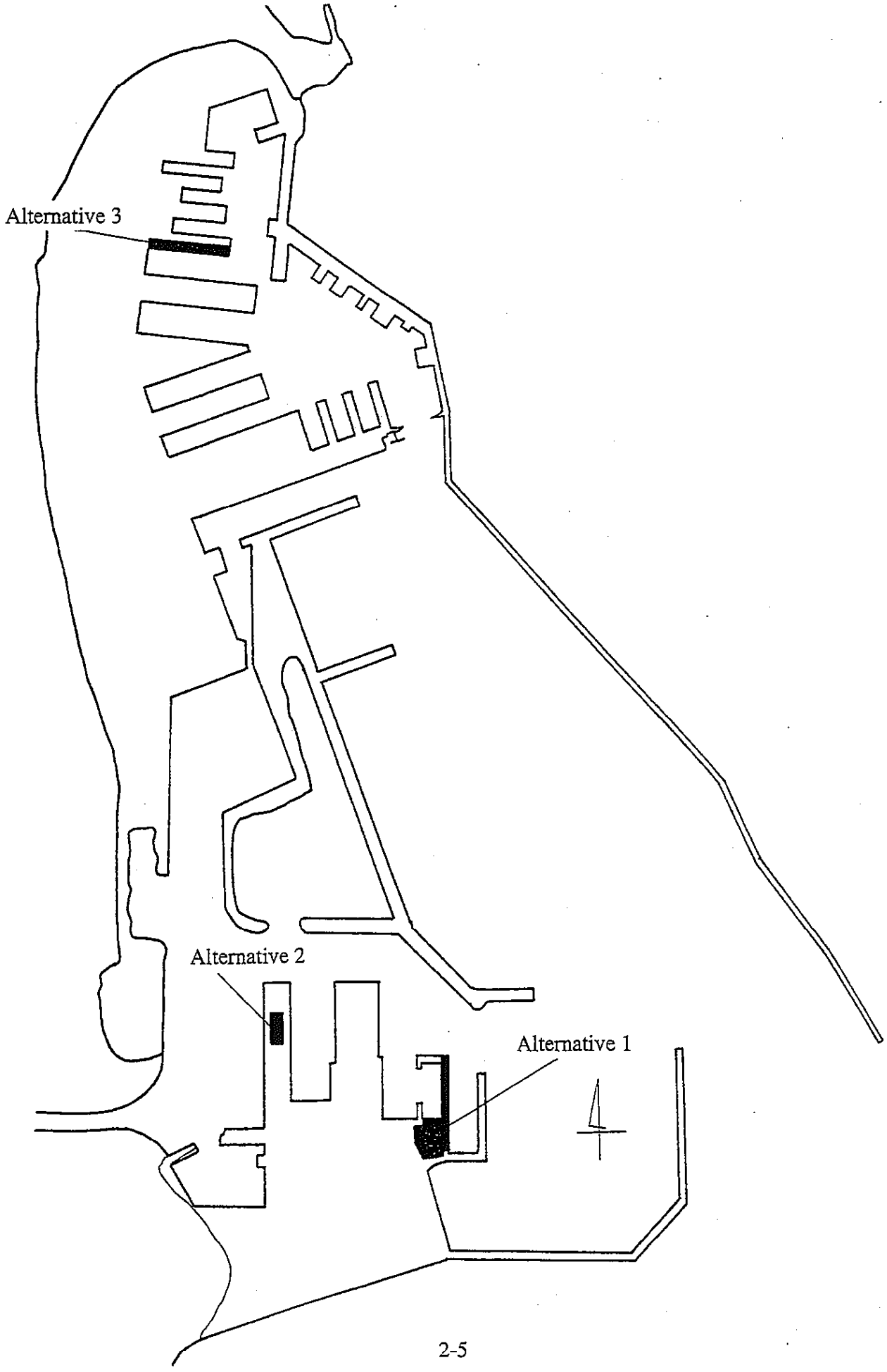
Alternative development sites are shown as Fig.2.2.1.

Alternative 1 presents the development of a new terminal in South Port, which can accommodate large vessels. The new terminal will be located on Pier 3S, next to existing Pier 2S, with landfill and construction of new quays required. Concrete caissons partly exist on the construction site. By making use of these structures, we can arrange options for staging the development.

Alternative 2 presents the development of a new terminal at the existing Pier 1S in South Port. The silo and equipment for handling grains are in place at an end of the pier, while the area next to the existing terminal will be developed.

Alternative 3 presents the development of Berth 31 to 33 in North Port. New silo and handling equipment will be developed on the existing quays. However, these berths cannot accommodate large vessels because the depth of these berths is –11.5m.

Fig.2.2.1 Alternative development sites for Grain Terminal



The results of the total evaluation of development alternatives are shown in Table 2.2.1.

Table 2.2.1 Evaluation of Development Alternatives

Item	Alternative 1	Alternative 2	Alternative 3
Function of Terminal	++	++	-
Existing utilization of land	++	-	+
Room for future extension	++	-	-
Development cost and period	+	++	++

Note: ++; Excellent, +; Better, -;Inferior

Alternative 3 is inferior in terms of "Function of Terminal", because these berths are not available for large grain vessels and there are not sufficient spaces for extension, so "Room for future extension" is marked as inferior.

Alternative 2 has a function of grain terminals, however this alternative is inferior in terms of "Existing utilization of land" and "Room for future extension". Pier 1S is now fully utilized not only for silos but also for general cargo handling. At the same time, Pier 1S is evaluated as the only modernized multi- purpose terminal in the Port of Constantza, which has some extended yards and access facilities. Therefore open storage and marshaling yards on Pier 1S are not recommended to shift into fixed structures such as grain silos more than they are at this moment.

Alternative 1 implies a new construction of the whole terminal, including infrastructure as landfill and quays, so it is more costly than other alternatives. However, this alternative has enough room for the future extension of grain handling and meets the future development strategy of the South Port.

As a result, Alternative 1 is proposed for the development site of the new Grain Terminal.

2.2.4 Layout of Grain Terminal

Two options have been set up as a layout for the Grain Terminal in locating on Pier 3S in South Port.

Option A: Construction as the modified configuration of 3S

In order to secure the slip width between Pier 3S and 2S, a modified configuration of a new pier is proposed. The new pier, which has a width of about 80m, is allocated along the existing eastern sides caissons. Grain vessels and

barges will berth at the western side of the new pier. Silo is allocated on the base of the pier. The existing caissons located on western sides of Pier 3S will be transferred and utilized to the new pier by the appropriate construction work method.

Option B: Construction as the initial configuration of Pier 3S

This option is to construct berths as the initial configuration of Pier 3S. Grain vessels and barges will berth at the western side of the 3S. Silo is located on the head of 3S, and the base of 3S will be reclaimed as required.

Layouts of each option are shown as Fig. 2.2.2 to 2.2.3.

Taking into account following issues, layout plan of Grain Terminal should be examined.

1) To secure slip width between 3S and 2S
   In the master plan for the year 2020, Berth 128 to 130, eastern side of Pier 2S, is allocated for additional container terminals. In the initial configuration of Pier 3S, slip width between 2S and 3S is about 220m, which is not sufficient for larger container vessel's maneuvering and too narrow for efficient operation of berthing. It is recommended to secure wider slip than the initial width.
2) Room/Utilization for future expansion
   It is important to secure room for future utilization in the surround area of the Grain Terminal, especially expansion of silo. Arrangement of land, which is not divided on a railway, should be suitable for silo, yards and industrial firms.
3) Utilization of the existing concrete caisson
   Caissons for berth already exist 1,125m long along the initial configuration. It is desirable to utilize these caissons as much as possible.

Evaluation results of the development options on 3S are shown in Table 2.2.2.

Table 2.2.2 Evaluation of Options of Layout on 3S

Item	Option A	Option B
To secure slip width	++	-
Room/Utilization for future extension	++	+
Work volume/Development cost	+	++

Note: ++; Excellent, +;Better, -;Inferior

The study team proposes Option A, since it is as important issue to secure safe and smooth operation of vessels in the future.

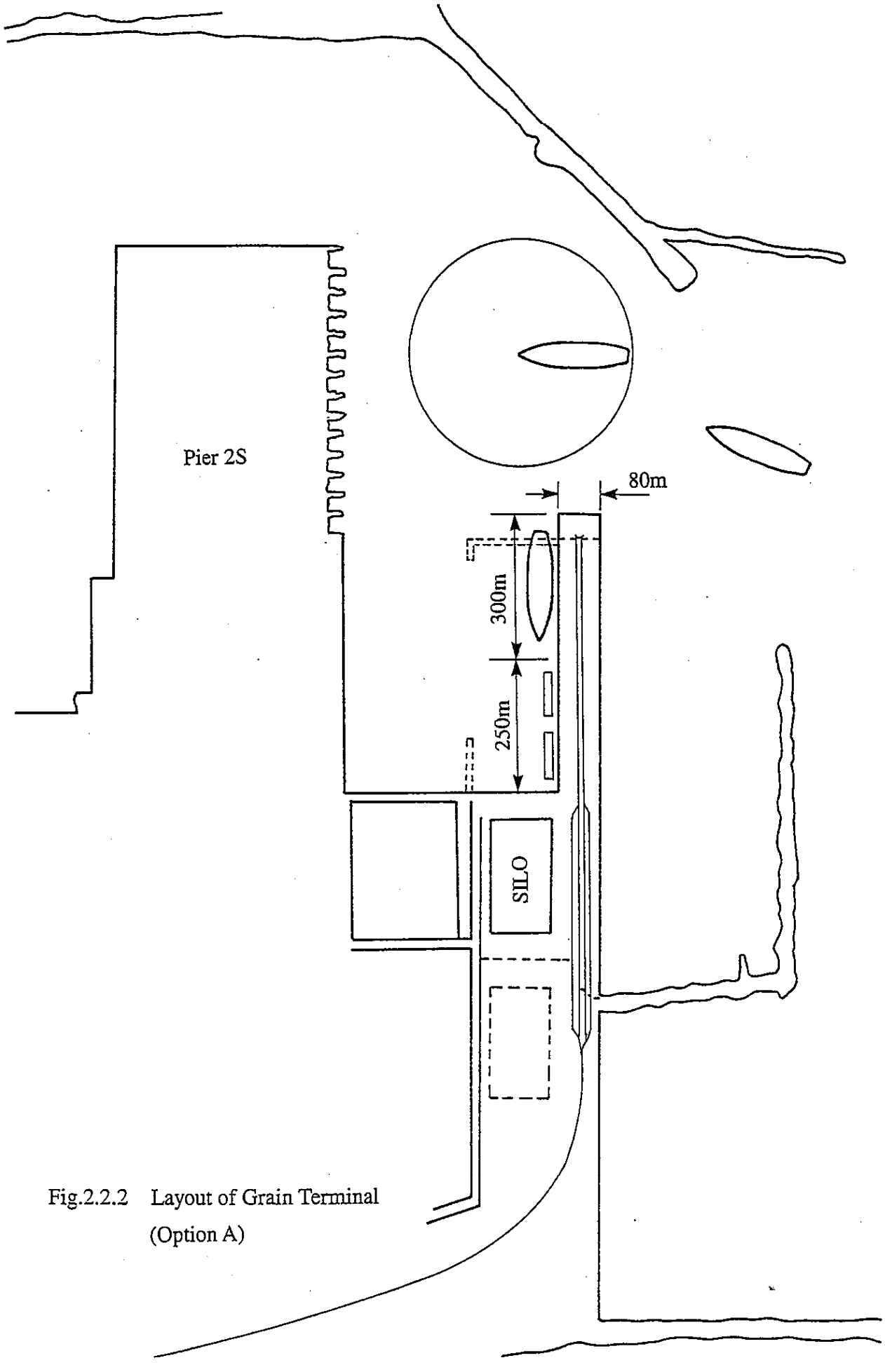


Fig.2.2.2 Layout of Grain Terminal
(Option A)

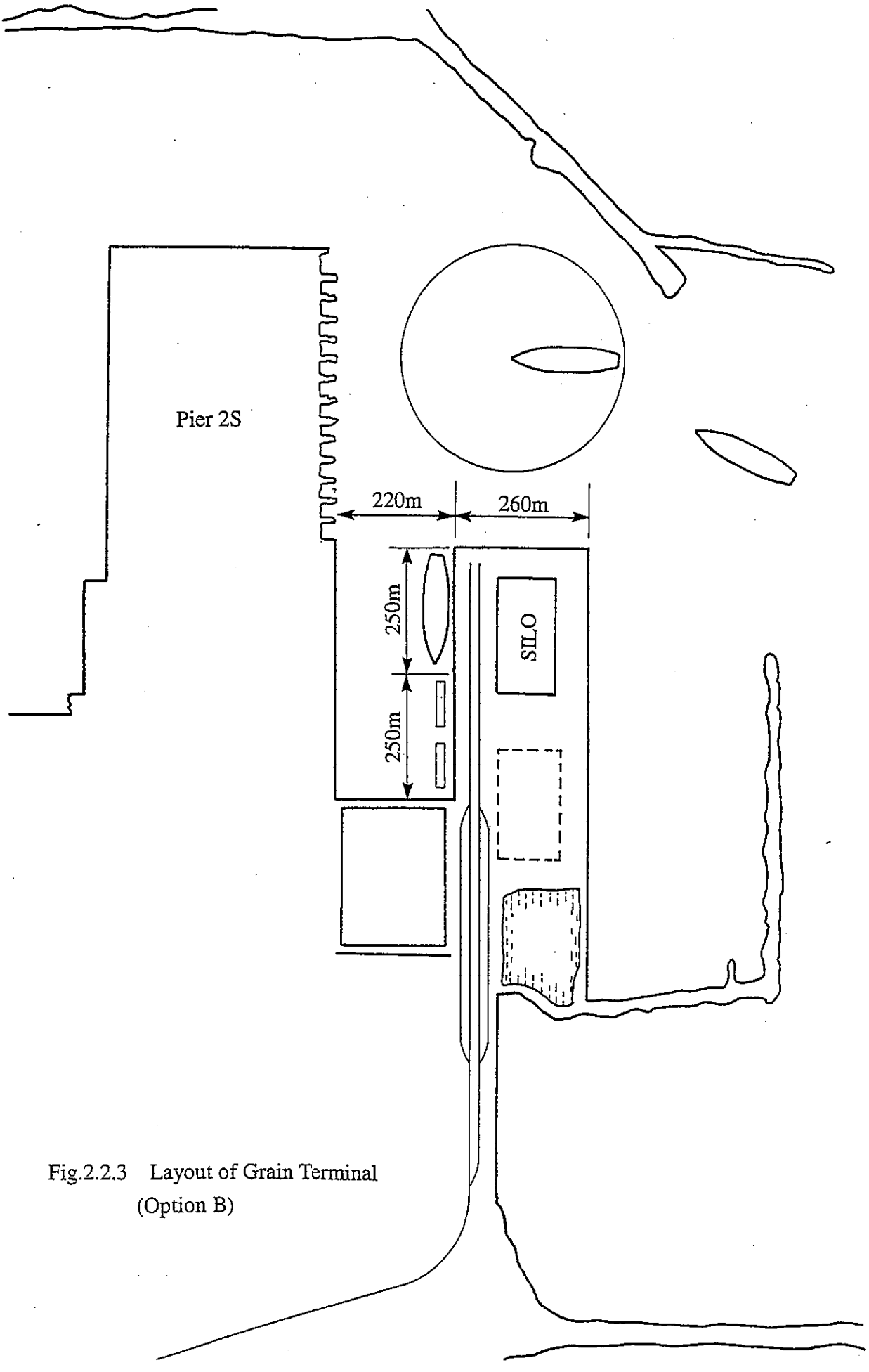


Fig.2.2.3 Layout of Grain Terminal
(Option B)

2.3 Barge Terminal

2.3.1 Review of the Present Barge Operation

(1) Barge traffic

Inland waterway traffic of the Port of Constantza is shown as Table 2.3.1.

Table 2.3.1 Inland Waterway Traffic of the Port of Constantza

(In thousand tons)

Year	Discharged from River Vessel	Loaded to River Vessel	Total
1998	2631	8358	10989
1999	2882	6369	9251
2000	2925	6554	9480

Source: CMPA

The Inland waterway cargo of the Port of Constantza is transported by barges through The Danube Black Sea Canal. Generally, barges navigate as a convoy through the Canal and Danube River, and when arriving at the Port, the convoy is split in separate barges. We could not obtain any accurate data related to barges and convoys in the Port. Therefore the Study Team has estimated the number of barges that called the Port of Constantza in the recent year. Statistics provided by the Administration of Navigable Canals show basic features of the barge traffic navigating the Canal (see Table 2.3.2). By using these statistics, the Team has calculated the basic parameters of barge operations as follows:

- Average barge capacity; 1500 ton/barge
- Average barge number per convoy; 5 barges/convoy
- Average convoy capacity; 7500 ton/convoy

Table 2.3.2 Traffic of The Danube Black Sea Canal

Year	Number of Vessels(no.)	Number of Convoys(no.)	Cargo Traffic (thousand tons)	Transport Capacity (thousand tons)
1998	17051	3339	12265	26035
1999	14423	2904	10567	21703
2000	15455	3121	11299	24189

Source: the Administration of Navigable Canals

In the same time, the Team has estimated the number of barges and convoys that called the

Port at present. Assuming that the barge cargo traffic at present is of 10 million tons, the number of barges and convoys is calculated by using the above basic parameters. It is noted that this number of barges and convoys represents the two-way traffic, which is inward and outward the Port.

Estimated traffic of barges in The Port of Constantza at present is as follows:

- Net number of barges per year ; 13300 barges
  = 10 million tons/1500ton/barge x 2
- Net number of convoys per year ; 2660 convoys
  = 13300 barges/5 barges/convoy

The Team has also estimated the number of operated barges in the port. This figure is important for planning the capacity of the facilities and port operation. Almost all barges are loaded with cargo in only one way, i.e. empty inward the port, loaded with cargo outward the port, vice versa. However, there are some barges loaded with cargo in both ways. It is estimated that the percentage of barges loaded in both directions, that are loaded and discharged in one round trip, is of 12% of the total barge traffic. Therefore operated barges in the port is as follows:

- Operated barges in the port per year; 11900 barges
  = 13300 barges/1.12

(2) Dimensions of barges/convoys

The Danube Black Sea Canal has locks, so there is a restriction of dimensions of vessels navigating through the Canal. Maximum size of vessels for the Canal is as follows:

Table 2.3.3 Maximum size of vessels for the Danube Black Sea Canal

	Pushed convoy	Self propelled vessel
Capacity	6 x 3000 t	5000 DWT
Length	296 m	138.3 m
Width	23 m	16.8 m
Draft	3.8 m	5.5 m

Source: the Administration of Navigable Canals

Dimensions of major barges operated in the Port are as follows:

Barges
- 3000 T (maximum size); LOA: 88.9m, B:11.0m, d:3.8m(in full)
- 2000T ; LOA:76.18m, B:11.0m, d:3.0m(in full)

- 1500T (average size) ; LOA:70.27m, B:11.0m, d:2.5m(in full)

Dimensions of major pushers and tugs operated in the Port are as follows:

Pushers
- 2 x 1200 HP; LOA: 34.6 m, B: 11m, d: 2m
- 2 x 820 HP; LOA: 33.16m, B: 10.17m, d: 1.7m
- 2 x 420 HP; LOA: 30.40m, B: 11m, d: 1.28m

Tugs
- 2 x 2400 HP; LOA: 34.4m, B: 10.5m, d: 4.6m
- 2 x 1200 HP; LOA: 35.81m, B: 9.71m, d: 3.35m
- 2 x 600 HP; LOA: 23.3m, B: 6.96m, d: 2.35m

(3) Barge Maneuvering in the Port

The barge convoys maneuver in the Port include the following:

1) Anchoring in the River-Maritime Basin
2) The convoy is dismantled into barges with a maneuvering tugboat
3) Each barge is tugged to a mooring point
4) Waiting to discharge/load cargoes
5) Tugged to the operational berth for discharge/load
6) Discharging/Loading cargoes
7) Tugged to a mooring point
8) Waiting to make new convoy
9) The new convoy is made in the River-Maritime Basin with a maneuvering tugboat
10) Sometime waiting until the Canal lock is opened

Barges dwell in the port for some days to wait for discharging/loading cargoes and making a convoy, as per above items 4), 8) and 10).

The existing facilities for mooring barges are tentatively allocated quays of about 2000 m, which are not used for handling cargoes or are operated for barge transport in the South Port, such as Berth no. 89 to 93, 97 to 101. Moreover, the basin surrounded by breakwaters at the Central Island in the South Port is used for the anchoring of barges. In addition, several concrete block dolphins for barges are located along the dike in the Central Island, however these facilities are not in good conditions because of collision by barges.

Analyzing statistics of barges in the Port, the Study Team has estimated the average dwelling time of barges in the Port at about 12 days at the present. The average dwelling time for convoys' pushers has been estimated at about 6 days, because of a quicker turn around than for barges.

2.3.2 Requirements for Barge Terminal

(1) Necessity of the Barge Terminal Development

Barge traffic demand in 2010 is forecasted to increase, and capacity of existing facilities is not sufficient for the future traffic demand. It is necessary to develop barge-related facilities for barge mooring and convoys preparations. The Barge Terminal will be developed:

To secure a space for barges waiting in the port and making a convoy

To develop a terminal for barges/pushers/tugs for efficient and smooth operation in the port

(2) Target Volume of Barge Traffic at the Port in 2010

Barge cargo demand in 2010 is forecasted at 17 million tons per annum (see PART II). Annual barge traffic in 2010 is estimated as follows:

- Net number of loaded barges; 11333 barges = 17 million tons/1500 tons/barge
- Net number of navigated barges; 22666 barges = 11333 barges x 2
  2:both directions, inward and outward the port
- Net number of convoys per annum; 4533 convoys
  = 22666 barges/ 5barges/convoy

And, daily barge traffic in 2010 is estimated as follows:

- Net number of loaded barges per day ; 31.0 barges/day
- Net number of navigated barges per day; 62.0 barges/day = 31.0 x 2
- Net number of loaded convoys per day ; 6.2 convoys/day
- Net number of convoys per day ; 12.4 convoys/day = 6.2 x 2

2.3.3 Required Dimensions of the Facilities

Required capacity of barge operation in the Port is calculated as follows:

- Average convoys per day; 12.4 convoys/day
- Net loaded barges per day; 31.0 barges/day
- Average dwelling days; 8 days = 12 days (in 2001) x 0.7

  It is assumed that average dwelling days will decrease accordingly, as cargo traffic will increase.
- Number of barges dwelling in the port a day; 221 barges

  = 31.0 barges/day x 8 days /1.12

  The gross number of barges in the port is calculated taking into account the loaded ratio of barges in both directions, that is of 12% at present.

In planning the capacity of the facilities, the following issues are considered:

- Some existing facilities such as Berth no. 92, 93 are allocated for barge mooring successively in the future, which has a mooring capacity of about 40 barges.

Required new facilities for barges

180 barges = 221 – 41

- Stand-by basins for making a convoy; 300m x 3 sets
- Quays for mooring barges; 2250m = 12.5m x 180

Sub total for barges: 3150 m

Required new facilities for pushers/tugs

28 pushers for navigation = 6.2 convoys/day x 4.5 days

10 pushers/tugs for operation in the port = 14/2

- Quays for mooring pusher/tugs; 450m = 28 x 12.5 + 10 x 10

Sub total for pusher/tugs:450m

2.3.4 Layout of Barge Terminal

Barge Terminal is allocated for 2 basins area as follows:

- River-Maritime Basin for North port; iron ore, coal, oil
- River Basin for South port; grain

New facilities to be required are allocated as follows:

- Quays:	Barge Operation Quay (berth 97,98,99)	700m x -4.5m
	North Barge Preparation Quay	600m x -4.5m
	South Barge Preparation Quay	500m x –4.5m
- Dolphin:	North Barge Stand-by Dolphins	500m (11units)
	South Barge Stand-by Dolphins	900m(19 units)

Sub total for barges:3200 m

- Quays for pushers: 450m
- Land development (landside only)
- Utilities (landside only)
- Access road (connecting to existing road to Gate 8)

Layout of Barge Terminal is shown as Fig. 2.3.1.

Fig.2.3.1 Layout of Barge Terminal