# CHAPTER 3 TRAFFIC DEMAND FORECAST

## 3.1 Introduction

This section deals with the traffic demand forecast for the feasibility study of priority projects in the Port of Constantza. Forecasts were undertaken accordingly based on the methodology proposed. Three frames of scenario were presented to the Steering Committee in 19, Dec. 2000 and necessary discussion was carried out between the Committee and the study team. These three basic scenarios are the following:

| | |
|---|---|
| **Case 1 : High case**, | (2001/2004, Romania Middle Term Economics Development Strategy) |
| **Case 2 : Medium case**, | (2001/2015, MOT Transport Master Plan, 1999) |
| **Case 3: Low case,** | (Modified Case 2 by the port planner of the study team) |

**Case 3** is so similar to **Case 2,** that there is no significant difference. Thus the study team carried out the traffic demand forecast for **Scenarios Case 1** and **Case 2.**

Basic input data were arranged through the collected statistics and results of direct interview to end uses and terminal operators at the port. The most important information and key decisions to the traffic demand forecast were as follows:

**(1) Port Development Potential**
**(2) Industrial Development Plan in Romania**
**(3) Socio-economic Frame of Romania and Surrounding Countries**
**(4) Inter-modal Transport Study**
**(5) Translation of above to Input Data for traffic demand forecast**
**(6) Undertaking Traffic Demand Forecast**

Among these, two port planners carried out the study on (1) Port Development Potential including the investigation of neighboring countries.
Various experts in the study team participated in this study. All these discussion are presented herewith elsewhere in different chapters. The experts carried out study of items (1) to (5) and the transport economist carried out study of Item (6) Undertaking Traffic Demand Forecast.

Forecast study was conducted by two-step approach namely, the over-all study and final study on specific commodities. Descriptions presented in Sections 3.2 to 3.9 covers the former and the last two sections concentrate to the traffics of bulk grains and passengers.

In order to ensure the forecast data accuracy, both the Micro-scopic Analysis and Macro-scopic Analysis were performed accordingly. The former consists of 14 commodity groups and is selected as the main method of traffic forecast.

Among the various economic indicators, GDP acts the main player to monitor the future traffics. Transition of economy is on-going to achieve a stabilized market economy. Transition was commenced in 1990 after the political change and modification in the former social countries. Nobody knows the time when period of this transition is over. It is however supposed that transition will continue for several years, after which steadily GDP growth will be maintained in all the Eastern European Countries.

## 3.2 Methodology of Demand Forecast

### 3.2.1 Demand Forecast

The analysis involves a commodity-wise examination of import, export and transit cargoes handled at the Port of Constantza, and develops forecasts of throughput based on such data, as well as the main demand drivers, which are likely to affect the supply and demand of each commodity group. Reference is also made, where appropriate, to the impact of potential changes in trading patterns on the main stevedoring companies operating in the Port of Constantza.

**Procedure to Possible Scenarios**

The scenarios for trade and transit cargo will be established by the following procedure. (Refer to the Figures 3.2.1 and 2)

1. Setting up scenarios for the future socio-economic framework of Romania, in order to forecast demand of trade cargo, as well as transit cargo. The socio-economic framework takes into consideration factors such as the development of GDP and per capita GDP in Romania.

2. Setting up scenarios for other potential developments that impact upon trade and transit cargo. Such developments will be considered on the basis of the following factors:
   - the port's Hinterland potential;
   - the economic development potential of the Black Sea basin;
   - the ability of the Port of Constantza port to act as a hub port;
   - potential industrial developments in the port's free trade zone;
   - Romania's accession to the European Union; and
   - The re-emergence of the Danube river as a viable waterway.

3. Integrating the scenarios for the socio-economic framework and the other potential developments.

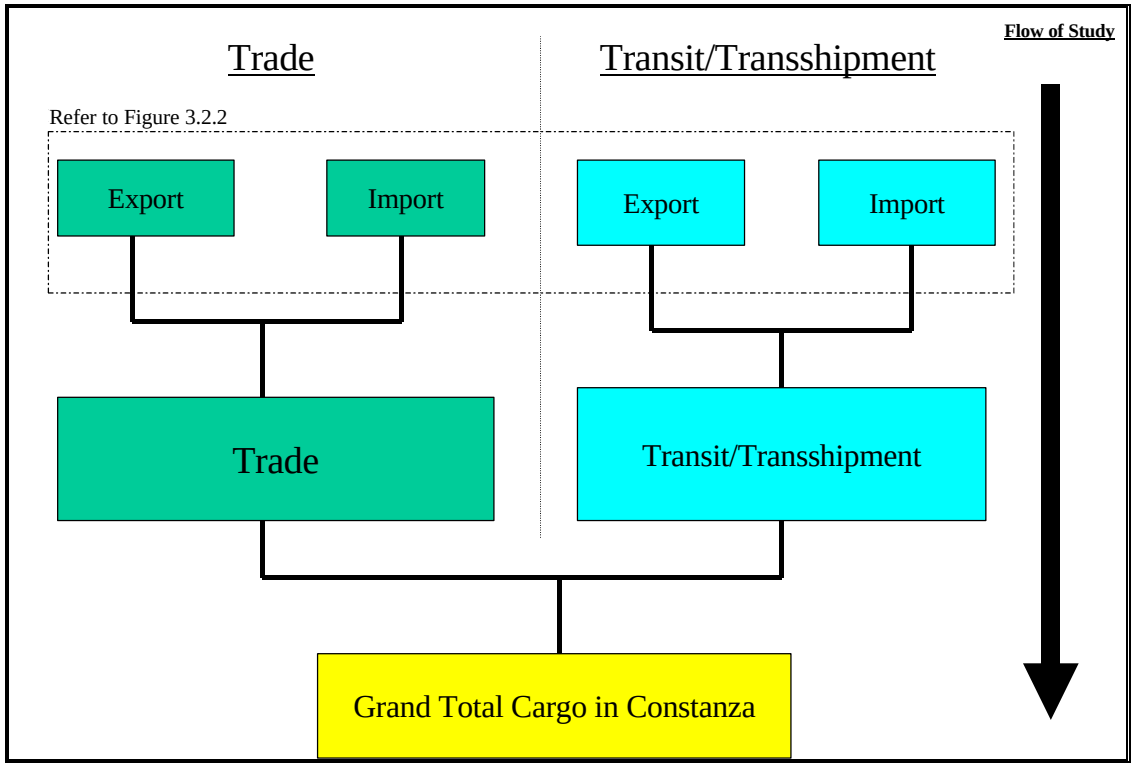



**Figure 3.2.1 Classification of Cargo**

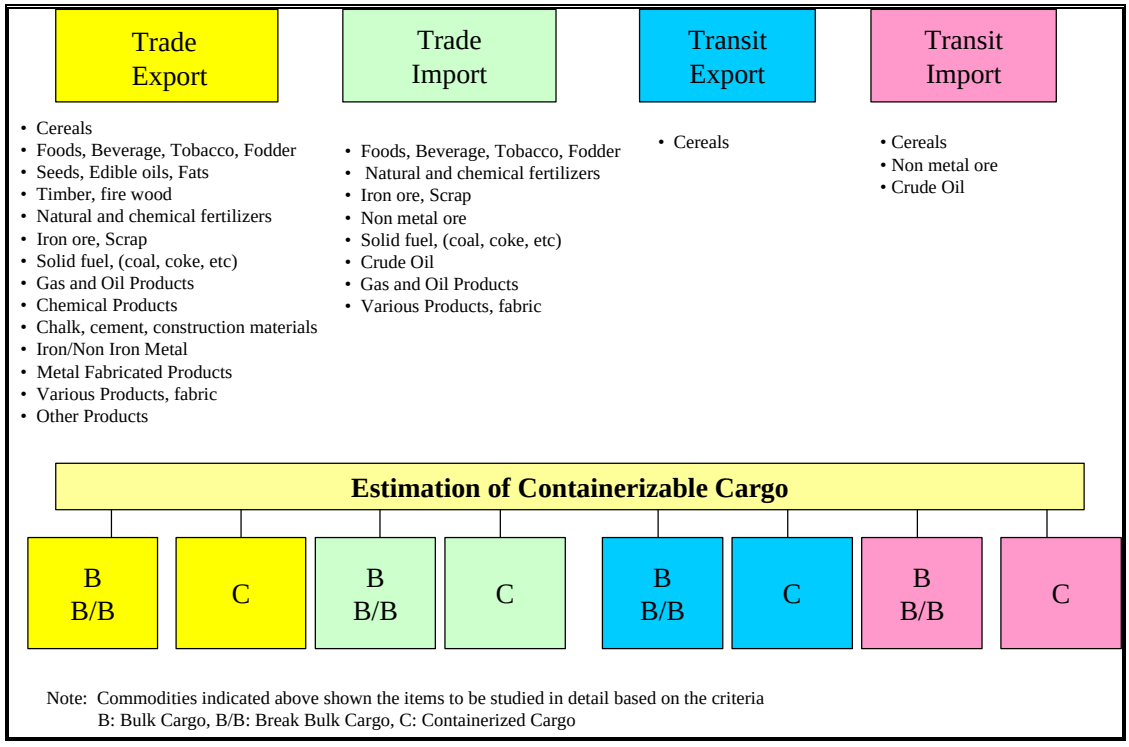



**Figure 3.2.2 Proposed Commodity Groups and Containerization**

4. Analyzing the cargo throughput at the Port of Constantza on the basis of historic data, and classifying this throughput into export, import, outbound-transit (export), and inbound-transit (import) traffic.

5. Subdividing these cargo flows into major commodity classifications, on the basis that the cargoes thus reclassified cover more than 70% of each particular cargo flow. Cargo selection is based upon the following:

    - The historical performance of Romania's trade for each particular commodity;
    - An analysis of future production and supply in Romania;
    - An analysis of future consumption and demand in Romania;
    - The historical performance of transit cargo by commodity; and
    - An analysis of the production and consumption in third-countries.

6. Classifying general cargoes and break-bulk cargoes into containerizable cargo and non-containerizable cargo, based upon experience and actual practice in the Port of Constantza.

7. Subdividing containerizable cargo into two categories, i.e., containerized and non-containerized, by applying the rate of containerization. The methodology for establishing the rate of containerization is described in the following section.

8. Evaluation of these micro-scopic traffics by the macro-scopic traffics. (Refer to Section 3.7, and Figure 3.7.3)

9. Finally, the following cargo flows will be identified: export; import; outbound-transit; and inbound-transit. Where applicable, these flows will additionally be classified as dry bulk, liquid bulk, break-bulk and containers. The total demand will be determined summing up the individual cargo flows.

### 3.2.2 Demand Forecast Methodology

The likely future demand for a particular commodity will depend upon factors that are specific to each commodity, however, as outlined earlier, these factors are likely to be different for trade cargoes and transit cargoes depends. Hence, as a first step, the cargo flows for each commodity are classified as export, import, outbound-transit and inbound-transit.

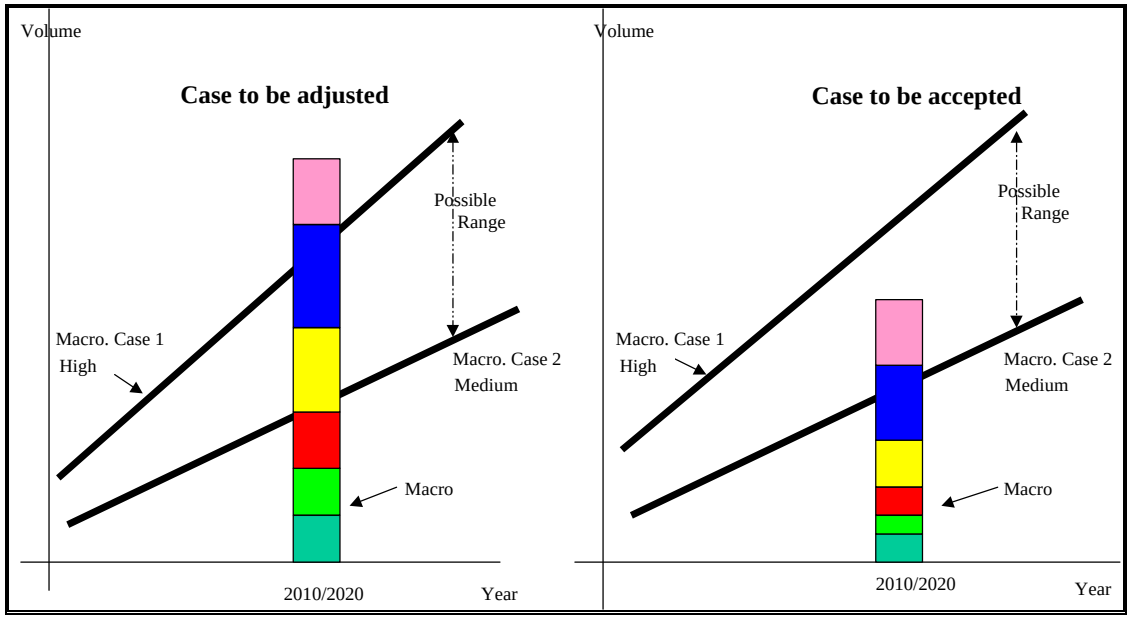



**Figure 3.2.3 Integration and Adjustment of Total vs. Individual Demand**

## Export Cargo

As outlined earlier, export cargoes are selected on the basis of the following criteria:

- The historical performance of Romania's trade for each particular commodity;
- An analysis of future production and supply in Romania;
- An analysis of future consumption and demand in Romania; and
- The selected commodities should cover more than 70% of total export volumes.

**Table 3.2.1 Selected Export Commodities**

| | Cargo Classification | Exports in 1999 |
|---|---|---|
| 1 | Cereals (Bulk Grain) | 1,008,155 |
| 2 | Foods, Beverages, Tobacco, Fodder | 140,653 |
| 3 | Seeds, Edible oils, Fats | 265,071 |
| 4 | Timber, fire wood | 636,591 |
| 5 | Natural and chemical fertilizers | 682,798 |
| 6 | Iron ore, Scrap | 618,115 |
| 7 | Solid fuel, (coal, coke, etc) | 104,097 |
| 8 | Gas and Oil Products | 1,376,000 |
| 9 | Chemical Products | 701,293 |
| 10 | Chalk, cement, construction materials | 1,810,262 |
| 11 | Iron/Non Iron Metals | 1,331,503 |
| 12 | Metal Fabricated Products | 90,950 |
| 13 | Various Products, fabric | 359,237 |
| 14 | Other Products | 154,999 |

A description of the forecast methodology, to be adopted for each of the selected export commodities, is as presented below.

*Cereals : Bulk Grains*

Firstly, a correlation analysis between the production and consumption of cereals in Romania will be carried out. Potential surplus volumes, which are likely to be available for export, will be determined on the basis of the balance between production and consumption in Romania. Additionally, it is anticipated that structural reforms in the agricultural sector, including increased private sector participation, will lead to improved yield management techniques and higher output per area unit of arable land, thus making increases in export surpluses likely.

*Foods, Beverage, Tobacco, Fodder*

Since experience suggests that these cargoes tend to demonstrate a high correlation with the GDP development in Romania, regression analysis will be adopted to forecast the future volumes of these commodities. Additionally, since these products are derived from agricultural outputs, they will be subject to similar considerations as those outlined for cereals.

*Seeds, Edible Oils, Fats*

Since these are primarily agricultural products, the same considerations as those outlined earlier for cereals will apply, and consequently, the above methodology for estimating surpluses will be applied.

*Timber, Firewood*

Although Romania possesses large forest areas, it is anticipated that in the longer term, once Romania joins the EU and has to meet its stringent environmental regulations with regards to deforestation, logging will decline. Nevertheless, in the near to medium term, it is anticipated that export volumes are likely to increase, in line with historical trends. Consequently, the potential future volumes will be estimated on the basis of a trend analysis.

*Scrap*

Presently, large scrap surpluses exist in Romania due to rationalization in a number of industries, and this is forecast to continue in the near term. An additional factor is the lack of industrial facilities in Romania that are able to process scrap. However, the country obviously does not possess an infinite supply of scrap, and it is anticipated that, in the medium term, these exports will cease.

*Petroleum Products*

Future export volumes of these products will be based upon an industry-specific analysis. This analysis will be based upon a number of factors, such as the available refining capacity in Romania, indigenous crude oil production, crude oil imports and domestic consumption of petroleum products. Rationalization of the industry will reduce refining capacity, and as disposable incomes increase, domestic demand is expected to increase as well. Nevertheless, in the near to medium term, it is anticipated that Romania will remain a net-exporter of these products.

*Chemical Products*

Since crude oil is the principal raw material utilized in the production of chemical products, similar considerations, as those outlined for petroleum products, are likely to govern the levels of future export volumes. Consequently, an industry-specific analysis will be used to forecast future export volumes of these products.

*Ferrous and Non-ferrous Metals*

The SIDEX steel plant at Galati, is Romania's largest steel producer, and one of the major users of the Port of Constantza. The future export volumes that are likely to materialize, will be estimated on the basis of an analysis of the metallurgical industry in general, and SIDEX in particular.

*Manufactured Metal Products*

Since experience suggests that these cargoes tend to demonstrate a high correlation with the GDP development in Romania, regression analysis will be adopted to forecast the future volumes of these commodities.

**Import Cargo**

As outlined earlier, import cargoes are selected on the basis of the following criteria:

- The historical performance of Romania's trade for each particular commodity;
- An analysis of future production and supply in Romania;
- An analysis of future consumption and demand in Romania; and
- The selected commodities should cover more than 70% of total import volumes.

**Table 3.2.2 Selected Import Commodities**

| | Cargo Classification | Imports in 1999 |
|---|---|---|
| 1 | Foods, Beverages, Tobacco, Fodder | 473,162 |
| 2 | Natural and chemical fertilizers | 374,000 |
| 3 | Iron ore, Scrap | 4,174,201 |
| 4 | Non metal ore | 1,069,794 |
| 5 | Solid fuel, (coal, coke, etc) | 1,731,783 |
| 6 | Crude oil | 3,137,000 |
| 7 | Gas and Oil Products | 829,000 |
| 8 | Various Products, fabric | 353,635 |

A description of the forecast methodology, to be adopted for each of the selected import commodities, is as presented below.

*Foods, Beverages, Tobacco, Fodder*

Since experience suggests that these cargoes tend to demonstrate a high correlation with disposable incomes, and thus the per capita GDP development in Romania, regression analysis will be adopted to forecast the future volumes of these commodities. It is anticipated that as disposable incomes increase, demand for these products will increase as well

*Natural and Chemical Fertilizers*

Agricultural production is the primary determinant variable of demand for these products, hence, a regression analysis will be carried out to determine future import volumes. Since, as outlined earlier, it is anticipated that structural reforms in the agricultural sector are likely lead to improved yield management techniques and higher output per area unit of arable land, it is anticipated that this will lead to increased demand for these products.

*Iron Ore*

It is understood that the vast majority of iron ore imports through the Port of Constantza are destined for the SIDEX facility at Galati. Therefore, the forecast of future import volumes will be based upon the above analysis of this facility.

*Crude oil*

Crude oil is imported as feedstock for Romania's refineries, and tends to be highly correlated to the country's economic development, and consequently, a regression analysis will form the basis for determining future imports. However, as outlined earlier, a number of factors, such as the available refining capacity in Romania, indigenous crude oil production, crude oil imports and domestic consumption of petroleum products, will also be taken into consideration. Although it is anticipated that rationalization of the industry will reduce

refining capacity, Romania is likely to remain a net-importer of these products, and imports are expected to increase.

**Outbound-transit (Export) Cargo**

Outbound-transit cargo volumes will be determined by analyzing the governing variables in third country origins, as well as the hinterland linkages between the Port of Constantza and these countries. As outlined earlier, outbound-transit cargoes are selected on the basis of the following criteria:

- The historical performance of transit cargo by commodity;
- An analysis of the production and consumption in third-countries; and
- The selected commodities should cover more than 70% of total outbound-transit volumes.

**Table 3.2.3 Selected Outbound-transit Commodities**

| | Cargo Classification | Outbound-transit in 1999 |
|---|---|---|
| 1 | Cereals(Bulk Grain) | 678,197 |

*Cereals : Bulk Grains*

Firstly, the third-country origins of cereals will be determined, followed by a correlation analysis between the production and consumption in these countries. Potential surplus volumes, which are likely to be available for export, will be determined on the basis of the balance between production and consumption in these countries. Based on the results of these analyses, as well as considering sector-specific and hinterland connectivity developments, the likely future volumes of outbound-transit cargo will be forecast.

**Inbound-transit (Import) Cargo**

Inbound-transit cargo volumes will be determined by analyzing the governing variables in third country destinations, as well as the hinterland linkages between the Port of Constantza and these countries. As outlined earlier, inbound-transit cargoes are selected on the basis of the following criteria:

- The historical performance of transit cargo by commodity;
- An analysis of the production and consumption in third-countries; and
- The selected commodities should cover more than 70% of total outbound-transit volumes.

**Table 3.2.4 Selected Inbound-transit Commodities**

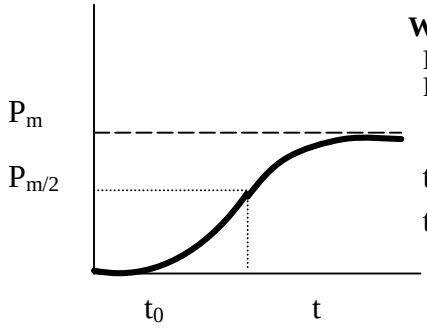
| | Cargo Classification | Inbound-transit in 1999 |
|---|---|---|
| 1 | Cereals(Bulk Grain) | 42,809 |
| 2 | Non metal ore | 100,286 |
| 3 | Crude Oil | 72,000 |

*Cereals, Non-metal ore and crude oil*

Firstly, the third-country destinations for cereals, non-metal ore and crude oil will be determined, followed by a correlation analysis between the production and consumption in these countries. Potential deficit volumes, which are likely to give rise to imports, will be determined on the basis of the balance between production and consumption in these countries. Based on the results of these analyses, as well as considering sector-specific and hinterland connectivity developments, the likely future volumes of inbound-transit cargo will be forecast.

## Containerization Rate

The future evolution of the containerization rate can be described by a basic formula, which approximates a logistic curve, as given below.




**Where**

P: Containerization rate at the time of **t** year
$P_m$: Maximum potential containerization rate
c: Determinant parameter of the shape of Curve
t: Year
$t_0$: The year that the containerization rate is half of maximum potential Containerization rate.

Experience suggests that, in developing economies such as Romania, containerization rates are generally lower than those in developed economies. Figure 3.2.4 depicts the historical performance of total cargo, containerizable cargo and containerized cargo at the Port of Constantza. It is envisaged that as the Romanian economy achieves greater sophistication, a shift will occur in the product mix of general cargoes. For example, it is conceivable that Romanian economic growth will be largely dependent on increased exports of consumer durables, much like the newly industrializing countries of South East Asia. Considering present levels of container penetration, the preferred packaging form of these types of products and a general development of the container market as such, an increase in the level of containerization is inevitable. Table 3.2.5 shows the containerization rates utilized in this study.

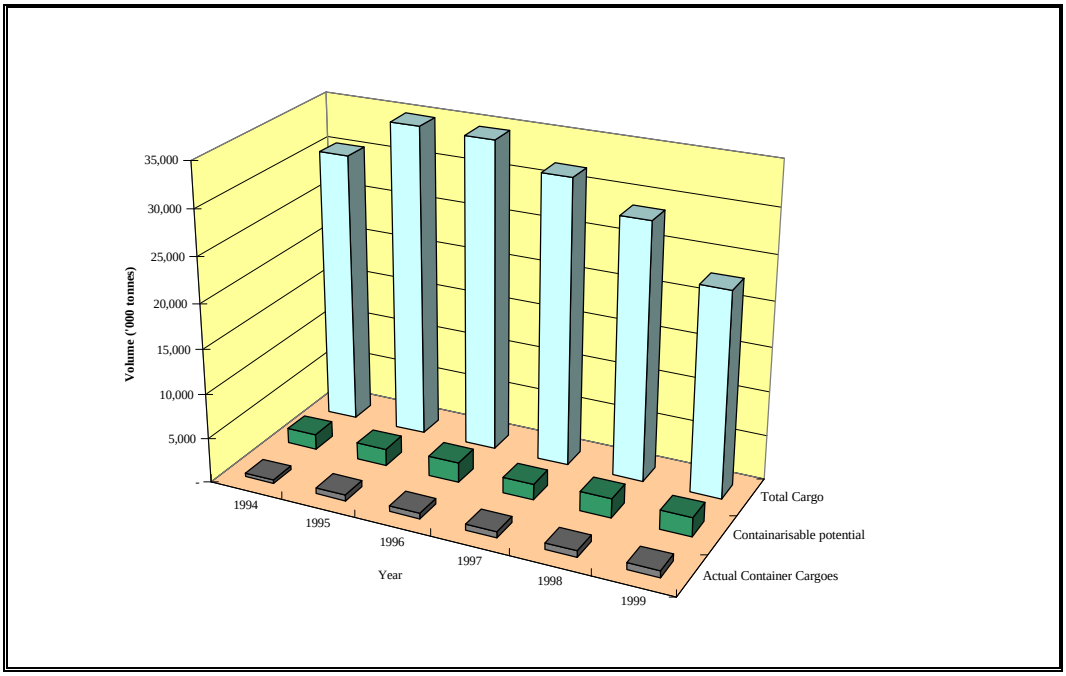



**Figure 3.2.4 Total, Containerisable and Containerised Cargoes**

**Table 3.2.5 Containerisation Potential of Commodities**

| Cargo Classification | Potential Containerization Rate (%) |
|---|---|
| Cereals ( Bulk Grains) | 0 |
| **Foods, Beverages, Tobacco, Fodder** | **100** |
| Seeds, Edible oils, Fats | 0 |
| **Timber, fire wood** | **20** |
| Natural and chemical fertilizers | 0 |
| Iron ore, Scrap | 0 |
| Non metal ore | 0 |
| Solid fuel,(coal, coke, etc) | 0 |
| Crude Oil | 0 |
| Gas and Oil Products | 0 |
| **Chemical Products** | **50** |
| Chalk, cement, construction materials | 0 |
| Iron / Non Iron Metals | 0 |
| **Metal Fabricated Products** | **75** |
| **Various Products, fabric** | **100** |
| **Other Products** | **100** |

The volume of container cargo is calculated on the basis of the following formula:

Volume of container cargo = Rate of containerization x Containerisable cargo
↑ ?

↑ is calculated from the above-mentioned formula.
**?** is calculated from the following formula.

$$(ContainerizableCargo)_i = \sum_{i=1}^{n} \left\{ (CargoVolume)_i \times (ContainerizablePotentialRate)_i \right\}$$

Where
*i* : i[th] kind of commodity
*n* : Total number of commodities

## 3.3 Scenario Approach to Forecasting

### 3.3.1 Preamble

Three main determinant variables, in connection with the development of demand forecast scenarios, have been identified in the preceding section. A number of factors will depend upon the eventual development of these determinant variables in the future. For the purposes of this study, it has been assessed that, for each of the aforementioned determinant variables, the following scenarios could arise:

- **Macro-economic developments – Low, Medium and High;**
- **Network developments – Poor, Gradual and Full; and**
- **Port Competition – Moderate and Intensive.**

Extending this logic would give rise to 18 (3 x 3 x 2) different scenarios. However, it is clearly evident that, not only are the numbers of scenarios too cumbersome to evaluate, but since it is highly unlikely that certain combinations of the determinant variables are likely to materialize, certain scenarios can be considered unrealistic as well. For example, it is unlikely that in an environment of high macro-economic development, the network developments will be poor; the two simply can not go hand-in-hand. Consequently, it is predicated that certain combinations of the determinant variables can be eliminated, and that this would give rise to the scenarios depicted in the matrices presented below (refer to Figures 3.3.1 and 3.3.2).

The cells depicted in gray are considered unlikely combinations of the determinant variables. Similarly, the combinations of the determinant variables, depicted in the red cells, are considered to give rise to too '*pessimistic*' and too '*optimistic*' scenarios. Based on the foregoing, it is concluded that these combinations of the determinant variables do not merit further consideration.

The intensity of competition between ports has been characterized as being '*moderate*' or '*intensive*'. These levels of competition are primarily related to the intensity of rivalry between ports for a particular share of the secondary hinterland market. Although, as outlined earlier, the competitive advantages of a particular port are likely to be defined by a variety of factors, experience indicates that, the higher the level of network development in a hinterland covered by multiple ports is, the higher the intensity of rivalry between these ports for that particular hinterland's market is likely to be.

Based on the foregoing consideration, the port competition scenario defined as '*moderate*' is linked to the GDP development scenarios defined as '*low*' and '*medium*', and the network

development scenarios defined as '*poor*' and '*gradual*'. Similarly, the port competition scenario defined as '*intensive*' is linked to the GDP development scenarios defined as '*medium*' and '*high*', and the network development scenarios defined as '*gradual*' and '*full*'.

Based on the foregoing, the following three scenarios are given further consideration:

- **'*Conservative*' Scenario**

'*Medium*' GDP – '*Poor*' Network Development
'*Low*' GDP – '*Gradual*' Network Development
'*Moderate*' Port Competition

- **'*Most Likely*' *Scenario***

**'*Medium*' GDP – '*Gradual*' Network Development**
**'*Moderate*' Port Competition**

- **'*Extended Hinterland*' Scenario**

'*Medium*' GDP – '*Full*' Network Development
'*High*' GDP – '*Gradual*' Network Development
'*Intensive*' Port Competition

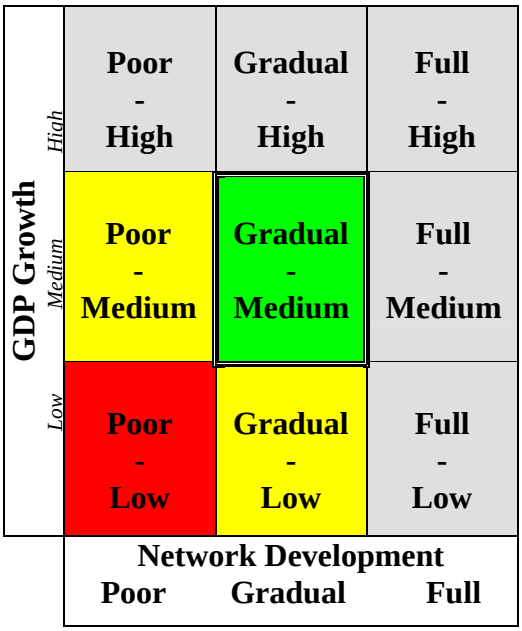



**Figure 3.2.1 Scenarios for Demand Forecast – '*Moderate*' Competition**

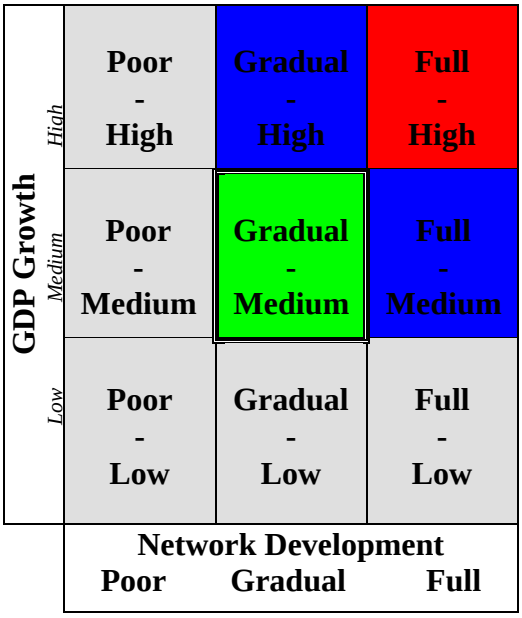



**Figure 3.2.2 Scenarios for Demand Forecast – '*Intensive*' Competition**

### 3.3.2 'Conservative' Scenario

Under the '*Conservative*' scenario, the following has been assumed:

- The problems presently plaguing the Romanian economy will continue in the short term, driven by political uncertainties in the wake of the recent election. The implementation of structural fiscal, monetary and economic policies will take longer than anticipated. As a result, the Romanian economy will only achieve stability and establish a platform for sustainable economic growth sometime after 2005. This will result in a '*knock-on*' effect, delaying Romania's entry into the EU, since meeting the pre-accession criteria laid down by the EU is largely dependent upon the implementation of the foregoing policies. Under this scenario, EU entry is only likely to be achieved by 2012 at the earliest.

- Reduced economic growth will have implied effects in terms of the availability of adequate funds for the development of a number of critical network components, and as a result the implementation of certain projects will be delayed or, in some cases, even cancelled. As a result, the development of TEN Corridor IV is only likely to materialize gradually, and effective access to the port's secondary hinterland areas located along this corridor is anticipated to become available between 2007 and 2012. The resulting lack of hinterland connectivity will erode the Port of Constantza's competitive position in the near to medium term, thereby rendering capture of market share at a later stage more difficult.

These problems are likely to be further exacerbated by Romania's delayed entry into the EU, since some of the economies, such as Hungary, that are considered part of the Port of Constantza's secondary hinterland will have successfully completed the transition process and will have become full members of the EU by this point. This will result in these economies increasingly using EU ports to meet their trading requirements, since EU entry will have rationalized cross-border customs procedures.

Probably more importantly, regional political differences and uncertainties combined with the scarce availability of funds, both from internal as well as external sources for the development of network components, will result in hampered decision making with regards to the development of the Danube river. As a result, the Danube River is only likely to emerge as a viable transportation corridor some time after 2008, thereby dramatically reducing the inherent competitive advantage the Port of Constantza possesses.

- Port competition will remain moderate, not only due to reduced growth in Romania, but in the regional economies as well. In the medium term, the secondary hinterlands of the Port of Constantza, as well as those of its competitors in the Black Sea basin, will largely remain as they are at present. The secondary hinterlands of the Port of Constantza's competitors in the Northern Adriatic region will also remain largely as they are at present.

However, with regards to the pre-accession candidate countries from Central and Eastern Europe, these ports will have the added advantage that they will be EU ports trading with EU members, thus reducing the competitiveness of the Port of Constantza.

- Partly as a consequence of the above:
  - ⇒ Growth of cargo throughput at the Port of Constantza, to and from locations within the port's captive hinterland, will continue as per present patterns.
  - ⇒ Growth of cargo throughput at the Port of Constantza, to and from locations within the port's primary hinterland, will demonstrate modest growth, more or less in line with Romania's macro-economic development.
  - ⇒ Cargoes originating from, or destined for, the port on an occasional basis will handle the Port of Constantza's secondary hinterland. Cross-border transit volumes of time-insensitive, high-volume and low-value commodities, for which IWT is the ideal mode of transportation, will only materialize in the medium to longer term.
  - ⇒ The proposed oil pipeline between Constantza and Trieste will not develop, and consequently, the port will not handle transit crude oil from the Caspian region.

### 3.3.3 'Most Likely' Scenario

Under the **'*Most Likely*' scenario**, the following has been assumed:

- The Romanian economy will move relatively rapidly to implement structural fiscal, monetary and economic policies required to facilitate the country's economic recovery and to put the country on a growth path. As a result, the Romanian economy will achieve stability and establish a platform for sustainable economic growth sometime between 2002 and 2003. Under this scenario Romania's entry into the EU is likely to be achieved sometime between 2010 and 2012.

- Relative economic stability, combined with gradual growth, will result in the gradual development of a number of critical network components. The availability of funds for the implementation of these projects, particularly from internal sources, is likely to be adequate to meet demands in the medium term. As a result, the development of TEN Corridor IV will materialize in a coordinated manner, and effective access to the port's secondary hinterland areas located along this corridor is anticipated to become available between 2005 and 2010. The resulting hinterland connectivity will serve to establish sustainable trading relationships between the port and these areas, and will help to establish the Port of Constantza as a credible competitor to the ports in the Northern Adriatic in the medium term.

Romania's entry into the EU will be achieved at a later stage than that achieved by the pre-accession candidate countries from Central and Eastern Europe. However, this is not considered to pose a major impediment in the medium term, since sustained economic growth

will serve to establish a timetable for Romania's entry into the EU. As a result of the foregoing, it is anticipated that Romania's foreign trading patterns, which already indicate a large proportion of trade conducted with EU member states, will tend to demonstrate an increasing trend in this direction. As a result, and based upon geographic proximity, Romania will increase its trade with those pre-accession candidate countries from Central and Eastern Europe that are included in the first wave of EU enlargement. Subsequently, once it achieves EU membership, Romania should be positioned to leverage the benefits, of such established trading relationships, as a springboard into the EU marketplace. Nevertheless, since some of these countries will have become full members of the EU by this point, they will continue to prefer to use EU ports to meet their trading requirements, since EU entry will have rationalized cross-border customs procedures.

As outlined earlier, the development of the Danube River is considered of critical importance to the Port of Constantza. Although regional political differences and uncertainties are likely to remain an, albeit minor, impediment to development of the Danube river, increased trade and the implied demands that this places on transport infrastructure is likely to result in capacity shortfalls. As a result, modal competition is set to increase, and the Danube River is expected to emerge as a viable alternative transportation corridor sometime between 2004 and 2006. It is anticipated that the foregoing, in combination with an increase in the decision-making powers of the Danube Commission, could lead to a coordinated development strategy, by the Danube countries, in order to eliminate navigational bottlenecks along the upstream stretches of the Danube River sometime between 2006 and 2010. The foregoing will increase the inherent competitive advantage the Port of Constantza possesses in this regard.

- Port competition can generally be expected to remain moderate, although increased economic growth in the region will result in increased external trade, which in turn will imply increased demand for port facilities. In the medium term, it is anticipated that the hinterlands of the Port of Constantza, and those of its competitors in the Black Sea basin, are not likely to overlap. However, the secondary hinterlands of the Port of Constantza, and those of its competitors in the Northern Adriatic region, will demonstrate a certain level of duplicity, which in turn will lead to an increased level of competition between these ports. The inherent competitive advantages that the Northern Adriatic ports possess, as a result of being ports in EU member states, will remain. However, the inherent transportation cost advantages that IWT provides will serve to put the Port of Constantza on a more equal competitive footing with these ports.

- Partly as a consequence of the above:
  - ⇒ Growth of cargo throughput at the Port of Constantza, to and from locations within the port's captive hinterland, will outpace Romania's macro-economic growth.
  - ⇒ Growth of cargo throughput at the Port of Constantza, to and from locations within the port's primary hinterland, will demonstrate solid growth, at a slightly higher rate than Romania's macroeconomic development.

⇒ Cargoes originating from, or destined for, the Port of Constantza's secondary hinterland will regularly be handled by the port. Cross-border transit volumes of time-insensitive, high-volume and low-value commodities, for which IWT is the ideal mode of transportation, will materialize in the medium term. As a result, the Port of Constantza will establish itself as a transit point in the medium term.

⇒ The proposed oil pipeline between Constantza and Trieste will not develop, and consequently, the port will not handle transit crude oil from the Caspian region.

### 3.3.4 'Extended Hinterland' Scenario

Under the '*Extended Hinterland*' scenario, the following has been assumed:

- More rapid growth than envisaged under the '*Most Likely*' scenario, driven by near immediate implementation of structural, fiscal, monetary and economic policies required facilitating the country's economic recovery will put the Romanian economy on an accelerated growth path. As a result, the Romanian economy will achieve stability and establish a platform for sustainable economic growth by 2002, and expand rapidly thereafter. Under this scenario Romania's entry into the EU is likely to be achieved sometime between 2008 and 2010.

## 3.4 Traffic Demand Growth

### 3.4.1 Basic Considerations

The preceding section outlines the basic underlying assumptions for each of the scenarios that will be further developed. Based on the foregoing, this Section presents a preliminary assessment of the overall growth in traffic, at the Port of Constantza that is likely to occur as a result of each of these scenarios. It is hereby noted that the analysis presented herein will result in a bandwidth of throughput that is likely to be handled by the Port of Constantza in the future. Consequently, this analysis does not necessarily represent the actual projected demand as such, however, it is purely considered a tool for planning purposes. The actual projected demand will be determined on the basis of a commodity-specific and trade-specific analysis, as outlined in Section 3.2.

One of the major tools to carry out traffic forecast is GDP growth assumed for the future. In order to confirm the real role of GDP in traffic forecast, it is prudent to review the past correlation between the trade growth and GDP growth in Romania.

Refer to Figure 3.4.1 for the relationship between the past trade growth and GDP growth in Romania. These data cover both the exports and imports. Major correlation between the export and GDP growth shown in the figure is summarised as follows:

***Exports vs. GDP : 1993-2000 in Romania***

a) GDP growth ranges between –6.1% and +7.1%.
b) Export growth runs among –11.2% and +35.3%.
c) Export growth leads GDP growth cycling the clockwise turn around zero point.
d) It seems that exports are ahead of GDP growth.
e) Elasticity between export growth and GDP growth is reasonably 1.0 to1.5.
f) After 1998, exports are on the recovery approaching the **Target Zone.**

**Note: Target Zone** is an ideal area for sustainable development after a economic stabilisation. The core of this zone will be a crossing point between GDP growth 4% and export growth 6%.

***Imports vs. GDP : 1993-2000 in Romania***

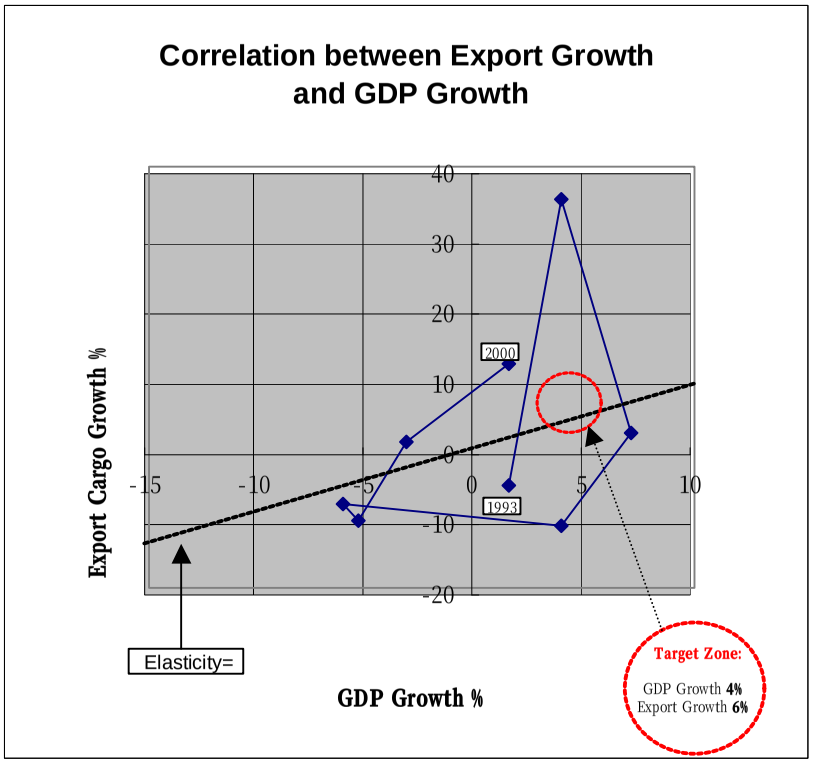
g) GDP growth ranges between –6.1% and +7.1%.
h) Import growth stays at –27.3% and +22.5%.
i) Import growth is likely led by GDP growth circulating on the anti-clockwise turn around zero point.
j) It seems that imports follow to GDP growth.
k) Elasticity between import growth and GDP growth is ranging among 1.0 to 2.0.
l) After 1999, imports are likely on the recovery pass closing the **Target Zone.**

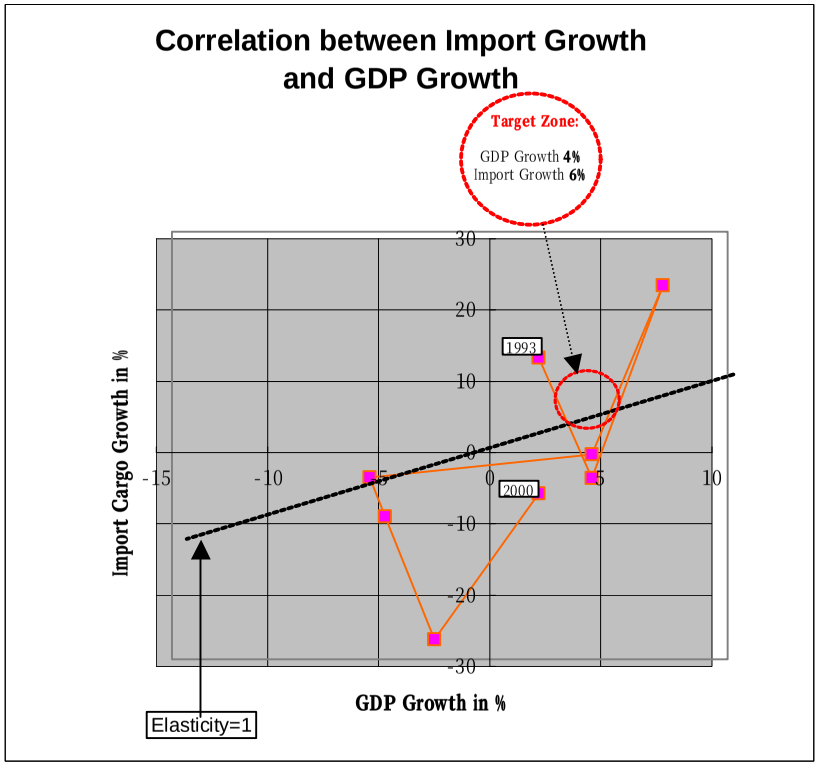
| Year | GDP | Export | Import | Trade | Export | Import | Trade |
|---|---|---|---|---|---|---|---|
| | growth | growth | growth | growth | | | |
| | % | % | % | % | 10^3 tons | 10^3 tons | 10^3 tons |
| 1991 | -12.9 | | | | | | |
| 1992 | -8.8 | | | | 9776 | 15248 | 25024 |
| 1993 | 1.5 | -5.4 | 12.3 | 5.4 | 9244 | 17122 | 26366 |
| 1994 | 3.9 | 35.3 | -4.6 | 9.4 | 12511 | 16339 | 28850 |
| 1995 | 7.1 | 2.1 | 22.5 | 13.6 | 12771 | 20014 | 32785 |
| 1996 | 3.9 | -11.2 | -1.2 | -5.1 | 11345 | 19765 | 31110 |
| 1997 | -6.1 | -8.1 | -4.5 | -5.8 | 10428 | 18883 | 29311 |
| 1998 | -5.4 | -10.5 | -9.9 | -10.1 | 9338 | 17005 | 26343 |
| 1999 | -3.2 | 0.8 | -27.3 | -17.3 | 9414 | 12370 | 21784 |
| 2000 | 1.5 | 11.9 | -6.8 | 1.3 | 10538 | 11535 | 22073 |
| | | | | | | | |

**Figure 3.4.1 Correlation between Cargo Growth and GDP Growth, 1993-2000**

**Port of Constantza**


**Area for Sustainable Development after Economic Stabilization**



### 3.4.2 Methodology

Experience around the world suggests that the traffic handled by a port is generally strongly correlated to the economic developments in the particular area, i.e., hinterland that port serves as a gateway for. As stipulated earlier, in the recent past the Port of Constantza has primarily served as a gateway for Romanian trade, and consequently, the primary hinterland of the port is considered to be Romania. Although recognising that the port has also handled transit traffic, the analysis carried out at this stage nevertheless does not specifically take this into consideration.

**Analysing the Port of Constantza's historic throughput, by major commodity, and correlating these figures to Romania's GDP growth, results in the establishment of multipliers, which represent the demand elasticity of cargo in relation to GDP. In other words, if the correlation analysis yields a close fit between the two variables, then it could be predicted, with a reasonable level of accuracy, how future changes in one variable will impact upon the other.** For example, the consumption of crude oil and petroleum products is directly linked to a country's economic performance, and this relationship is proven to hold for Romania as well.

Analysis of the foregoing indicates that, for example, a growth of 1% in the Romanian economy, the demand for crude oil grows by approximately 0.9%. Similarly, a growth of 1% in the Romanian economy results in a corresponding growth in the demand for petroleum products. Consequently, it is concluded that the demand elasticity for crude oil is 0.9, i.e., the demand for crude oil grows at 0.9 times the GDP growth rate. Similarly, the demand elasticity for petroleum products is 1, i.e.; the demand for petroleum products grows at the same rate as GDP. Carrying out similar analyses for a number of major commodities, as well as the total traffic, handled at the Port of Constantza, yields a basic relationship for the growth of these commodities in relation to GDP growth.

**Additionally, the scenario approaches to forecast demand, as adopted in this Study, predicates the inclusion of additional variables, i.e., network developments and port competition. The aforementioned variables are essentially determinants of cargo volumes that are generated deep in the port's primary hinterland, and cargoes generated in the port's secondary hinterland, i.e., transit cargoes. Consequently, the growth in those cargoes that such considerations are applicable to, will not be solely determined by GDP growth, and solely applying GDP multipliers is likely to yield erroneous results.**

**For the cargoes that are not solely generated by the Romanian economy, or Romanian cargoes that could conceivably access alternative port facilities, an additional '*Hinterland Factor*' has been applied. These factors have been determined on the basis of a combination of qualitative and quantitative considerations, which in turn have**

**evolved from a combination of established industry benchmarks, Consultants' experiences in similar projects elsewhere and Consultants' judgement.**

Based on the foregoing, the growth in traffic can be described by the following equation:

**Traffic Growth Multiplier = GDP Growth x Demand Elasticity x '*Hinterland Factor*'**

### 3.4.3 Traffic Demand Growth

Analysis of the cargo throughput at the Port of Constantza indicates that the average demand elasticity, of total traffic handled at the port, corresponds to a multiplier of approximately 1.03. Commodity-specific analyses obviously result in a different multiplier for each commodity, and consequently a different multiplier for the total traffic, which in this case is approximately 1.08. **Additionally, combining these multipliers with the '*Hinterland Factor*', as applicable for each particular commodity, results in a multiplier for total traffic that, under the '*Most Likely*' scenario, increases over the forecast period, from 1.13 in 2000 to 1.20 by 2020. These increases in the traffic growth multiplier can primarily be ascribed to the progressive development of network connectivity within the port's hinterland.**

**Based on the foregoing, under the '*Most Likely*' scenario, preliminary estimations indicate that the total throughput, to be handled at the Port of Constantza, is likely to increase at a compounded annual growth rate of 3.75% between 2000 and 2020. Similarly, under the '*Conservative*' scenario, preliminary estimations indicate that the total throughput, to be handled at the Port of Constantza, is likely to increase at a compounded annual growth rate of 2.5% between 2000 and 2020.** Finally, under the '*Extended Hinterland*' scenario, preliminary estimations indicate that the total throughput, to be handled at the Port of Constantza, is likely to increase at a compounded annual growth rate of 5.5% between 2000 and 2020.

## 3.5 Commodity Specific Micro Forecast

### 3.5.1 General Description

The projections presented in this Chapter are not statements of what will happen, but rather estimates of what might happen given the available information, specific assumptions and analysis methodologies used. These projections provide an objective, unbiased analysis of the potential market opportunities for the Port of Constantza, and the projections will be used to determine the developments that are likely to be required as a result of the long-term strategy by the Port's Administration and its operators, in pursuit of such market opportunities. As an independent Consultant, the Project Team has not advocated, nor speculated upon, future legislative and regulatory changes, except where these are considered to be directly relevant to the project and its development. The projections presented herein are based on current Romanian, European Union and other (foreign) information sources, trading patterns and policies.

Models are abstractions of macroeconomic and port-related activities, regulatory activities, and producer and consumer behaviour. The forecasts are highly dependent on the data, analytical methodologies, model structures, and specific assumptions used in their development. Trends depicted in the analysis are indicative of tendencies in the real world rather than representations of specific real-world outcomes. Even where trends are stable and well understood, the projections are subject to uncertainty. Many events that shape Romania, and consequently the Port of Constantza's, market are random and cannot be anticipated, and assumptions concerning future technology characteristics, demographics, and resource availability cannot be known with any degree of certainty.

Statistics of volumes handled by the Port of Constantza, between 1994 and 1999, were obtained from the Port's Administration. These statistics were complemented by detailed discussions with operators at the Port of Constantza, and these statistics were thoroughly checked for completeness and accuracy as well. Consequently, these statistics are understood to be reliable, and they are herewith used as the basis for forecasting probable future volumes to be handled by the Port of Constantza.

The statistics of traffic volumes handled at the Port of Constantza are classified into 24 commodities, as presented hereafter. Out of these 24 commodities, a number of 'significant' commodities have been selected, on the basis of established and accepted practices for statistical analyses. Such practices indicate that, in a given sample of data, a particular item is considered 'significant' if its relative share represents more than 2% of that particular sample of data. Additionally, the combined share of the items selected should generally exceed 90% - 95% of a particular sample of data.

Hence, those commodities that individually account for a share of more than 2% of total trade export, trade import, transit export and transit import volumes, whilst concurrently representing more than 90% - 95% of the total volume of each of these trade and transit flows, have been selected for further analysis in detail, and are presented in Tables 3.5.1 to 3.5.3 hereafter.

**Table 3.5.1 Significant Commodities – Classified by Trade and Transit**

| COMMODITY | TRADE EXPORT | TRADE IMPORT | TRANSIT EXPORT | TRANSIT IMPORT |
|---|---|---|---|---|
| **Cereals (Bulk Grains)** | X | | X | X |
| **Foods, beverages, tobacco** | X | X | | |
| **Timber, charcoal** | X | | | |
| **Natural and chemical fertilizers** | X | X | | |
| **Iron ore, scrap** | X | X | X | |
| **Non-ferrous ores** | | X | | X |
| **Solid fuels (coal, coke, etc.)** | X | X | X | |
| **Crude oil** | | X | | X |
| **Gas and oil products** | X | X | | |
| **Chemical products** | X | | | |
| **Chalk, cement, construction materials** | X | | | |
| **Ferrous / Non-ferrous metals** | X | | X | |
| **Various manufactured products** | X | X | | |
| **Other products** | X | X | | |

**Note: It is hereby noted that the cells depicted in grey, in the aforementioned table, denote cargoes that are considered containerizable.**

**Table 3.5.2 Significant Commodities – Classified by Packaging Form**

| COMMODITY | DB | LB | BB | CT |
|---|---|---|---|---|
| **Cereals (Bulk Grains)** | X | | X | |
| **Foods, beverages, tobacco** | | | X | X |
| **Timber, charcoal** | | | X | |
| **Natural and chemical fertilizers** | X | X | X | |
| **Iron ore, scrap** | X | | X | |
| **Non-ferrous ores** | X | | | |
| **Solid fuels (coal, coke, etc.)** | X | | | |
| **Crude oil** | | X | | |
| **Gas and oil products** | | X | | |
| **Chemical products** | X | X | X | |
| **Chalk, cement, construction materials** | X | | X | |
| **Ferrous / Non-ferrous metals** | | | X | |
| **Various manufactured products** | | | X | X |
| **Other products** | | | X | X |

**Notes: DB: Dry bulk cargo, LB: Liquid bulk cargo, BB: Break-bulk cargo ( general cargo or conventional cargo), CT: Containerised cargo**

**Table 3.5.3 Significant Commodities – Classified by Overland Transportation Modes**

| COMMODITY | ROAD | RAIL | IWT | PIPE |
|---|---|---|---|---|
| **Cereals (Bulk Grains)** | -- | ++ | ++ | X |
| **Foods, beverages, tobacco** | ++ | + | O | X |
| **Timber, charcoal** | ++ | + | - | X |
| **Natural and chemical fertilizers** | - | + | + | O |
| **Iron ore, scrap** | X | + | ++ | X |
| **Non-ferrous ores** | -- | + | + | X |
| **Solid fuels (coal, coke, etc.)** | X | + | ++ | X |
| **Crude oil** | X | + | -- | ++ |
| **Gas and oil products** | O | + | - | ++ |
| **Chemical products** | + | ++ | -- | + |
| **Chalk, cement, construction materials** | -- | + | ++ | X |
| **Ferrous, non-ferrous metals** | - | + | + | X |
| **Various manufactured products** | ++ | + | - | X |
| **Other products** | ++ | + | - | X |

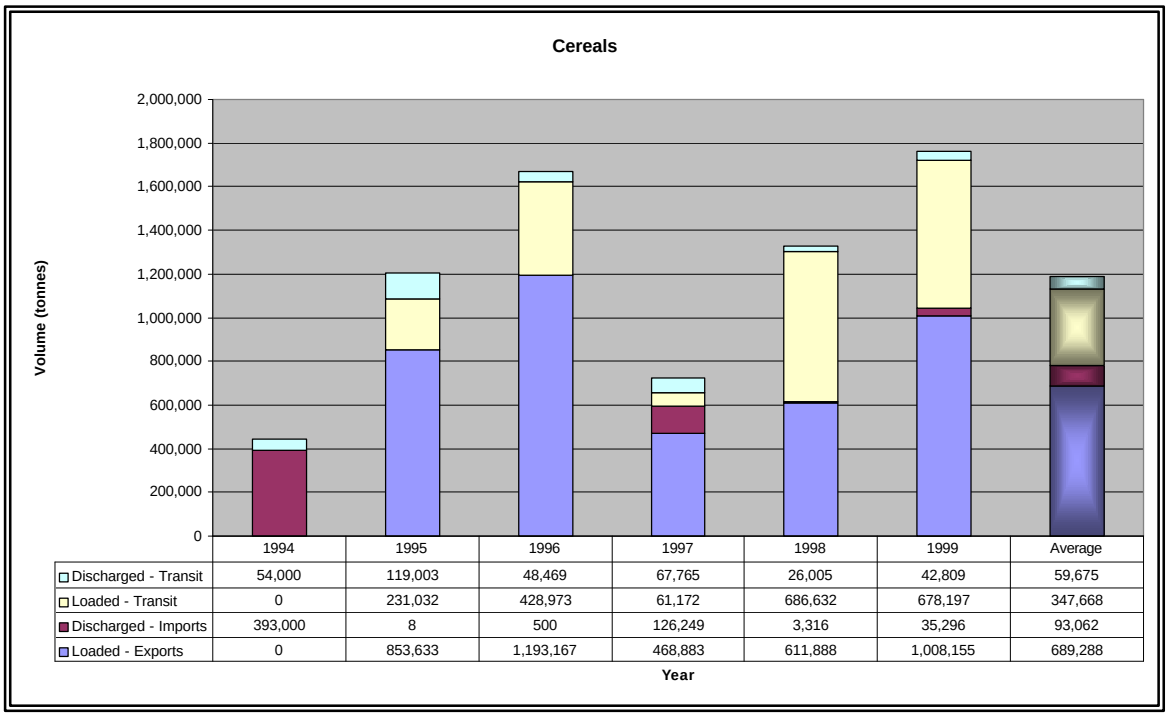
**Note:** **++ Very good potential** **- Limited potential**
**+ Good potential** **-- Very limited potential**
**O Some potential** **X Not applicable**

### 3.5.2 Cereals (Bulk Grains)

Cereal traffic at the Port of Constantza primarily consists of exports, both from Romania, as well as transit traffic from neighbouring countries such as Hungary and Yugoslavia. Since Romania and its neighbouring countries are generally not exporters of grains and cereals, imports are not considered significant. However, in the event that a particular year's harvest is unsuccessful, imports do arise. For example, it is understood that the summer of 2000, which led to drought-like conditions in Romania, has had a negative impact on the total amount harvested, and as a consequence, Romania will have to resort to imports in 2001.

The most significant coarse grains produced in Romania are maize, wheat, rye and barley. Additionally, small quantities of leguminous grains are produced as well. Maize is the largest quantity produced, and generally accounts for approximately 50% - 60% of total production, whilst wheat and rye account for 30% - 35% of total production and barley accounts for 5% - 10% of total production. Primarily due to favourable climatic conditions, outstanding harvests have been realised in the recent past, particularly in 1995 and 1997. These harvests have yielded significant export surpluses, and Romania managed to export between 500,000 and 1,200,000 million tons between 1994 and 1999. Nevertheless, it is noted that agricultural productivity in Romania, as measured by yields, i.e., kilogram of crop per hectare of land cultivated, is below world standards. In other words, there is significant scope for improvement of yields, by application of more productive farming methods and the increased use of complex (NPK) fertilisers. It is anticipated that such an improvement of yields, if

achieved by the Romanian industry, could lead to a doubling of exports in the medium (Case 1) to long (Case 2) term.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 54,000 | 119,003 | 48,469 | 67,765 | 26,005 | 42,809 | 59,675 |
| Loaded - Transit | 0 | 231,032 | 428,973 | 61,172 | 686,632 | 678,197 | 347,668 |
| Discharged - Imports | 393,000 | 8 | 500 | 126,249 | 3,316 | 35,296 | 93,062 |
| Loaded - Exports | 0 | 853,633 | 1,193,167 | 468,883 | 611,888 | 1,008,155 | 689,288 |

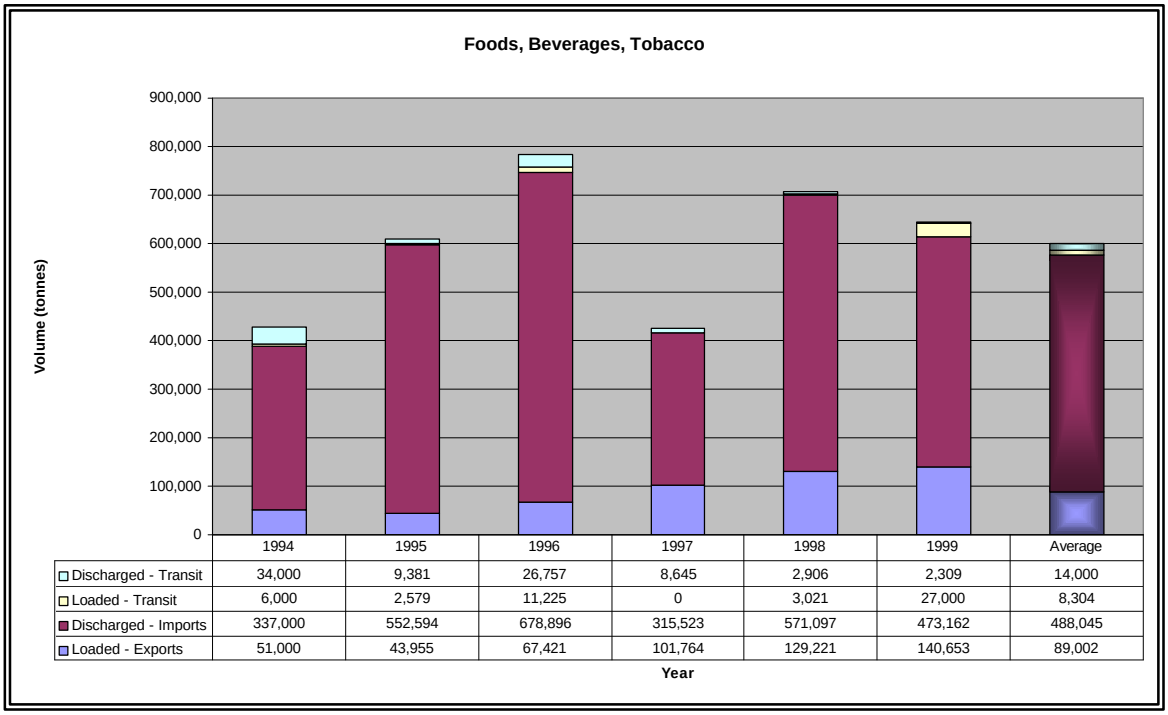
**Figure 3.5.1 Cereal ( Bulk Grains ) Traffic**

Similar considerations, as outlined earlier for the Romanian industry, are deemed to apply to the Hungarian and Yugoslavian trades. Although trade from the latter country has been affected by the ongoing UN embargo, it is anticipated that this embargo will be lifted sometime in the near future. In the past, when exports from these countries have materialised, volumes have tended to show a good correlation with those achieved by Romanian exporters. The foregoing would suggest that the characteristics of grain production in these countries are very similar to those of the Romanian industry. The trade embargo on Yugoslavia has meant that, in the recent past, the majority of transit volumes loaded at the Port of Constantza have originated from Hungary. However, the NATO bombing campaign, which destroyed bridges in Serbia, has meant that the Danube River is no longer available as a viable transportation route, and as a result, the Port of Constantza has (temporarily) lost these trades. These problems were further exacerbated by the fact that Romania supported the NATO campaign, which led to Serbian authorities blocking navigation, by Romanian flag vessels, on Serbian stretches of the Danube River.

### 3.5.3 Foods, Beverages, Tobacco

Volumes of '*Foods, Beverages, Tobacco*' handled at the Port of Constantza have fluctuated between 1994 and 1999. From Figure 3.5.2, it is evident that import flows dominate, on average accounting for approximately 80% of the total volume handled at the Port, whilst

export flows account for more than 15% of the total volume handled at the Port. Transit flows are less significant, on average accounting for less than 5% of the total volume handled at the Port.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 34,000 | 9,381 | 26,757 | 8,645 | 2,906 | 2,309 | 14,000 |
| Loaded - Transit | 6,000 | 2,579 | 11,225 | 0 | 3,021 | 27,000 | 8,304 |
| Discharged - Imports | 337,000 | 552,594 | 678,896 | 315,523 | 571,097 | 473,162 | 488,045 |
| Loaded - Exports | 51,000 | 43,955 | 67,421 | 101,764 | 129,221 | 140,653 | 89,002 |

**Figure 3.5.2 Traffic of Food, Beverages and Tobacco**

Generally speaking, goods classified under this heading tend to show a good correlation with GDP, reflecting a pattern that has been established in several other developing markets. Basically, as such economies go through the development cycle, they initially tend to undergo unstable growth, prior to establishing a platform for sustainable growth. Such initial periods are often characterised by rapid economic expansion, whereby import growth tends to expand more rapidly than what is deemed sustainable and manageable at that particular level of GDP growth. Subsequently, such increases generally lead to a widening of the trade deficit, which in turn leads to economic contraction. The foregoing cyclical pattern is not only clearly evident in the case of Romania's economic and foreign trade, but in the volumes of '*Foods, Beverages, Tobacco*' handled at the Port of Constantza as well.

It is anticipated that the ratio between imports and exports will remain more or less as it has been in the past. The foregoing is forecast on the premise that as the Romanian economy achieves stability and sustainable growth, the disposable incomes of the Romanian population will increase. Such increases in disposable incomes will lead to increased demand for a variety of consumables, such as those classified under '*Foods, Beverages, Tobacco*', and which are produced in external markets.

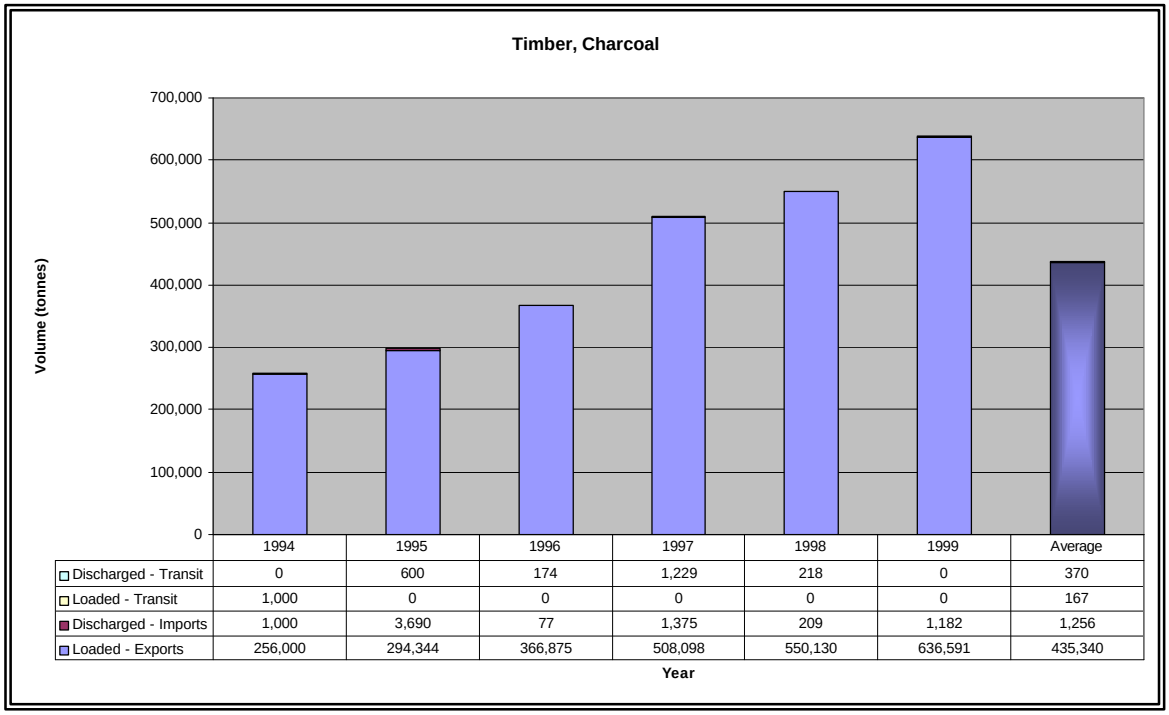
Exports have also demonstrated growth, and this pattern is also anticipated to continue in the future. The status of food processing and packaging industries in Romania is still relatively nascent, however, in developing economies, this is generally one of the sectors that is the first to attract the attention and funds of foreign investors. Romanian exports are therefore likely to witness growth, once considerations such as packaging, branding, quality assurance and marketing become established business practices. For example, Romania already exports a considerable amount of wine, but the marketability of these wines has been hampered by a perceived quality deficiency. However, the introduction of more advanced manufacturing and crop management procedures is likely to lead to better yields and increased production of wine. When combined with the introduction of packaging and preservation processes, this is likely to lead to an improvement in brand perception, which in turn is likely to give rise to increased exports.

As indicated earlier, transit volumes handled at the Port of Constantza have not been significant. However, these cargoes are considered to be 100% containerizable, and it is anticipated that the development of the new Container Terminal at the South Port will likely give rise to some transit traffic from the landlocked neighbouring countries of Central Europe. As a result, it is anticipated that a proportion of such transit container cargoes handled at the Port of Constantza will include goods classified under '*Foods, Beverages, Tobacco*', and that these containers will have their origin or destination in Central Europe.

The study "Container Terminal Project on Pier II-S", which included the involvement of various members of the present Study Team, established that, in Romania, the correlation between containerizable cargoes and economic growth is one-to-one. In other words, an increase of a percentage point in real GDP leads to an increase of a percentage point in the tonnage-volume of containerizable cargo handled at the Port of Constantza. This relationship was re-examined in the context of the present study, and was found to remain valid. As a result, the tonnage-volume of goods classified under '*Foods, Beverages, Tobacco*' that will be handled at the Port of Constantza is expected to increase in line with GDP growth.

### 3.5.4 Timber, Charcoal

Timber exports through the Port of Constantza have demonstrated impressive growth between 1994 and 1999, achieving a compounded annual growth rate of 20% during this period. Whilst the foregoing has meant that the timber industry has become a significant contributor of export earnings to the Romanian economy, accounting for 10% of exports and 5% of GDP in value terms, it is anticipated that such rapid growth is unlikely to be sustainable in the longer term. The reasons for the foregoing conclusion are as outlined hereafter.



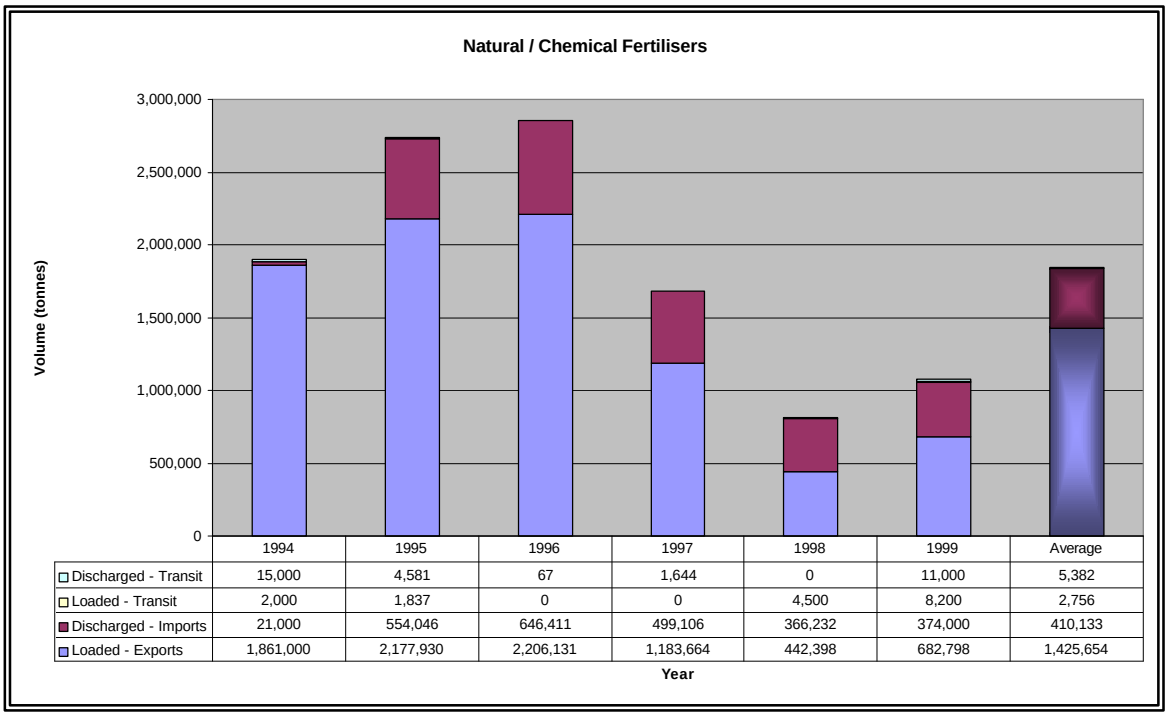

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 0 | 600 | 174 | 1,229 | 218 | 0 | 370 |
| Loaded - Transit | 1,000 | 0 | 0 | 0 | 0 | 0 | 167 |
| Discharged - Imports | 1,000 | 3,690 | 77 | 1,375 | 209 | 1,182 | 1,256 |
| Loaded - Exports | 256,000 | 294,344 | 366,875 | 508,098 | 550,130 | 636,591 | 435,340 |

**Figure 3.5.3 Traffic of Timber and Charcoal**

Firstly, the industry's rapid growth can be largely attributed to the relatively unregulated nature of the business in Romania. Hence, the private sector has been able to rapidly expand logging, and to a certain extent, it has been understood that this process has been carried out somewhat indiscriminatingly. However, since the areas that are currently under exploitation are deemed to be limited, it is inevitable that continuous logging, without the implementation of adequate reforestation measures, is likely to result in reduced availability of export volumes in the longer run. Secondly, Romania's accession to the European Union imposes certain environmental criteria upon the country, and it is anticipated that the legislative framework will not allow for continued depletion of forest areas. Finally, Romania does possess large, commercially exploitable forest areas, however, it is understood that access to these areas is limited due to the unavailability of adequate road infrastructure.

### 3.5.5 Natural / Chemical Fertilizers

The total volumes of fertilisers handled at the Port of Constantza, between 1994 and 1999, have fluctuated dramatically, with a minimum of approximately 800,000 tons in 1998 and a maximum of nearly 2.9 million tons in 1996. The most dramatic decreases have been in export volumes, with the minimum and maximum respectively being 440,000 tons and 2.2 million tons. Volumes in recent years have been far lower than those achieved between 1994 and 1996, and the foregoing is attributable to a variety of factors, which are outlined hereafter.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 15,000 | 4,581 | 67 | 1,644 | 0 | 11,000 | 5,382 |
| Loaded - Transit | 2,000 | 1,837 | 0 | 0 | 4,500 | 8,200 | 2,756 |
| Discharged - Imports | 21,000 | 554,046 | 646,411 | 499,106 | 366,232 | 374,000 | 410,133 |
| Loaded - Exports | 1,861,000 | 2,177,930 | 2,206,131 | 1,183,664 | 442,398 | 682,798 | 1,425,654 |

**Figure 3.5.4 Traffic of Natural/Chemical Fertilisers**

The structure of Romania's fertiliser trade through the Port of Constantza would suggest a trading imbalance of sorts. However, closer scrutiny indicates that exports and imports comprise different commodities. Exports are primarily understood to be natural fertilisers, whilst imports are primarily understood to be complex (NPK) fertilisers and fertiliser raw materials. Furthermore, the graph depicted above suggests a reasonable correlation between GDP and the total volume of fertilisers handled at the Port of Constantza. Between 1994 and 1996, when the Romanian economy grew, both export and import volumes handled at the Port of Constantza grew. The foregoing can be explained by the fact that economic growth led to financial gains in the agricultural sector, thereby allowing farmers to purchase complex fertilisers, which in turn reduced their dependency on natural fertilisers. Inevitably, such a reduction in dependency on natural fertilisers led to increased surpluses of the same being available for exports, thus explaining the increased export volumes handled at the Port.

Similarly, the reverse argument applies for the period between 1997 and 1999. During this period the Romanian economy contracted, and the implied effect was that the agricultural sector resorted to less costly fertilisers, thus increasing the consumption of natural fertilisers, and reducing the surpluses available for export. Primarily due to the aforementioned financial considerations, imports during this period declined as well, with 1999 volumes being approximately 60% of the peak volumes achieved in 1996.

Structural changes in the Romanian have led to a decreased contribution by the agricultural sector to GDP. This change has been brought about by a restructuring of the industry, which has resulted in the majority of farms being transferred from the State's ownership to private

hands. Consequently, the agricultural sector has had to cope with market and commercial realities, resulting in a closer scrutiny of costs. One of the consequences of the foregoing has been a reduction in the number of livestock, thus reducing the quantities of natural fertiliser produced by the country's agricultural sector.

Nevertheless, the sector is expected to continue to remain significant, even as the Romanian economy goes through the transition process. The Romanian agricultural sector is expected to implement improved yield management techniques, in order to increase the productivity per hectare of cultivated land. The foregoing is likely to lead to increases in imports of complex (NPK) fertilisers and fertiliser raw materials. Further rationalization within the sector and the implied effect on livestock numbers is expected to decrease the overall production of natural fertilisers in the medium to longer term. As a result of the foregoing, total volumes to be handled by the Port of Constantza are expected to decrease slightly in the medium term, and thereafter grow moderately in the longer term.

From the factors and reasons mentioned above, the chemical fertilizer as the imported cargoes is not expected to grow rapidly but will increase slowly and steadily.

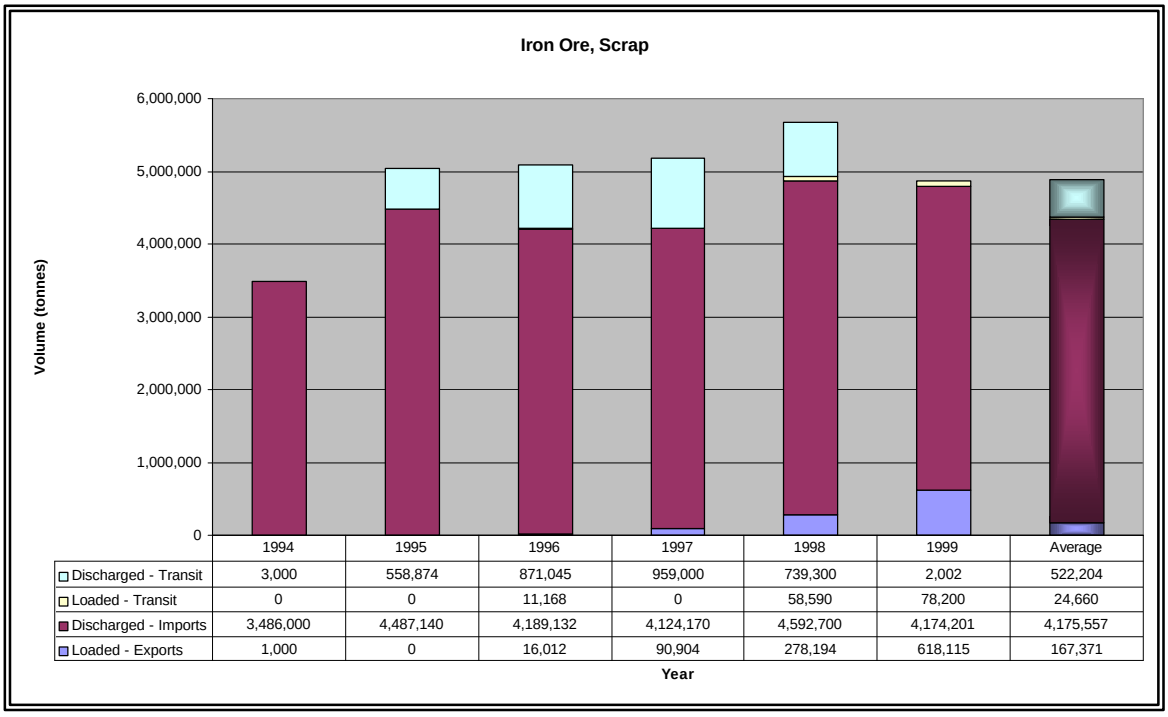
### 3.5.6 Iron Ore, Scrap

This category primarily consists of iron ore imports, both for trade as well as transit. On average, the annual volumes handled at the Port of Constantza, between 1994 and 1999, were nearly 4.2 million tons of trade-related imports, and 500,000 tons of transit-related imports, primarily destined for Hungary, and to a lesser extent Yugoslavia. The future demand of such commodities is primarily likely to be determined by the production capacities of factories, which are end-users of such imports. In this regard, it is noted that the vast majority of iron ore imports, which are presently handled by the Port of Constantza, are destined for the SIDEX steel factory at Galati.

The vast majority of transit import volumes, handled by the Port, are understood to have been destined for a Hungarian steel factory at Dunajvaros. However, due to political considerations outlined earlier, i.e., the situation in Serbia and its implied impact on the navigability of the Danube River, virtually no import transit traffic was handled during 1999. It is now understood that this trade is taking place via alternative routings, through the Adriatic and Mediterranean seas. However, as with cereals, the impact of the situation in Yugoslavia is considered to be temporary, and it is considered likely that these trades will reappear in the near future.

The Study Team undertook a visit to the SIDEX factory, and a number of detailed discussions were held with SIDEX representatives. Furthermore, the Study Team also analysed the facilities and production capabilities of the factory. Based on the production technology used, the age of the facilities as well as the implied raw material requirements, it is anticipated that

medium term growth would be likely, thus leading to an increase in import volumes through the Port of Constantza. In Case 2, these import volumes are forecast to increase to 6.9 million tons per annum by 2010, and remain constant thereafter. Conversely, in Case 1, these import volumes are also forecast to increase to 6.9 million tons per annum by 2010, subsequently further increasing to 8.3 million tons per annum by 2020. The latter case not only assumes that some augmentation of the SIDEX facilities will take place, but that increased economic activity in Romania will be led by productivity gains and increases in industrial output as well, thus placing the Romanian steel industry in a more competitively advantageous position in the global marketplace. It is hereby noted that this assumption implicitly suggests a less competitive stance by some of the world's major low-cost steel producers, i.e., Russia, China, which might be considered somewhat optimistic, given the present status of the Romanian steel industry.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 3,000 | 558,874 | 871,045 | 959,000 | 739,300 | 2,002 | 522,204 |
| Loaded - Transit | 0 | 0 | 11,168 | 0 | 58,590 | 78,200 | 24,660 |
| Discharged - Imports | 3,486,000 | 4,487,140 | 4,189,132 | 4,124,170 | 4,592,700 | 4,174,201 | 4,175,557 |
| Loaded - Exports | 1,000 | 0 | 16,012 | 90,904 | 278,194 | 618,115 | 167,371 |

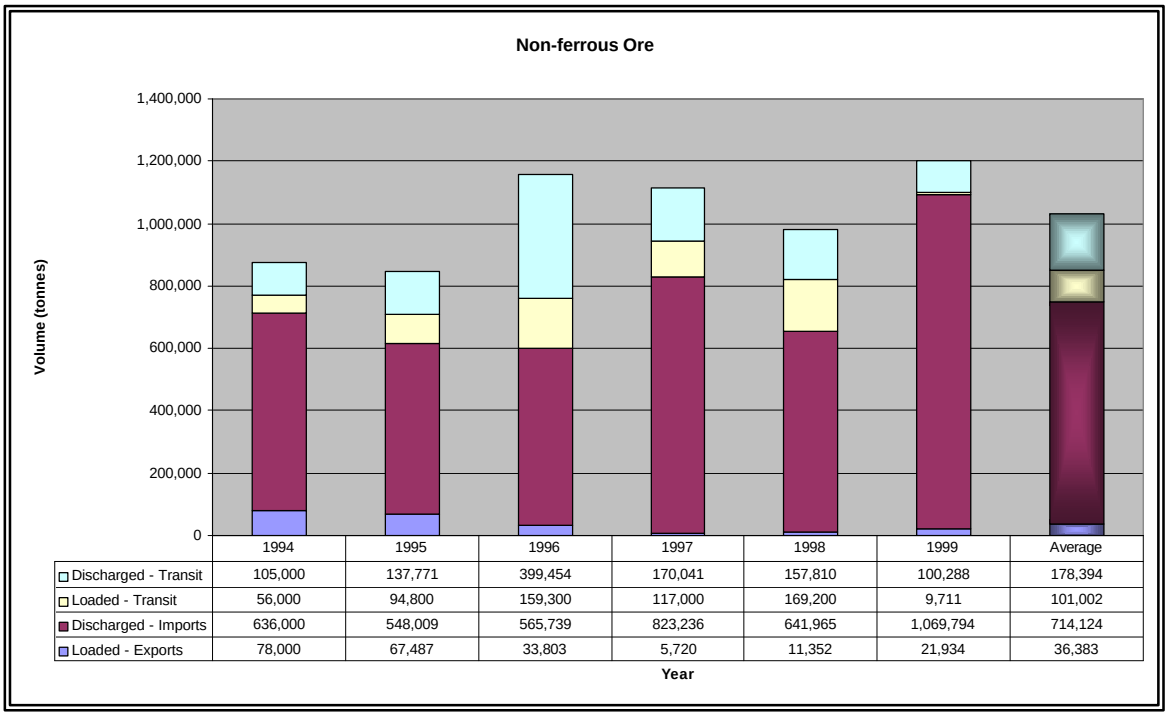
**Figure 3.5.5 Traffic of Iron Ore and Scrap**

As far as export flows classified under this category are concerned, they are understood to purely comprise steel scrap. Scrap volumes handled at the Port of Constantza, between 1994 and 1999, grew at a compounded annual rate of more than 250% during this period. This dramatic growth has been effected by the transition, of the former COMECON economies, from centrally-planned economies to market-oriented ones, which has led to dramatic reductions in reliance on heavy manufacturing and a variety of transportation means. As a result, these economies have been decommissioning a variety of industrial plants, rolling stock, waterborne vessels, etc. Additionally, a number of abandoned construction projects have led to surpluses of steel scrap being available for export.

Firstly, it is obvious that growth rates achieved in the recent past are not likely to be sustainable, simply due to the fact that such growth rates are indicative of the initial growth pattern of a market in its establishment phase. Secondly, Romania, or any other former COMECON country for that matter, does not possess an infinite supply of scrap. Finally, the lack of facilities in Romania, with the ability to process steel scrap, is understood to have facilitated scrap exports, however, it is deemed likely that such facilities will emerge in the medium term. Based on the foregoing, it has been concluded that scrap exports through the Port of Constantza are likely to grow, albeit at more moderate rates, in the near term, and remain constant in the medium term. However, in the longer-term scrap exports are expected to decline.

### 3.5.7 Non-ferrous Ore

The imported and incoming transit non-ferrous ore occupy about 90% of all traffic volume in of the average. Especially the imported volume has been increasing.



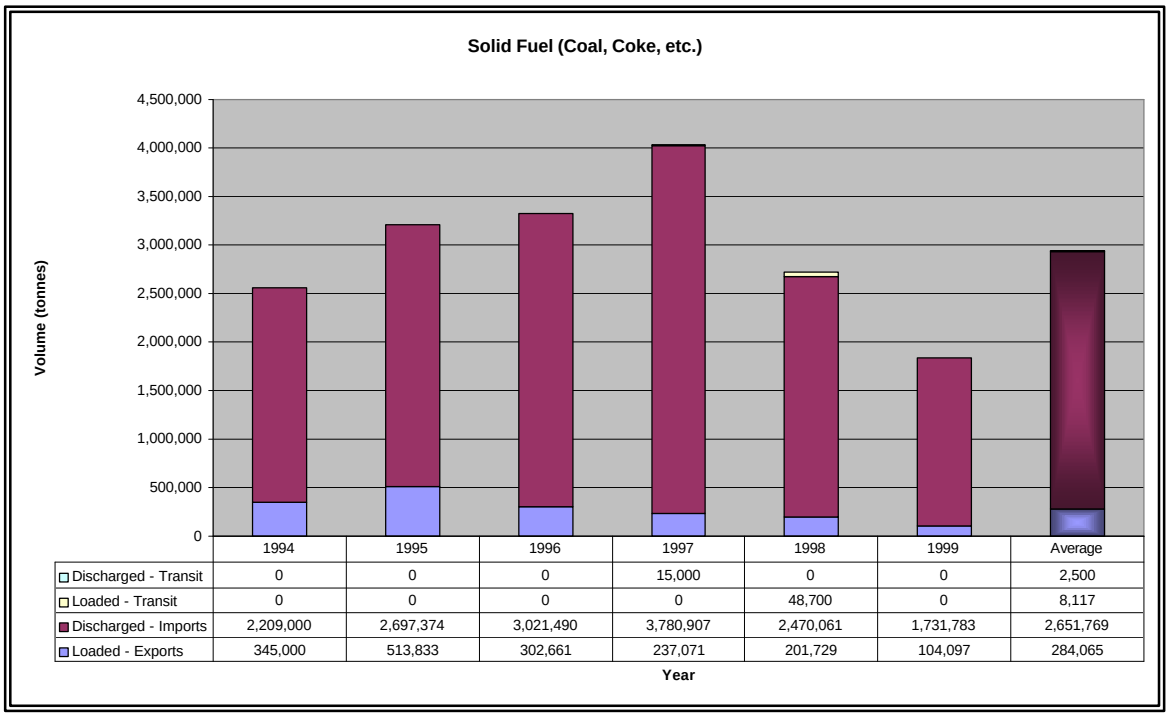

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 105,000 | 137,771 | 399,454 | 170,041 | 157,810 | 100,288 | 178,394 |
| Loaded - Transit | 56,000 | 94,800 | 159,300 | 117,000 | 169,200 | 9,711 | 101,002 |
| Discharged - Imports | 636,000 | 548,009 | 565,739 | 823,236 | 641,965 | 1,069,794 | 714,124 |
| Loaded - Exports | 78,000 | 67,487 | 33,803 | 5,720 | 11,352 | 21,934 | 36,383 |

**Figure 3.5.6 Traffic of Non-ferrous Ore**

### 3.5.8 Solid Fuel (Coal, Coke, etc.)

Solid fuel traffic at the Port of Constantza primarily comprises imports of coal for the SIDEX steel factory at Galati, and the average share of these imports is nearly 90% of the total solid fuel traffic handled by the Port. Additionally, the Port also handles exports, which are understood to comprise petroleum coke. The total annual volumes handled by the Port,

between 1994 and 1999, have fluctuated between approximately 1.8 and 4.0 million tons, with annual import volumes ranging between 1.7 and 3.7 million tons.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 0 | 0 | 0 | 15,000 | 0 | 0 | 2,500 |
| Loaded - Transit | 0 | 0 | 0 | 0 | 48,700 | 0 | 8,117 |
| Discharged - Imports | 2,209,000 | 2,697,374 | 3,021,490 | 3,780,907 | 2,470,061 | 1,731,783 | 2,651,769 |
| Loaded - Exports | 345,000 | 513,833 | 302,661 | 237,071 | 201,729 | 104,097 | 284,065 |

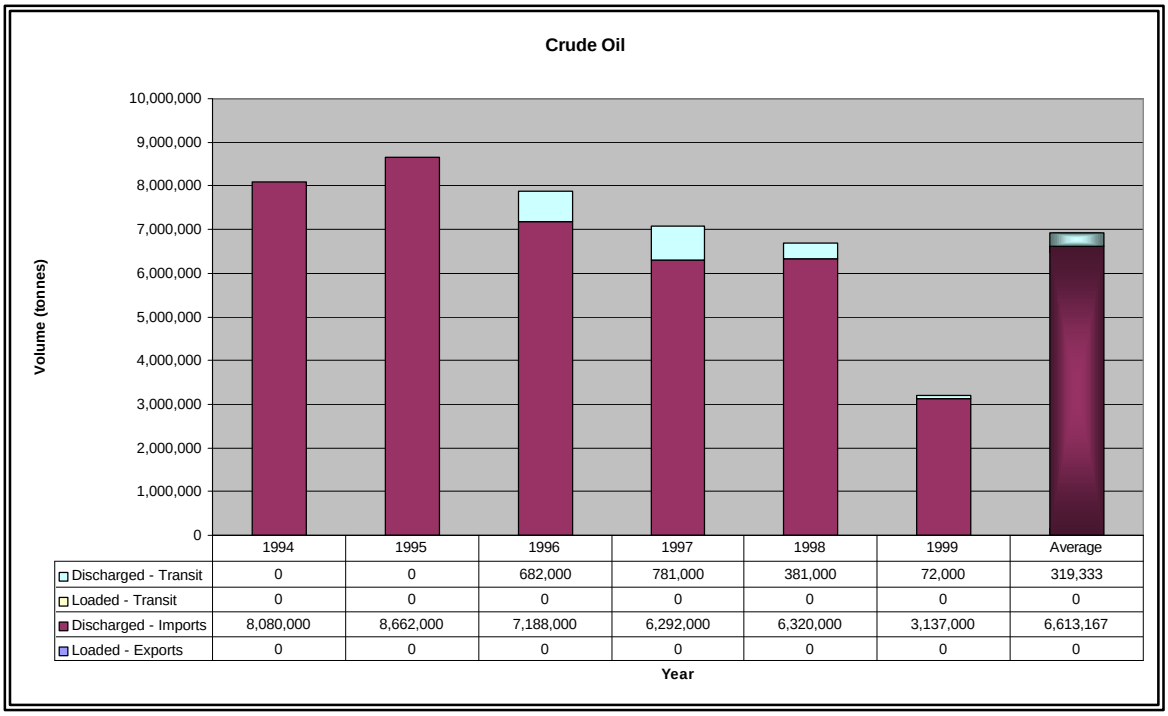
**Figure 3.5.7 Traffic of Solid Fuel (Coal, Coke, etc.)**

As with iron ore imports, the future demand for solid fuels is primarily likely to be determined by the production capacity of the SIDEX facility, which is the primary end-user of such imports. As outlined earlier, the Study Team analysed the SIDEX facility, and the projected import volumes are based upon the projected production volume of the facility. Based on the foregoing, it was anticipated that medium term growth would be likely, thus leading to an increase in import volumes through the Port of Constantza. In Case 2, these import volumes are forecast to increase to 2.1 million tons per annum by 2010, and remain constant thereafter. Conversely, in Case 1, these import volumes are also forecast to increase to 2.1 million tons per annum by 2010, subsequently further increasing to 2.55 million tons per annum by 2020. The latter case assumes that some augmentation of the SIDEX facilities will take place, that increased economic activity in Romania will be led by productivity gains as well as increases in industrial output, thereby rendering the Romanian steel industry more competitive in the global marketplace.

### 3.5.9 Crude Oil

Crude oil traffic handled at the Port of Constantza, between 1994 and 1999, fluctuated between approximately 3.1 and 8.6 million tons per annum. It is also noted that crude oil traffic at the Port solely consists of trade and transit imports, with the latter, it is understood,

primarily being destined for Yugoslavia. During its membership of the COMECON, Romania created a refining industry, which is still the largest in Eastern Europe. It is understood that, as recently as three years ago, this refining capacity was in excess of 30 million tons per annum.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 0 | 0 | 682,000 | 781,000 | 381,000 | 72,000 | 319,333 |
| Loaded - Transit | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Discharged - Imports | 8,080,000 | 8,662,000 | 7,188,000 | 6,292,000 | 6,320,000 | 3,137,000 | 6,613,167 |
| Loaded - Exports | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Figure 3.2.8 Traffic of Crude Oil**

However, antiquated technology, and its implied inability to produce premium-grade petroleum products, combined with the commercial impacts of a market economy, has forced a restructuring of the refining industry. The Romanian Government has repeatedly tried to privatise a number of refineries, but it has unfortunately found few, if any, buyers. The only success story, in this regard, seems the privatisation of the refinery at Midia, which was awarded to Petrom.

The United States' Department of Energy (DoE) provides long-term forecasts of world energy demand, through its agency the Energy Information Administration (EIA). The EIA annually publishes two reports, titled "International Energy Outlook" and "Annual Energy Outlook", both of which contain long-term forecasts for energy production and consumption. These forecasts are broken down by a number of key segmentation variables, such as fuel type, energy prices and geographic region. These forecasts are generated by the World Energy Projection System (WEPS), which is a complex econometric model that correlates the various segmentation variables to macroeconomic development. As per the forecasts, presented in the latest editions of the aforementioned publications, crude oil demand in Central and Eastern Europe is expected to increase at an annual rate of 1% per annum up to 2020 under the '*Reference Scenario*'. This scenario estimates that GDP growth in Central and Eastern

Europe will be 4.2% per annum up to 2020. Conversely, Romania's long-term GDP growth during the same period, is estimated to be approximately 20% lower, i.e. 3.4% per annum, than that of Central and Eastern European countries that are considered 'first wave' entrants to the European Union. This forecast is exactly in line with the GDP forecast utilised in Case 2, and consequently it is estimated that Romanian crude oil consumption will increase at an annual rate of 0.8% per annum up to 2020.

In order to estimate the future crude oil volumes that are likely to be handled at the Port of Constantza, and assessment has to be made of the country's domestic production and consumption. From data published by the EIA, it is understood that Romanian crude oil production, from its oilfields in the Black Sea, amounts to approximately 6.5 million tons per annum. This data also estimates that Romania's consumption, on the other hand, is approximately 14.5 million tons per annum, thus resulting in an import requirement of 8 million tons per annum. Although this figure is clearly larger than the volumes handled at the Port in the recent past, it is nevertheless considered to be an accurate estimate for a variety of reasons, as outlined below.

Firstly, adverse economic conditions in Romanian led to a decrease in demand, and thus imports. Secondly, in order to maintain its standing with the international financial community, it is understood that Romania resorted to alternative trading methods, such as bartering, with Russia in particular. It is understood that a significant amount of such crude oil imports by Romania from Russia was transported by rail. Finally, adverse price conditions in the world's energy markets are likely to have had their impact on Romanian buyers' purchasing ability as well.

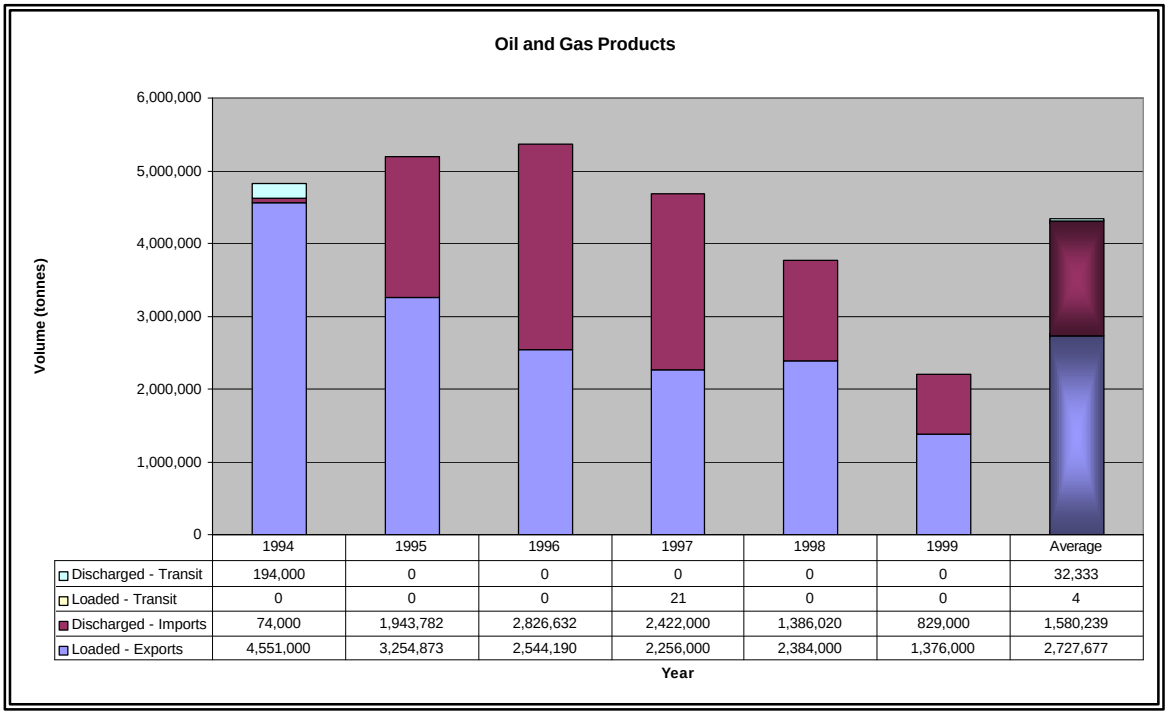
Hence, in Case 2, Romanian demand for crude oil is estimated to grow, from 14.5 million tons per annum, at a rate of 0.8% per annum. Subtracting Romania's domestic production, i.e., 6.5 million tons per annum, from this figure yields the total imports that are likely to be required by Romania. Additionally, assuming normal trading patterns, as well as most favourable transportation modes and routes, it is considered likely that all these volumes could be handled at the Port of Constantza. Similarly, in Case 1, which is based upon the WEPS high economic growth scenario, Romanian demand for crude oil is estimated to grow, from 14.5 million tons per annum, at a rate of 2.2% per annum. Once again, subtracting Romania's domestic production from these figures, and assuming that these trades are best routed through the Port of Constantza, yields the future volumes that are likely to be handled by the Port.

There seems to be doubts for increased traffic demand of crude oil due to the recent decreasing trend. However, the traffic demand of crude oil has a high potential to increase judging from the many aspects mentioned above such as demand and production of Romania, more advantages of the Port of Constantza over other modes of transports (railways and

roads) and the GDP growth scenario mentioned in the Section, 3.3 Scenario Approach to Forecasting.

### 3.5.10 Oil and Gas Products

Imported oil and gas products have increased since 1995. Judging from the performance during the past five years, total traffic volume of oil and gas products are predicted to fall. Especially, the imported traffic volume shows drastic decrease. These trends are assumed to be closely related with the slowdown of economic activity in Romania.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 194,000 | 0 | 0 | 0 | 0 | 0 | 32,333 |
| Loaded - Transit | 0 | 0 | 0 | 21 | 0 | 0 | 4 |
| Discharged - Imports | 74,000 | 1,943,782 | 2,826,632 | 2,422,000 | 1,386,020 | 829,000 | 1,580,239 |
| Loaded - Exports | 4,551,000 | 3,254,873 | 2,544,190 | 2,256,000 | 2,384,000 | 1,376,000 | 2,727,677 |

**Figure 3.5.9 Traffic of Oil and Gas Products**

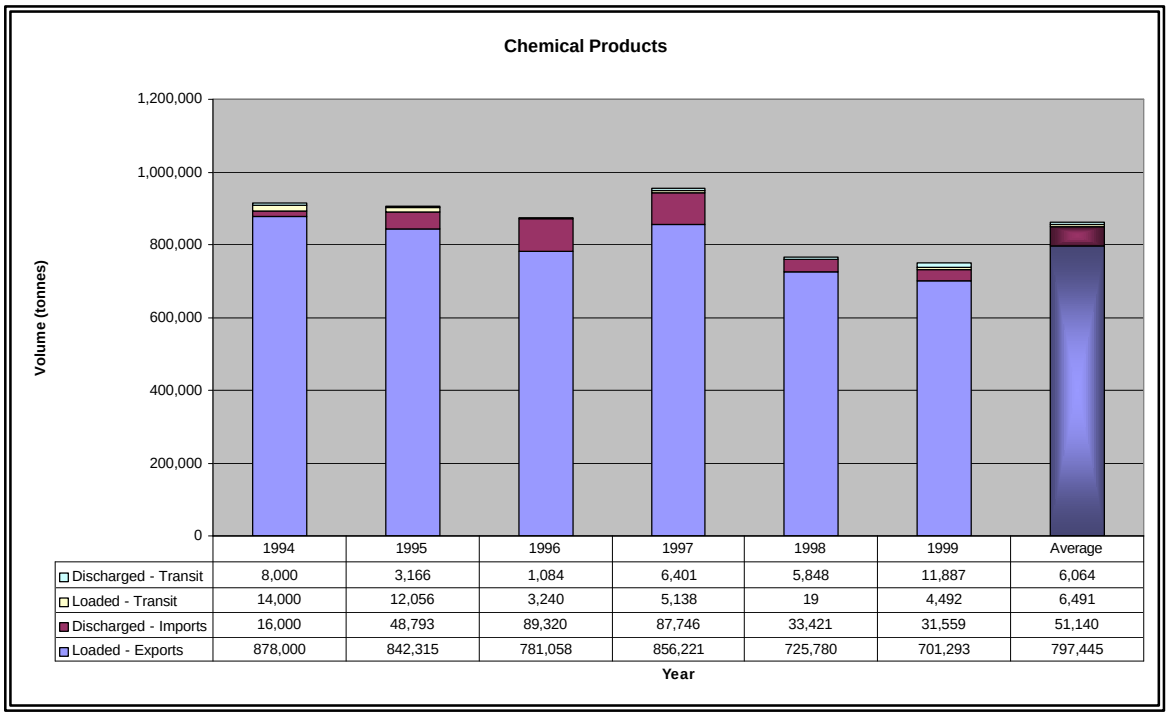
### 3.5.11 Chemical Products

The traffic volume of chemical products are heavily occupied by the export cargoes and has not drastically decreased in spite of slowdown of economic activity in Romania. This is caused by the stronger economic activity of importing countries than of Romanian activity. If the economic growth of Romania would recover, it is expected that the traffic volume of imports will soon increase.

The two major factors were considered in the forecast of this commodity as follows;

(1) The chemical sector in Romania is undergoing industrial restructuring and privatization under the Government PSAL program. Up to 1998, about 45% of chemical plants had been privatized but only represented 20% of the total capital.

Chemical products also include petro-chemicals which are also undergoing industrial restructuring. However, the petro-chemical industry is just beginning to show some sign of improved efficiency and this will improve slowly in the short term.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 8,000 | 3,166 | 1,084 | 6,401 | 5,848 | 11,887 | 6,064 |
| Loaded - Transit | 14,000 | 12,056 | 3,240 | 5,138 | 19 | 4,492 | 6,491 |
| Discharged - Imports | 16,000 | 48,793 | 89,320 | 87,746 | 33,421 | 31,559 | 51,140 |
| Loaded - Exports | 878,000 | 842,315 | 781,058 | 856,221 | 725,780 | 701,293 | 797,445 |

**Figure 3.5.10 Traffic of Chemical Products**

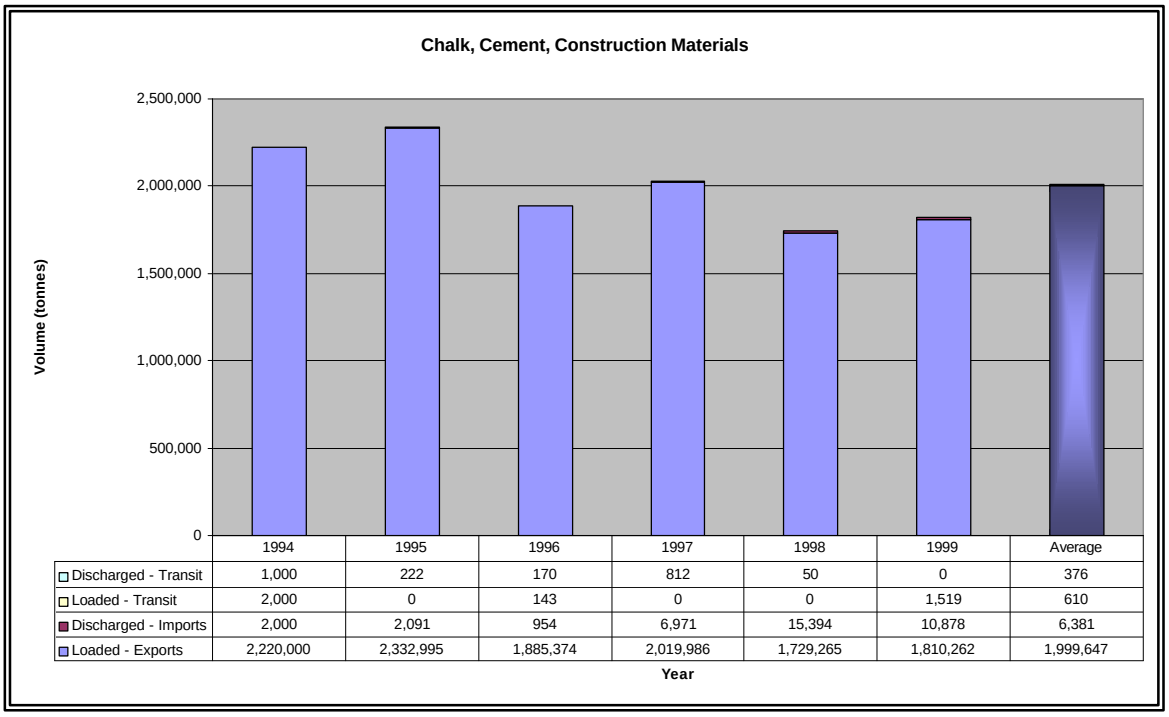
(2) Accession into the EU in the near future, just like the reason explained earlier for cement, will put added stringent measures on production of chemicals and chemical products in Romania. The past trend of export traffic of this commodity through Constantza was about 700,000 to 800,000 tons a year. The Master Plan Study forecasted this traffic to increase slightly in the short term up to 900,000 tons in 2005, after which, it will gradually decline to about 700,000 tons in 2010 and 600,000 tons in 2020.

### 3.5.12 Chalk, Cement, Construction Materials

The traffic demand for chalk, cement and construction materials is mostly occupied by the export cargoes. It shows gradual decline during the past five years but has increased slightly after 1998 reflecting the economic growth of European countries leading to import these cargoes. It is expected to recover the level of volume in 1997 after the return to increased economic growth of Romania.

The Master Plan Study confirmed the strength of cement and construction materials industry in Romania up to now. In the past, Romania managed to export these commodities in the

amount of about 1.5-2.0 million tons a year of which 50% are to Middle East and North Africa, 10-15% to EU countries. For these markets, Romania is facing increasing competition from S-E Asian countries which are large producers of cement and construction materials.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 1,000 | 222 | 170 | 812 | 50 | 0 | 376 |
| Loaded - Transit | 2,000 | 0 | 143 | 0 | 0 | 1,519 | 610 |
| Discharged - Imports | 2,000 | 2,091 | 954 | 6,971 | 15,394 | 10,878 | 6,381 |
| Loaded - Exports | 2,220,000 | 2,332,995 | 1,885,374 | 2,019,986 | 1,729,265 | 1,810,262 | 1,999,647 |

**Figure 3.5.11 Traffic of Chalk, Cement and Construction Materials**

For forecasting traffic of this commodity, two major factors must be considered:

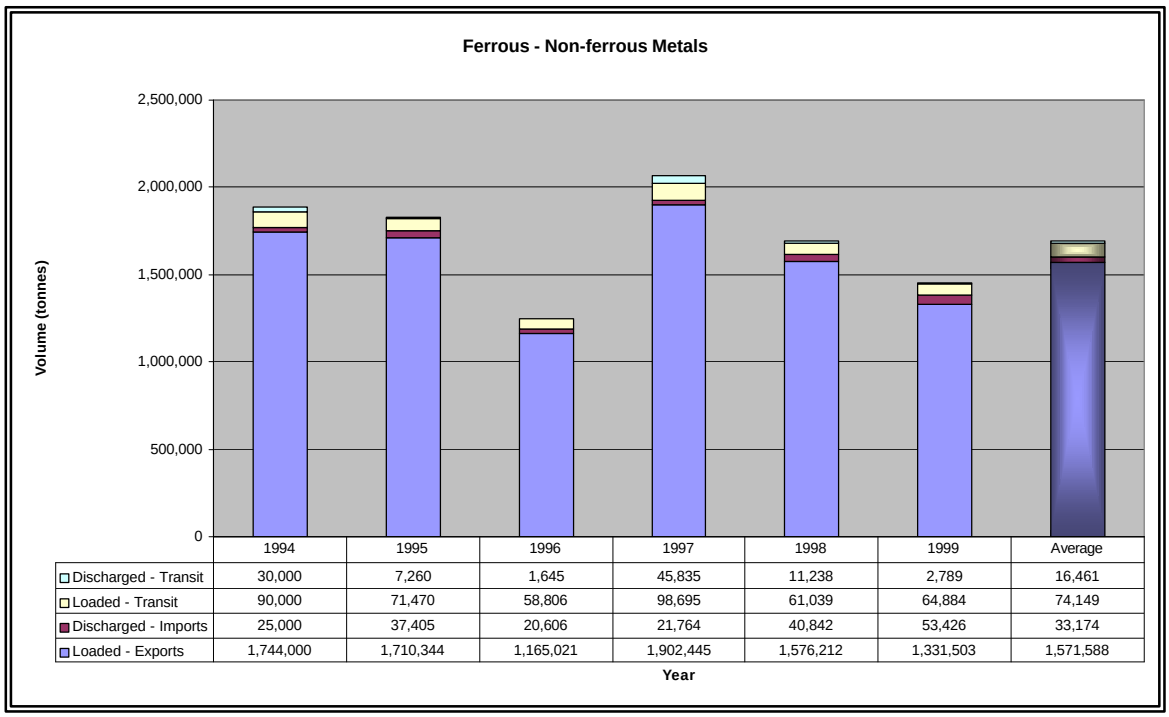
(1) That demand for this commodity in Romania itself will increase quite rapidly once the economy picks up, for when construction industries grow and demand for cement and materials will definitely increase rapidly. The most competitive cement plant is presently at Medgidia which has the best facility so far, faces the Black Sea-Danube Canal, and is 95% owned by Lafarge (France) company with a capacity of about 2 million tons a year. Cement production plants acquired by foreign companies had to undergo major plant restructuring and modernization and this required large capital. Production of cement in Romania has in fact declined from a high of 12 million tons a year in 1989 to about 5.4 million tons in 1999 and 2000.

(2) That membership into the EU will come with a string of more stringent requirements on products that can be exported and to be in line with production rules and regulations, particularly pertaining to environment. Cement production is notoriously known as an industry that often pollutes the environment. Presently, there are 9 cement plants in Romania of which 8 are already mainly owned by 3 foreign companies: Lafarge (3 plants), Holderbank (3 plants) and Heidelberger (2 plants)

With these factors in mind, the total production of such commodity may not decline in future in Romania but likely will increase. But as a commodity for export, it will probably decline gradually up to 2020.

### 3.5.13 Ferrous / Non-ferrous Metals

The traffic demand of ferrous/non-ferrous metal recorded big volumes before and after 1997. The traffic volume is heavily occupied by the export cargoes. During the three years (1996-1999), a big decrease was recorded. This commodity also depends on the economic growth of importing countries mainly of Europe. (See Figure 3.5.12)

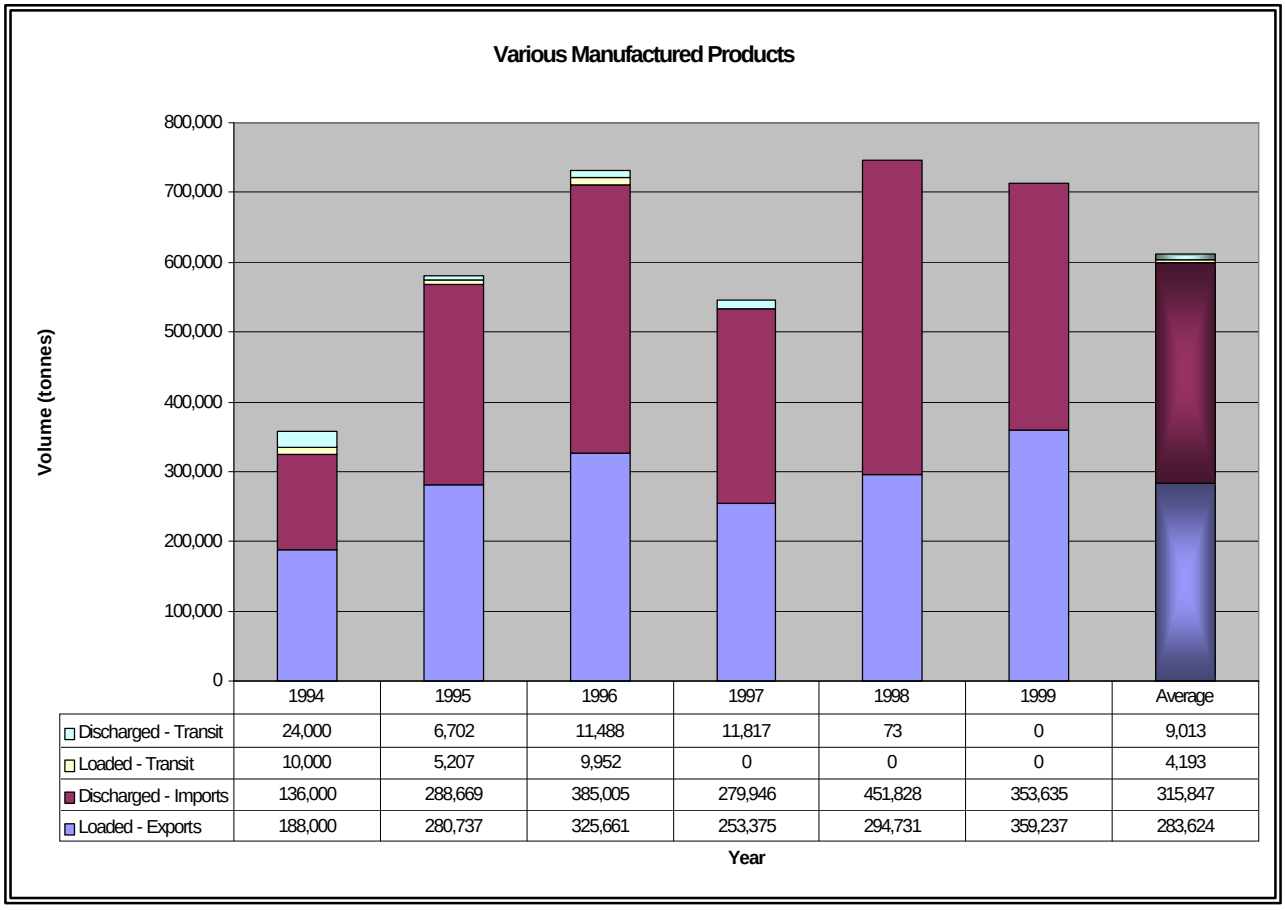



| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 30,000 | 7,260 | 1,645 | 45,835 | 11,238 | 2,789 | 16,461 |
| Loaded - Transit | 90,000 | 71,470 | 58,806 | 98,695 | 61,039 | 64,884 | 74,149 |
| Discharged - Imports | 25,000 | 37,405 | 20,606 | 21,764 | 40,842 | 53,426 | 33,174 |
| Loaded - Exports | 1,744,000 | 1,710,344 | 1,165,021 | 1,902,445 | 1,576,212 | 1,331,503 | 1,571,588 |

**Figure 3.5.12 Traffic of Ferrous / Non-ferrous Metals**

### 3.5.14 Various Manufactured Products

The traffic demand of various manufactured products is expected to increase in the long-term in spite of drastic fall in 1997. Total demand is shared by imports and exports and share and volume of exports shows slight increase which is assumed to reflect the solid economic activity of surrounding countries leading to import. (See Figure 3.5.13)



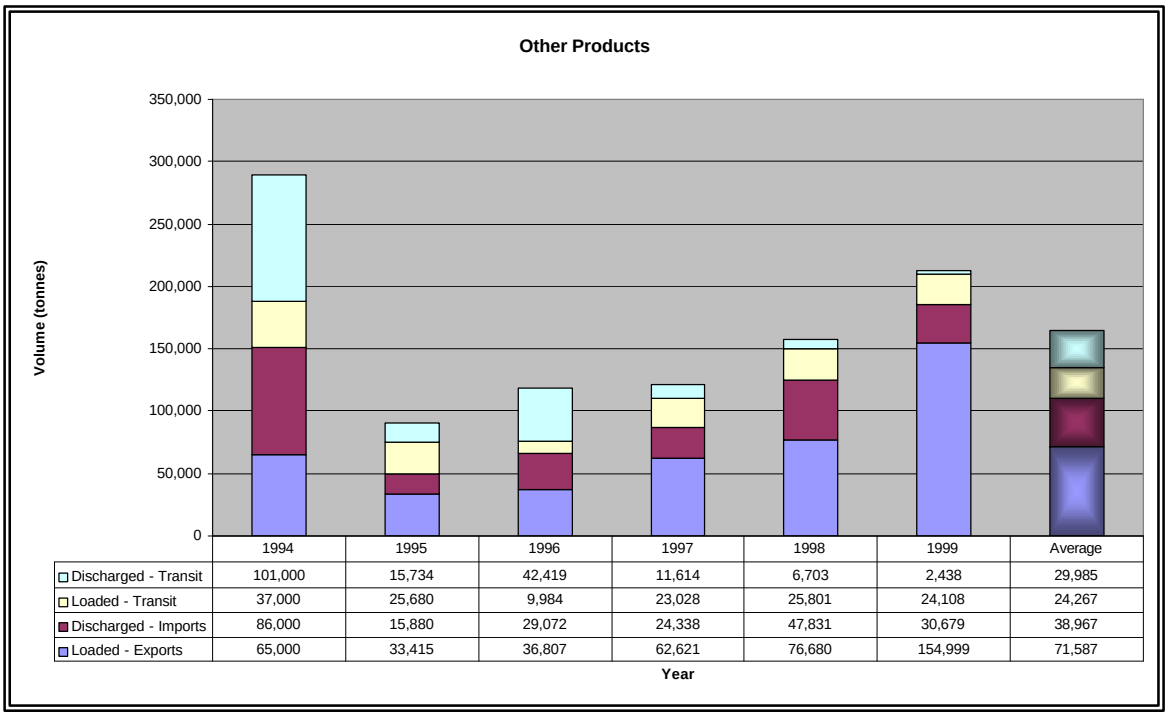

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 24,000 | 6,702 | 11,488 | 11,817 | 73 | 0 | 9,013 |
| Loaded - Transit | 10,000 | 5,207 | 9,952 | 0 | 0 | 0 | 4,193 |
| Discharged - Imports | 136,000 | 288,669 | 385,005 | 279,946 | 451,828 | 353,635 | 315,847 |
| Loaded - Exports | 188,000 | 280,737 | 325,661 | 253,375 | 294,731 | 359,237 | 283,624 |

**Figure 3.5.13 Traffic of Various Manufactured Products**

### 3.5.15 Other Products

The category '*Other Products*', includes the following commodities:

- Fresh Fruits and Vegetables
- Livestock, Sugarcane
- Seeds, Edible Oils and Fats
- Crude Minerals (Quarry)
- Textile, Textile Fibre and Products
- Pulp, Recycled Paper
- Coal and Natural Gas Tars
- Glass, Ceramic Products
- Manufactured Metal Products
- Cars, Transport Material
- Other Products




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average |
|---|---|---|---|---|---|---|---|
| Discharged - Transit | 101,000 | 15,734 | 42,419 | 11,614 | 6,703 | 2,438 | 29,985 |
| Loaded - Transit | 37,000 | 25,680 | 9,984 | 23,028 | 25,801 | 24,108 | 24,267 |
| Discharged - Imports | 86,000 | 15,880 | 29,072 | 24,338 | 47,831 | 30,679 | 38,967 |
| Loaded - Exports | 65,000 | 33,415 | 36,807 | 62,621 | 76,680 | 154,999 | 71,587 |

**Figure 3.5.14 Traffic of Other Products**

On average, between 1994 up to and including 1999, the combined share of these commodities was less than 2.5%. Furthermore, the containerizable cargoes considered for the Port of Constantza, also include '*Foods, beverages, tobacco'* and '*Various manufactured products*', both of which are considered to be 100% containerizable, in the longer term. While it is recognised that some of these commodities are inherently non containerizable, by virtue of their packaging form, it is anticipated that the relative share of such non-containerizable commodities will decline. This trend is already evident for a number of commodities. Furthermore, since containerisation at the Port of Constantza is only expected to peak at 90% in 2020, it is anticipated that those cargoes that are not containerizable, are accounted for in the share of non-containerised, i.e., general cargo or break bulk, cargoes that are likely to be handled at the Port.

## 3.6 Result of Traffic Demand Forecast

This subsection deals with the summary of traffic demand forecast carried out by the study team. Study results were summarised by the forecast case and the target years. Cargo demand by the type of cargo including containerised cargo have also been summarised.

### 3.6.1 Grand Summary

A grand summary was prepared to demonstrate the general tendency of future cargo traffic. This summary is classified basically with the forecast case and the target years, namely:

**Case 1: High Demand Scenario and**
**Case 2: Medium Demand Scenario**

**Target Years: 2010 as for the Short Term Development and**
**Target Years: 2020 as for the Master Plan Stage or Long Term Development**

For this aspect, refer to the following tables.

| | |
|---|---|
| **Table 3.6.1** | **Grand Summary of Cargo Traffic Demands** |
| **Table 3.6.2** | **Summary of Cargo Traffic Demands** |
| **Table 3.6.3** | **Summary of Cargo Traffic Demands: Commodity-wise by Target Year** |
| **Table 3.6.4** | **Summary: Type of Cargo by Target Year** |

For further detail discussions, detailed contents have been attached at **Sections 3.10 and 3.11** also **in Appendix IIA.**

### 3.6.2 Containerised Cargo

Currently a tender for the new container terminal at South Pier 2 is underway with implementation due to start in early 2002 be completed within 2004. The study team believes that the containerisation in Romania is a necessity for establishing a market oriented economy. As seen in world maritime transport, containerisation contributes heavily to hike the transport efficiency and safety. It is clear that manufacturing industries generally require smooth trade through containerisation.

The study team paid special attention to this mode.

Forecast data for the containerised cargo is shown tables below both in terms of volume (or tons) and TEU units.

### 3.6.3 Review of Forecast Traffics by Past Trends

Based on the demand forecast procedure and methodology as shown in the Sections 3.2, 3.3 and 3.4, micro-scopic traffic forecast was carried out. In order to highlight the basic traffic trends for 14 commodity groups, traffic data between 1994 and 2020 for Case 1: High Demand Scenario are reviewed accordingly.

Study results are demonstrated in five figures as follows:



According to these figures, six large traffic commodities in 2020 are :

| | | |
|---|---|---|
| i) | Crude oil | 16.86 million tons |
| ii) | Iron ore, scraps | 9.64 million tons |
| iii) | Bulk grains | 6.73 million tons |
| vi) | Oil and gas products | 4.04 million tons |
| v) | Solid fuel ( coal, coke etc.,) | 2.55 million tons |
| vi) | Manufactured products | 2.54 million tons |

Among these, two highest growth commodities are bulk grains and manufactured products. The former is expected to earn the hard currency by the agriculture sector. The latter is assumed to be increase due to results of industrization.

### 3.6.4 Detailed Analysis by Modal Splits

As shown in subsection 3.5.1, fourteen commodity groups were selected for the detailed traffic forecast analysis. Each cargo belong to commodity classification was sub-divided into four type of cargo, namely:

- ✓ **General Cargo ( or Break bulk )**
- ✓ **Containerizable Cargo ( as part of general cargo )**
- ✓ **Dry Bulk Cargo**
- ✓ **Liquid Bulk Cargo**

These classification were further sub-divided into four modal splits, namely:

- ✓ **Road Transport ( by Trucks and transport vehicles )**
- ✓ **Railway Transport**
- ✓ **Inland Waterway Transport ( by mainly Barges )**
- ✓ **Pipelines ( only for the liquid bulk cargoes )**

Final study results on the modal split are presented in Part II Chapter 4. These were concluded by the port planners employed in the study team. In order to estimate the sub-divided cargo by transport modes, they carried successfully out interview to operators, governmental organisation and agencies. They also carried out the neighbouring countries in order to strengthen contents of their studies.

**Notes:** Preliminary modal split forecast was also presented in Appendix IIA, which was carried out by the transport economist nominated in the study team. This Appendix also indicates the possible vessel size calling Constantza. However these are all preliminary data for utilising in the preliminary study until the port planners prepare their study results. Refer to Chapter 4 and 6.

## Table 3.6.1 Grand Summary of Cargo Traffic Demands

Unit: Million tons

| No. | Case Forecast Scenario | Trade/ Transit | Year 1999 Base year | Year 2010 Short Term | Year 2020 Master Plan | Notes |
|---|---|---|---|---|---|---|
| 1 | **Case 1** | Trade | 21.76 | 38.66 | 46.53 | Export & Import |
| | **High** | Transit | 1.15 | 4.78 | 6.82 | Including transshipment cargo |
| | | Total | 22.91 | 43.44 | 53.35 | |
| 2 | **Case 2** | Trade | 21.76 | 35.26 | 35.65 | Export & Import |
| | **Medium** | Transit | 1.17 | 1.76 | 3.48 | Including transshipment cargo |
| | | Total | 22.91 | 37.96 | 39.13 | |
| 3 | Index | | 1.00 | 1.14 | 1.36 | Case 1/Case 2 |

Note. 1. Figure is rounded, thus a total may not equal to the sum.

## Table 3.6.2 Summary of Cargo Traffic Demands

Unit: Million tons

| No. | Case Forecast Scenario | Trade/ Transit | Year 1999 Base year | Year 2010 Short Term | Year 2020 Master Plan | Notes |
|---|---|---|---|---|---|---|
| 1 | **Case 1** | Trade Export | 9.41 | 12.12 | 11.62 | |
| | **High** | Trade Import | 12.35 | 26.54 | 34.91 | |
| | | Trade Total | 21.76 | 38.66 | 46.53 | |
| | | Transit Loaded | 0.91 | 3.05 | 4.63 | |
| | | Transit Discharged | 0.24 | 1.73 | 2.19 | |
| | | Transit Total | 1.15 | 4.78 | 6.82 | |
| | | Total | 22.91 | 43.44 | 53.35 | |
| 2 | **Case 2** | Trade Export | 9.41 | 12.26 | 10.43 | |
| | **Medium** | Trade Import | 12.35 | 23.00 | 25.22 | |
| | | Trade Total | 21.76 | 35.26 | 35.65 | |
| | | Transit Loaded | 0.91 | 0.94 | 1.29 | |
| | | Transit Discharged | 0.24 | 1.76 | 2.19 | |
| | | Transit Total | 1.15 | 2.70 | 3.48 | |
| | | Total | 22.91 | 37.96 | 39.13 | |
| 3 | Difference | | | | | Balance between Case 1 and Case 2 |
| | | Trade Export | 0 | -0.14 | 1.19 | |
| | | Trade Import | 0 | 3.54 | 9.69 | |
| | | Trade Total | 0 | 3.40 | 10.88 | |
| | | Transit Loaded | 0 | 2.11 | 3.34 | |
| | | Transit Discharged | 0 | -0.03 | 0 | |
| | | Transit Total | 0 | 2.08 | 3.34 | |
| | | Total | 0 | 5.48 | 14.22 | |

Note. 1. Figure is rounded, thus a total may not equal to the sum.

## Table 3.6.3 Summary of Cargo Traffic Demands: Commodity by Target Years

Unit:Million tons

| No. | Commodity Groups | 1999 | | | | | | | 2010 | | | | | | | 2020 | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Trade | | | Transit | | | | Trade | | | Transit | | | | Trade | | | Transit | | | |
| | | Ex | Im | ST | Load | Disch. | ST | T | Ex | Im | ST | Load | Disch. | ST | T | Ex | Im | ST | Load | Disch. | ST | T | |
| | **Case 1** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Grains | 1.01 | 0.04 | 1.05 | 0.68 | 0.04 | 0.72 | 1.77 | 1.80 | 0.20 | 2.00 | 2.61 | 0.05 | 2.66 | **4.66** | 2.64 | 0.20 | 2.84 | 3.84 | 0.05 | 3.89 | **6.73** | |
| 2 | Foods | 0.14 | 0.47 | 0.61 | 0.03 | 0.00 | 0.03 | 0.64 | 0.24 | 0.82 | 1.06 | 0.03 | 0.09 | 0.12 | **1.18** | 0.42 | 1.41 | 1.83 | 0.08 | 0.26 | 0.34 | **2.17** | |
| 3 | Timber | 0.64 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 | 0.64 | 1.13 | 0.00 | 1.13 | 0.00 | 0.00 | 0.00 | **1.13** | 0.68 | 0.00 | 0.68 | 0.00 | 0.00 | 0.00 | **0.68** | |
| 4 | Fertilizers | 0.68 | 0.37 | 1.05 | 0.01 | 0.01 | 0.02 | 1.07 | 0.36 | 0.69 | 1.05 | 0.00 | 0.00 | 0.00 | **1.05** | 0.19 | 1.24 | 1.43 | 0.00 | 0.00 | 0.00 | **1.43** | |
| 5 | Iron Ore & Scrap | 0.62 | 4.17 | 4.79 | 0.08 | 0.00 | 0.08 | 4.87 | 0.85 | 6.90 | 7.75 | 0.11 | 0.83 | 0.94 | **8.69** | 0.30 | 8.30 | 8.60 | 0.04 | 1.00 | 1.04 | **9.64** | |
| 6 | Non-ferrous Ore | 0.02 | 1.07 | 1.09 | 0.01 | 0.10 | 0.11 | 1.20 | 0.00 | 1.68 | 1.68 | 0.00 | 0.27 | 0.27 | **1.95** | 0.00 | 1.01 | 1.01 | 0.00 | 0.00 | 0.00 | **1.01** | |
| 7 | Solid Fuel | 0.10 | 1.73 | 1.83 | 0.00 | 0.00 | 0.00 | 1.83 | 0.00 | 2.11 | 2.11 | 0.00 | 0.00 | 0.00 | **2.11** | 0.00 | 2.55 | 2.55 | 0.00 | 0.16 | 0.16 | **2.71** | |
| 8 | Crude Oil | 0.00 | 3.14 | 3.14 | 0.00 | 0.07 | 0.07 | 3.21 | 0.00 | 11.92 | 11.92 | 0.00 | 0.39 | 0.39 | **12.31** | 0.00 | 16.4 | 16.40 | 0.00 | 0.00 | 0.00 | **16.40** | |
| 9 | Oil & Gas Products | 1.38 | 0.83 | 2.21 | 0.00 | 0.00 | 0.00 | 2.21 | 2.39 | 1.44 | 3.83 | 0.00 | 0.00 | 0.00 | **3.83** | 1.57 | 2.47 | 4.04 | 0.00 | 0.46 | 0.46 | **4.50** | |
| 10 | Chemical Products | 0.70 | 0.03 | 0.73 | 0.00 | 0.01 | 0.01 | 0.74 | 0.67 | 0.00 | 0.67 | 0.00 | 0.00 | 0.00 | **0.67** | 0.36 | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | **0.36** | |
| 11 | Chalk, Cement | 1.81 | 0.01 | 1.82 | 0.00 | 0.00 | 0.00 | 1.82 | 1.07 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 | **1.07** | 0.64 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 | **0.64** | |
| 12 | Ferrous & Non-ferrous Metals | 1.33 | 0.05 | 1.38 | 0.06 | 0.00 | 0.06 | 1.44 | 1.90 | 0.00 | 1.90 | 0.10 | 0.00 | 0.10 | **2.00** | 1.90 | 0.00 | 1.90 | 0.10 | 0.00 | 0.10 | **2.00** | |
| 13 | Manufactured Producs | 0.36 | 0.35 | 0.71 | 0.00 | 0.00 | 0.00 | 0.71 | 0.63 | 0.62 | 1.25 | 0.07 | 0.08 | 0.15 | **1.40** | 1.07 | 1.05 | 2.12 | 0.21 | 0.21 | 0.42 | **2.54** | |
| 14 | Other Cargoes | 0.62 | 0.09 | 0.71 | 0.04 | 0.01 | 0.05 | 0.76 | 1.08 | 0.16 | 1.24 | 0.13 | 0.02 | 0.15 | **1.39** | 1.85 | 0.28 | 2.13 | 0.36 | 0.05 | 0.41 | **2.54** | |
| | **Total** | **9.41** | **12.35** | **21.76** | **0.91** | **0.24** | **1.15** | **22.91** | **12.12** | **26.54** | **38.66** | **3.05** | **1.73** | **4.78** | **43.44** | **11.62** | **34.91** | **46.53** | **4.63** | **2.19** | **6.82** | **53.35** | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | **Case 2** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Grains | 1.01 | 0.04 | 1.05 | 0.68 | 0.04 | 0.72 | 1.77 | 1.50 | 0.38 | 1.88 | 0.50 | 0.13 | 0.63 | **2.51** | 1.50 | 0.38 | 1.88 | 0.50 | 0.13 | 0.63 | **2.51** | |
| 2 | Foods | 0.14 | 0.47 | 0.61 | 0.03 | 0.00 | 0.03 | 0.64 | 0.19 | 0.64 | 0.83 | 0.03 | 0.09 | 0.12 | **0.95** | 0.29 | 0.96 | 1.25 | 0.08 | 0.26 | 0.34 | **1.59** | |
| 3 | Timber | 0.64 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 | 0.64 | 1.13 | 0.00 | 1.13 | 0.00 | 0.00 | 0.00 | **1.13** | 0.68 | 0.00 | 0.68 | 0.00 | 0.00 | 0.00 | **0.68** | |
| 4 | Fertilizers | 0.68 | 0.37 | 1.05 | 0.01 | 0.01 | 0.02 | 1.07 | 0.48 | 0.52 | 1.00 | 0.00 | 0.00 | 0.00 | **1.00** | 0.30 | 0.81 | 1.11 | 0.00 | 0.00 | 0.00 | **1.11** | |
| 5 | Iron Ore & Scrap | 0.62 | 4.17 | 4.79 | 0.08 | 0.00 | 0.08 | 4.87 | 0.85 | 6.90 | 7.75 | 0.11 | 0.83 | 0.94 | **8.69** | 0.30 | 6.90 | 7.20 | 0.04 | 0.95 | 0.99 | **8.19** | |
| 6 | Non-ferrous Ore | 0.02 | 1.07 | 1.09 | 0.01 | 0.10 | 0.11 | 1.20 | 0.00 | 1.39 | 1.39 | 0.00 | 0.22 | 0.22 | **1.61** | 0.00 | 0.84 | 0.84 | 0.00 | 0.13 | 0.13 | **0.97** | |
| 7 | Solid Fuel | 0.10 | 1.73 | 1.83 | 0.00 | 0.00 | 0.00 | 1.83 | 0.00 | 2.10 | 2.10 | 0.00 | 0.00 | 0.00 | **2.10** | 0.00 | 2.10 | 2.10 | 0.00 | 0.00 | 0.00 | **2.10** | |
| 8 | Crude Oil | 0.00 | 3.14 | 3.14 | 0.00 | 0.07 | 0.07 | 3.21 | 0.00 | 9.33 | 9.33 | 0.00 | 0.39 | 0.39 | **9.72** | 0.00 | 10.64 | 10.64 | 0.00 | 0.46 | 0.46 | **11.10** | |
| 9 | Oil & Gas Products | 1.38 | 0.83 | 2.21 | 0.00 | 0.00 | 0.00 | 2.21 | 2.82 | 1.13 | 3.95 | 0.00 | 0.00 | 0.00 | **3.95** | 2.02 | 1.68 | 3.70 | 0.00 | 0.00 | 0.00 | **3.70** | |
| 10 | Chemical Products | 0.70 | 0.03 | 0.73 | 0.00 | 0.01 | 0.01 | 0.74 | 0.70 | 0.00 | 0.70 | 0.00 | 0.00 | 0.00 | **0.70** | 0.51 | 0.00 | 0.51 | 0.00 | 0.00 | 0.00 | **0.51** | |
| 11 | Chalk, Cement | 1.81 | 0.01 | 1.82 | 0.00 | 0.00 | 0.00 | 1.82 | 1.36 | 0.00 | 1.36 | 0.00 | 0.00 | 0.00 | **1.36** | 0.94 | 0.00 | 0.94 | 0.00 | 0.00 | 0.00 | **0.94** | |
| 12 | Ferrous & Non-ferrous Metals | 1.33 | 0.05 | 1.38 | 0.06 | 0.00 | 0.06 | 1.44 | 1.90 | 0.00 | 1.90 | 0.10 | 0.00 | 0.10 | **2.00** | 1.90 | 0.00 | 1.90 | 0.10 | 0.00 | 0.10 | **2.00** | |
| 13 | Manufactured Producs | 0.36 | 0.35 | 0.71 | 0.00 | 0.00 | 0.00 | 0.71 | 0.49 | 0.48 | 0.97 | 0.07 | 0.08 | 0.15 | **1.12** | 0.73 | 0.72 | 1.45 | 0.21 | 0.21 | 0.42 | **1.87** | |
| 14 | Other Cargoes | 0.62 | 0.09 | 0.71 | 0.04 | 0.01 | 0.05 | 0.76 | 0.84 | 0.13 | 0.97 | 0.13 | 0.02 | 0.15 | **1.12** | 1.26 | 0.19 | 1.45 | 0.36 | 0.05 | 0.41 | **1.86** | |
| | **Total** | **9.41** | **12.35** | **21.76** | **0.91** | **0.24** | **1.15** | **22.91** | **12.26** | **23.00** | **35.26** | **0.94** | **1.76** | **2.70** | **37.96** | **10.43** | **25.22** | **35.65** | **1.29** | **2.19** | **3.48** | **39.13** | |
| | | | | | | | | | | | | | | | | | | | | | | | |

Note.
1. Figure is rounded, thus a total may not equal to the sum.
2. Traffic demand of grains exports in Case 1 was reviewed and separated into net demand and annual fluctuation in the Feasibility Study. After that the imported and discharged to be unloaded were added to the exports by taking account of past data as 400,000 tons in maximum.
   500,000 tons of import together with 2,000,000 tons of export are considered for facility design.
3. Traffic demand of grain in Case 2 is the same vallues as the one studied in the Master Plan.

## Table 3.6.4 Summary: Type of Cargo by Target Year

Unit: Million tons

| No | Type of Cargo | 1999 | | | | 2010 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C1 | % | C2 | % | C1 | % | C2 | % | C1 | % | C2 | % |
| 1 | **General Cargo** | 4.04 | 18% | 4.04 | 18% | 4.98 | 11% | 5.14 | 14% | 3.54 | 7% | 3.76 | 10% |
| 2 | **Containerizable Cargo** | 2.11 | 9% | 2.11 | 9% | 3.97 | 9% | 3.19 | 8% | 7.25 | 14% | 5.32 | 14% |
| 3 | **Dry Bulk** | 10.75 | 47% | 10.75 | 47% | 17.60 | 41% | 15.30 | 40% | 20.94 | 39% | 14.51 | 37% |
| 4 | **Liquid Bulk** | 6.01 | 26% | 6.01 | 26% | 16.89 | 39% | 14.33 | 38% | 21.82 | 41% | 15.54 | 40% |
| | **Total** | 22.91 | 100% | 22.91 | 100% | 43.44 | 100% | 37.96 | 100% | 53.55 | 100% | 39.13 | 100% |

**Table 3.6.5 Summary of Containerisable Cargo (Tons) (1)**

Unit: Million tons

| No. | Case | Trade/ Transit | Year | | | Notes |
|---|---|---|---|---|---|---|
| | | | 1999 | 2010 | 2020 | |
| | | | Base year | Short Term | Master Plan | |
| 1 | **Case 1** | Trade | 2.03 | 3.55 | 6.08 | Export & Import |
| | | Transit | 0.08 | 0.42 | 1.17 | Including transshipment cargo |
| | | **Total** | **2.11** | **3.97** | **7.25** | |
| 2 | **Case 2** | Trade | 2.03 | 2.77 | 4.15 | Export & Import |
| | | Transit | 0.08 | 0.42 | 1.17 | Including transshipment cargo |
| | | **Total** | **2.11** | **3.19** | **5.32** | |
| 3 | Index | | 1.00 | 1.24 | 1.36 | Case 1/Case 2 |

**Table 3.6.6 Summary of Containerizable Cargo (Tons) (2)**

Unit: Million tons

| No. | Case | Trade/ Transit | Year | | | Notes |
|---|---|---|---|---|---|---|
| | | | 1999 | 2010 | 2020 | |
| | | | Base year | Short Term | Master Plan | |
| 1 | **Case 1** | Trade Export | 1.12 | 1.95 | 3.34 | |
| | | Trade Import | 0.91 | 1.60 | 2.74 | |
| | | Trade Total | 2.03 | 3.55 | 6.08 | |
| | | Transit Loaded | 0.07 | 0.23 | 0.65 | |
| | | Transit Discharged | 0.01 | 0.19 | 0.52 | |
| | | Transit Total | 0.08 | 0.42 | 1.17 | |
| | | **Total** | **2.11** | **3.97** | **7.25** | |
| 2 | **Case 2** | Trade Export | 1.12 | 1.52 | 2.28 | |
| | | Trade Import | 0.91 | 1.25 | 1.87 | |
| | | Trade Total | 2.03 | 2.77 | 4.15 | |
| | | Transit Loaded | 0.07 | 0.23 | 0.65 | |
| | | Transit Discharged | 0.01 | 0.19 | 0.52 | |
| | | Transit Total | 0.08 | 0.42 | 1.17 | |
| | | **Tatal** | **2.11** | **3.19** | **5.32** | |
| 3 | **Difference** | | | | | Balance between Case 1 and Case 2 |
| | | Trade Export | 0 | 0.43 | 1.06 | |
| | | Trade Import | 0 | 0.35 | 0.87 | |
| | | Trade Total | 0 | 0.78 | 1.93 | |
| | | Transit Loaded | 0 | 0 | 0 | |
| | | Transit Discharged | 0 | 0 | 0 | |
| | | Transit Total | 0 | 0 | 0 | |
| | | **Total** | **0** | **0.78** | **1.93** | |

## Table 3.6.7 Summary of Containerized Cargo (Tons) (1)

Unit: Million tons

| No. | Case | Trade/ Transit | Year 1999 Base year | 2010 Short Term | 2020 Master Plan | Notes |
|---|---|---|---|---|---|---|
| 1 | **Case 1** | Trade | | 2.84 | 5.47 | Export & Import |
| | | Transit | | 0.42 | 1.18 | Including transshipment cargo |
| | | **Total** | | **3.26** | **6.65** | |
| 2 | **Case 2** | Trade | | 2.22 | 3.73 | Export & Import |
| | | Transit | | 0.42 | 1.18 | Including transshipment cargo |
| | | **Total** | | **2.64** | **4.91** | |
| 3 | Index | | | 1.23 | 1.35 | Case 1/Case 2 |

Notes 1. Containerized cargo in tons = Containerization rate x Containerizable cargo (Tons)

## Table 3.6.8 Summary of Containerized Cargo (Tons) (2)

Unit: Million tons

| No. | Case | Trade/ Transit | Year 1999 Base year | 2010 Short Term | 2020 Master Plan | Notes |
|---|---|---|---|---|---|---|
| 1 | **Case 1** | Trade Export | | 1.56 | 3.00 | |
| | | Trade Import | | 1.28 | 2.47 | |
| | | Trade Total | | 2.84 | 5.47 | |
| | | Transit Loaded | | 0.18 | 0.59 | |
| | | Transit Discharged | | 0.15 | 0.48 | |
| | | Transit Total | | 0.34 | 1.07 | |
| | | **Total** | | **3.18** | **6.54** | |
| 2 | **Case 2** | Trade Export | | 1.22 | 2.05 | |
| | | Trade Import | | 1.00 | 1.68 | |
| | | Trade Total | | 2.22 | 3.73 | |
| | | Transit Loaded | | 0.18 | 0.59 | |
| | | Transit Discharged | | 0.15 | 0.48 | |
| | | Transit Total | | 0.33 | 1.07 | |
| | | **Total** | | **2.55** | **4.80** | |
| 3 | **Difference** | | | | | Balance between Case 1 and Case 2 |
| | | Trade Export | 0 | 0.34 | 0.95 | |
| | | Trade Import | 0 | 0.28 | 0.79 | |
| | | Trade Total | 0 | 0.62 | 1.74 | |
| | | Transit Loaded | 0 | 0 | 0 | |
| | | Transit Discharged | 0 | 0 | 0 | |
| | | Transit Total | 0 | 0.01 | 0 | |
| | | Total | 0 | 0.63 | 1.74 | |

Notes 1. Original data as show in Appendix.
2. Containerized cargo in tons = Containerization rate x Containerizable cargo (Tons)

## Table 3.6.9 Grand Summary of Cargo Traffic Demands: Containerized Cargo (TEUs)

Unit: 1000 TEUs

| | | | Year | | | |
|---|---|---|---|---|---|---|
| **No.** | **Scnario Case** | **Trade/ Transit** | **1999 Base year** | **2010 Short Term Development** | **2020 Master Plan Development** | **Notes** |
| 1 | **Case 1** | Trade | | 343.2 | 661.3 | Export & Import |
| | | Transit | | 40.5 | 128.7 | Including transshipment cargo |
| | | **Total** | | **383.7** | **790.0** | |
| 2 | **Case 2** | Trade | | 267.5 | 451.4 | Export & Import |
| | | Transit | | 40.5 | 128.7 | Including transshipment cargo |
| | | **Total** | | **308.0** | **580.1** | |
| 3 | Index | | | 1.25 | 1.36 | Case 1/Case 2 |

Notes 1. These figures include empty containers.
2. Empty container was counted as a balance between " In " and "Out '
3. Ten % allowance of empty is provided to the larger one between "In" and "Out".

4. These figures are of throughput. Actual move of boxes for th transit cargo will increase by 67% due to double handling at quay

## Table 3.6.10 Summary of Cargo Traffic Demands: Containerized Cargo (TEUs), (1)

Unit: 1,000 TEUs

| No. | Case | Trade/ Transit | Year 1999 Base year | Year 2010 Short Term | Year 2020 Master Plan | Notes |
|---|---|---|---|---|---|---|
| 1 | **Case 1** | Trade Export | | 171.6 | 330.7 | |
| | | Trade Import | | 171.6 | 330.7 | |
| | | Trade Total | | 343.2 | 661.4 | |
| | | Transit Loaded | | 20.2 | 64.4 | |
| | | Transit Discharged | | 20.2 | 64.4 | |
| | | Transit Total | | 40.4 | 128.8 | |
| | | **Total** | | **383.6** | **790.2** | |
| | | | | | | |
| 2 | **Case 2** | Trade Export | | 133.8 | 225.7 | |
| | | Trade Import | | 133.8 | 225.7 | |
| | | Trade Total | | 267.6 | 451.4 | |
| | | Transit Loaded | | 20.2 | 64.4 | |
| | | Transit Discharged | | 20.2 | 64.4 | |
| | | Transit Total | | 40.4 | 128.8 | |
| | | **Total** | | **308.0** | **580.2** | |
| | | | | | | |
| 3 | Difference | | | | | Balance between Case 1 and Case 2 |
| | | Trade Export | | 37.8 | 105.0 | |
| | | Trade Import | | 37.8 | 105.0 | |
| | | Trade Total | | 75.6 | 210.0 | |
| | | Transit Loaded | | 0.0 | 0.0 | |
| | | Transit Discharged | | 0.0 | 0.0 | |
| | | Transit Total | | 0.0 | 0.0 | |
| | | Total | | 75.6 | 210.0 | |

Notes 1. Empty containers are included. (*)

## Table 3.6.11 Summary of Cargo Traffic Demands: Containerized Cargo (TEUs), (2)

Unit: 1,000 TEUs

| No. | Case | Trade/ Transit | 1999 | Year 2010 | 2020 | Notes |
|---|---|---|---|---|---|---|
| | | | Base year | Short Term | Master Plan | |
| 1 | **Case 1** | Trade Export Ld. | | 156.0 | 300.6 | |
| | | Trade Export Ey. | | 15.6 | 30.1 | |
| | | Trade Import Ld. | | 128.0 | 246.6 | |
| | | Trade Import Ey. | | 43.6 | 84.1 | |
| | | Ld. | | 284.0 | 547.2 | |
| | | Ey. | | 59.2 | 114.1 | |
| | | **Trade Total** | | **343.2** | **661.3** | |
| | | Transit Loaded Ld. | | 18.4 | 58.5 | |
| | | Transit Loaded Ey. | | 1.8 | 5.9 | |
| | | Transit Discharged. Ld. | | 15.2 | 47.7 | |
| | | Transit Discharged. Ey. | | 5.0 | 16.7 | |
| | | Ld. | | 33.6 | 106.2 | |
| | | Ey. | | 6.9 | 22.5 | |
| | | **Transit Total** | | **40.5** | **128.7** | |
| | | Ld. | | 317.6 | 653.4 | |
| | | Ey. | | 66.1 | 136.6 | |
| | | **Total** | | **383.7** | **790.0** | |
| 2 | **Case 2** | Trade Export Ld. | | 121.6 | 205.2 | |
| | | Trade Export Ey. | | 12.2 | 20.5 | |
| | | Trade Import Ld. | | 100.0 | 168.3 | |
| | | Trade Import Ey. | | 33.8 | 57.4 | |
| | | Ld. | | 221.6 | 373.5 | |
| | | Ey. | | 45.9 | 77.9 | |
| | | **Trade Total** | | **267.5** | **451.4** | |
| | | Transit Loaded Ld. | | 18.4 | 58.5 | |
| | | Transit Loaded Ey. | | 1.8 | 5.9 | |
| | | Transit Discharged. Ld. | | 15.2 | 47.7 | |
| | | Transit Discharged. Ey. | | 5.0 | 16.7 | |
| | | Ld. | | 33.6 | 106.2 | |
| | | Ey. | | 6.9 | 22.5 | |
| | | **Transit Total** | | **40.5** | **128.7** | |
| | | Ld. | | 255.2 | 479.7 | |
| | | Ey. | | 52.8 | 100.4 | |
| | | **Total** | | **308.0** | **580.1** | |
| 3 | **Defference** | Trade Export Ld. | | 34.4 | 95.4 | |
| | | Trade Export Ey. | | 3.4 | 9.5 | |
| | | Trade Import Ld. | | 28.0 | 78.3 | |
| | | Trade Import Ey. | | 9.8 | 26.6 | |
| | | Ld. | | 62.4 | 173.7 | |
| | | Ey. | | 13.3 | 36.2 | |
| | | Trade Total | | 75.7 | 209.9 | |
| | | Transit Loaded Ld. | | 0.0 | 0.0 | |
| | | Transit Loaded Ey. | | 0.0 | 0.0 | |
| | | Transit Discharged. Ld. | | 0.0 | 0.0 | |
| | | Transit Discharged. Ey. | | 0.0 | 0.0 | |
| | | Ld. | | 0.0 | 0.0 | |
| | | Ey. | | 0.0 | 0.0 | |
| | | Transit Total | | 0.0 | 0.0 | |
| | | Ld. | | 62.4 | 173.7 | |
| | | Ey. | | 13.3 | 36.2 | |
| | | Total | | 75.7 | 209.9 | |
| | | | | | | |

Notes. 1. Ld: Laden Container, Ey: Empty Container

2. Empty container is counted as a balance between "In" and "Out".

## Table 3.6.12 Summary of Cargo Traffic Demands: Containerized Cargo (TEUs), CASE-1

| No. | Case | Trade/ Transit | Containerisable Cargo | Containerisation Rate | Containerized Cargo | Containerized Cargo |
|---|---|---|---|---|---|---|
| | | | Million Tons | % | Milion Tons | 1,000 TEUs |
| | | | 1 | 2 | 3=1 x 2 | 4=3/10t*1000 |
| **1** | **1999** | Trade Export Ld. | | | | |
| | | Trade Export Ey. | | | | |
| | | Trade Import Ld. | | | | |
| | | Trade Import Ey. | | | | |
| | | Ld. | | | | |
| | | Ey. | | | | |
| | | Trade Total | | | | |
| | | Transit Loaded Ld. | | | | |
| | | Transit Loaded Ey. | | | | |
| | | Transit Discharged. Ld. | | | | |
| | | Transit Discharged. Ey. | | | | |
| | | Ld. | | | | |
| | | Ey. | | | | |
| | | Transit Total | | | | |
| | | Ld. | | | | |
| | | Ey. | | | | |
| | | Total | | | | |
| **2** | **2010** | Trade Export Ld. | 1.95 | 80 | 1.56 | 156.0 |
| | **Short term** | Trade Export Ey. | 0 | | 0 | 15.6 |
| | | Trade Import Ld. | 1.60 | 80 | 1.28 | 128.0 |
| | | Trade Import Ey. | 0 | | | 43.6 |
| | | Ld. | 3.55 | | 2.84 | 284.0 |
| | | Ey. | 0 | | | 59.2 |
| | | **Trade Total** | **3.55** | | **2.84** | **343.2** |
| | | Transit Loaded Ld. | 0.23 | 80 | 0.18 | 18.4 |
| | | Transit Loaded Ey. | 0 | | 0 | 1.84 |
| | | Transit Discharged. Ld. | 0.19 | 80 | 0.15 | 15.2 |
| | | Transit Discharged. Ey. | 0 | | 0 | 5.0 |
| | | Ld. | 0.42 | | 0.34 | 33.6 |
| | | Ey. | 0 | | 0 | 6.88 |
| | | **Transit Total** | **0.42** | | **0.34** | **40.5** |
| | | Ld. | 3.97 | | 3.18 | 317.6 |
| | | Ey. | 0 | | 0.00 | 66.1 |
| | | **Total** | **3.97** | | **3.18** | **383.7** |
| **3** | **2020** | Trade Export Ld. | 3.34 | 90 | 3.01 | 300.6 |
| | **Long term** | Trade Export Ey. | 0 | | 0 | 30.1 |
| | | Trade Import Ld. | 2.74 | 90 | 2.47 | 246.6 |
| | | Trade Import Ey. | 0 | | 0 | 84.1 |
| | | Ld. | 6.08 | | 5.47 | 547.2 |
| | | Ey. | 0 | | 0 | 114.1 |
| | | **Trade Total** | **6.08** | | **5.47** | **661.3** |
| | | Transit Loaded Ld. | 0.65 | 90 | 0.59 | 58.5 |
| | | Transit Loaded Ey. | 0 | | 0 | 5.9 |
| | | Transit Discharged. Ld. | 0.53 | 90 | 0.48 | 47.7 |
| | | Transit Discharged. Ey. | 0 | | 0.00 | 16.7 |
| | | Ld. | 1.18 | | 1.06 | 106.2 |
| | | Ey. | 0 | | 0 | 22.5 |
| | | **Transit Total** | **1.18** | | **1.06** | **128.7** |
| | | Ld. | 7.26 | | 6.53 | 653.4 |
| | | Ey. | 0 | | 0 | 136.6 |
| | | **Total** | **7.26** | | **6.53** | **790.0** |

Notes. 1. Ld: Laden Container, Ey: Empty Container
2. Empty container is counted as a balance between "In" and "Out".

## Table 3.6.13 Summary of Cargo Traffic Demands: Containerized Cargo (TEUs), CASE-2

| No. | Scenario Case | Trade/ Transit | Containerisable Cargo Tons | Containerisation Rate % | Containerized Cargo Million Tons | Containerized Cargo 1,000 TEUs |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3=1 x 2 | 4=3/10t*1000 |
| **1** | **1999** | Trade Export Ld. | | | | |
| | | Trade Export Ey. | | | | |
| | | Trade Import Ld. | | | | |
| | | Trade Import Ey. | | | | |
| | | Ld. | | | | |
| | | Ey. | | | | |
| | | Trade Total | | | | |
| | | Transit Loaded Ld. | | | | |
| | | Transit Loaded Ey. | | | | |
| | | Transit Discharged. Ld. | | | | |
| | | Transit Discharged. Ey. | | | | |
| | | Ld. | | | | |
| | | Ey. | | | | |
| | | Transit Total | | | | |
| | | Ld. | | | | |
| | | Ey. | | | | |
| | | Total | | | | |
| **2** | **2010** | Trade Export Ld. | 1.52 | 80 | 1.22 | 121.6 |
| | **Short term** | Trade Export Ey. | 0 | | 0.0 | 12.2 |
| | | Trade Import Ld. | 1.25 | 80 | 1.00 | 100.0 |
| | | Trade Import Ey. | 0 | | 0 | 33.8 |
| | | Ld. | 2.77 | | 2.22 | 221.6 |
| | | Ey. | 0 | | 0 | 45.92 |
| | | **Trade Total** | **2.77** | | **2.22** | **267.5** |
| | | Transit Loaded Ld. | 0.23 | 80 | 0.18 | 18.4 |
| | | Transit Loaded Ey. | 0 | | 0 | 1.8 |
| | | Transit Discharged. Ld. | 0.19 | 80 | 0.15 | 15.2 |
| | | Transit Discharged. Ey. | 0 | | 0 | 5.0 |
| | | Ld. | 0.42 | | 0.34 | 33.6 |
| | | Ey. | 0 | | 0 | 6.9 |
| | | **Transit Total** | **0.42** | | **0.34** | **40.5** |
| | | Ld. | 3.19 | | 2.55 | 255.2 |
| | | Ey. | 0 | | 0 | 52.8 |
| | | **Total** | **3.19** | | **2.55** | **308.0** |
| **3** | **2020** | Trade Export Ld. | 2.28 | 90 | 2.05 | 205.2 |
| | **Long term** | Trade Export Ey. | 0 | | 0 | 20.5 |
| | | Trade Import Ld. | 1.87 | 90 | 1.68 | 168.3 |
| | | Trade Import Ey. | 0 | | 0 | 57.4 |
| | | Ld. | 4.15 | | 3.74 | 373.5 |
| | | Ey. | 0 | | 0 | 77.9 |
| | | **Trade Total** | **4.15** | | **3.74** | **451.4** |
| | | Transit Loaded Ld. | 0.65 | 90 | 0.59 | 58.5 |
| | | Transit Loaded Ey. | 0 | | 0 | 5.9 |
| | | Transit Discharged. Ld. | 0.53 | 90 | 0.48 | 47.7 |
| | | Transit Discharged. Ey. | 0 | | 0 | 16.7 |
| | | Ld. | 1.18 | | 1.06 | 106.2 |
| | | Ey. | 0 | | 0 | 22.5 |
| | | **Transit Total** | **1.18** | | **1.06** | **128.7** |
| | | Ld. | 5.33 | | 4.80 | 479.7 |
| | | Ey. | 0 | | 0 | 100.4 |
| | | **Total** | **5.33** | | **4.80** | **580.1** |

Notes. 1. Ld: Laden Container, Ey: Empty Container
2. Empty container is counted as a balance between "In" and "Out".
3. Unit load per container , assuming 10 tons / TEU

# Table 3.6.14 Conatiner Cargo Calculation Sheet : Case 1 : High Scenario

Unit : 1,000 TEUs

| | | | Containerizable Cargo | | | | | | | Containerization Rate | | | | Containerized Cargo | | | | | | | Containerized Cargo | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Trade | | | Trans. | | | | Trade | | Trans. | | | Trade | | | Trans. | | | | | | | Trade | | | | | Trans. | | | | Total | | |
| | | | Exp. | Imp. | S-ttl | Load. | Disc. | S-ttl | Total | Exp. | Imp. | Load. | Disc. | Exp. | Imp. | S-ttl | Load. | Disc. | S-ttl | Total | Exp. | Exp. | Imp. | Imp. | | | S-ttl | Load. | Load. | Disc. | Disc. | | | S-ttl | | | Notes |
| | | | | 10^6 | | | 10^6 | | | | | | | | 10^6 | | | 10^6 | | | | Ld. | Ey. | Ld. | Ey. | Ld. | Ey. | | Ld. | Ey. | Ld. | Ey. | | | | | |
| No. | No. | Year | t | t | t | t | t | t | t | % | % | % | % | t | t | t | t | t | t | t | teu | teu | teu | teu | teu | teu | teu | teu | teu | teu | teu | teu | teu | teu | |
| | | | 1 | 2 | 3 | 4* | 5* | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 19' | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 27' | 28 | 29 | 30 | 31 | 32 | 33 | |
| | | | FT | FT | 1+2 | FT | FT | 4+5 | 3+6 | | | | | 1*8 | 2*9 | 12+13 | 4*10 | 5*11 | 15+16 | 14+17 | 12/10t | 10%x19 | 13/10t | 1.1*19-2( | 19+20 | 19'+21 | 22+23 | 15/10t | 0.1*25 | 16/10t | 1*25-2 | 25+27 | 26+27' | 28+29 | 22+28 | 23+29 | 31+32 | |
| | | 1991 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1992 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1993 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1994 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1995 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1996 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1997 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1998 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1999 | 1.12 | 0.92 | 2.04 | 0 | 0 | 0 | 2.04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | Base Year |
| | | 2000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2000 | 1.14 | 0.94 | 2.08 | 0 | 0 | 0 | 2.08 | 45 | 45 | 45 | 45 | 0.51 | 0.42 | 0.94 | 0.00 | 0.00 | 0.00 | 0.94 | 51.3 | 5.1 | 42.3 | 14.1 | 93.6 | 19.3 | 112.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 93.6 | 19.3 | 112.9 | |
| 1 | | 2001 | 1.18 | 0.97 | 2.15 | 0 | 0 | 0 | 2.15 | 49 | 49 | 49 | 49 | 0.58 | 0.48 | 1.05 | 0.00 | 0.00 | 0.00 | 1.05 | 57.8 | 5.8 | 47.5 | 16.1 | 105.4 | 21.9 | 127.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 105.4 | 21.9 | 127.2 | |
| 2 | | 2002 | 1.24 | 1.02 | 2.26 | 0 | 0 | 0 | 2.26 | 52 | 52 | 52 | 52 | 0.64 | 0.53 | 1.18 | 0.00 | 0.00 | 0.00 | 1.18 | 64.5 | 6.4 | 53.0 | 17.9 | 117.5 | 24.3 | 141.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 117.5 | 24.3 | 141.9 | |
| 3 | | 2003 | 1.30 | 1.07 | 2.37 | 0 | 0 | 0 | 2.37 | 56 | 56 | 56 | 56 | 0.73 | 0.60 | 1.33 | 0.00 | 0.00 | 0.00 | 1.33 | 72.8 | 7.3 | 59.9 | 20.2 | 132.7 | 27.4 | 160.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 132.7 | 27.4 | 160.2 | |
| 4 | | 2004 | 1.38 | 1.13 | 2.51 | 0 | 0 | 0 | 2.51 | 59 | 59 | 59 | 59 | 0.81 | 0.67 | 1.48 | 0.00 | 0.00 | 0.00 | 1.48 | 81.4 | 8.1 | 66.7 | 22.9 | 148.1 | 31.0 | 179.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 148.1 | 31.0 | 179.1 | |
| 5 | | 2005 | 1.46 | 1.20 | 2.66 | 0.11 | 0.09 | 0.20 | 2.86 | 63 | 63 | 63 | 63 | 0.92 | 0.76 | 1.68 | 0.07 | 0.06 | 0.13 | 1.80 | 92.0 | 9.2 | 75.6 | 25.6 | 167.6 | 34.8 | 202.4 | 6.9 | 0.7 | 5.7 | 2.0 | 12.6 | 2.6 | 15.2 | 180.2 | 37.4 | 217.6 | |
| 6 | 1 | 2006 | 1.55 | 1.27 | 2.82 | 0.13 | 0.11 | 0.24 | 3.06 | 66 | 66 | 66 | 66 | 1.02 | 0.84 | 1.86 | 0.09 | 0.07 | 0.16 | 2.02 | 102.3 | 10.2 | 83.8 | 28.7 | 186.1 | 38.9 | 225.1 | 8.6 | 0.9 | 7.3 | 2.2 | 15.8 | 3.0 | 18.9 | 202.0 | 42.0 | 243.9 | |
| 7 | 2 | 2007 | 1.64 | 1.35 | 2.99 | 0.15 | 0.12 | 0.27 | 3.26 | 70 | 70 | 70 | 70 | 1.15 | 0.95 | 2.09 | 0.11 | 0.08 | 0.19 | 2.28 | 114.8 | 11.5 | 94.5 | 31.8 | 209.3 | 43.3 | 252.6 | 10.5 | 1.1 | 8.4 | 3.2 | 18.9 | 4.2 | 23.1 | 228.2 | 47.5 | 275.7 | |
| 8 | 3 | 2008 | 1.74 | 1.43 | 3.17 | 0.17 | 0.14 | 0.31 | 3.48 | 73 | 73 | 73 | 73 | 1.27 | 1.04 | 2.31 | 0.12 | 0.10 | 0.23 | 2.54 | 127.0 | 12.7 | 104.4 | 35.3 | 231.4 | 48.0 | 279.4 | 12.4 | 1.2 | 10.2 | 3.4 | 22.6 | 4.7 | 27.3 | 254.0 | 52.7 | 306.7 | |
| 9 | 4 | 2009 | 1.84 | 1.51 | 3.35 | 0.20 | 0.17 | 0.37 | 3.72 | 77 | 77 | 77 | 77 | 1.42 | 1.16 | 2.58 | 0.15 | 0.13 | 0.28 | 2.86 | 141.7 | 14.2 | 116.3 | 39.6 | 258.0 | 53.7 | 311.7 | 15.4 | 1.5 | 13.1 | 3.9 | 28.5 | 5.4 | 33.9 | 286.4 | 59.1 | 345.6 | |
| 10 | 5 | 2010 | 1.95 | 1.60 | 3.55 | 0.23 | 0.19 | 0.42 | 3.97 | 80 | 80 | 80 | 80 | 1.56 | 1.28 | 2.84 | 0.18 | 0.15 | 0.34 | 3.18 | 156.0 | 15.6 | 128.0 | 43.6 | 284.0 | 59.2 | 343.2 | 18.4 | 1.8 | 15.2 | 5.0 | 33.6 | 6.9 | 40.5 | 317.6 | 66.1 | 383.7 | Short term Stage |
| 11 | 6 | 2011 | 2.07 | 1.70 | 3.77 | 0.25 | 0.21 | 0.46 | 4.23 | 81 | 81 | 81 | 81 | 1.68 | 1.38 | 3.05 | 0.20 | 0.17 | 0.37 | 3.43 | 167.7 | 16.8 | 137.7 | 46.7 | 305.4 | 63.5 | 368.9 | 20.3 | 2.0 | 17.0 | 5.3 | 37.3 | 7.3 | 44.6 | 342.6 | 70.8 | 413.4 | |
| 12 | 7 | 2012 | 2.20 | 1.80 | 4.00 | 0.28 | 0.23 | 0.51 | 4.51 | 82 | 82 | 82 | 82 | 1.80 | 1.48 | 3.28 | 0.23 | 0.19 | 0.42 | 3.70 | 180.4 | 18.0 | 147.6 | 50.8 | 328.0 | 68.9 | 396.9 | 23.0 | 2.3 | 18.9 | 6.4 | 41.8 | 8.7 | 50.5 | 369.8 | 77.6 | 447.4 | |
| 13 | 8 | 2013 | 2.33 | 1.91 | 4.24 | 0.31 | 0.25 | 0.56 | 4.80 | 83 | 83 | 83 | 83 | 1.93 | 1.59 | 3.52 | 0.26 | 0.21 | 0.46 | 3.98 | 193.4 | 19.3 | 158.5 | 54.2 | 351.9 | 73.5 | 425.5 | 25.7 | 2.6 | 20.8 | 7.6 | 46.5 | 10.1 | 56.6 | 398.4 | 83.7 | 482.1 | |
| 14 | 9 | 2014 | 2.47 | 2.03 | 4.50 | 0.34 | 0.27 | 0.61 | 5.11 | 84 | 84 | 84 | 84 | 2.07 | 1.71 | 3.78 | 0.29 | 0.23 | 0.51 | 4.29 | 207.5 | 20.7 | 170.5 | 57.7 | 378.0 | 78.5 | 456.5 | 28.6 | 2.9 | 22.7 | 8.7 | 51.2 | 11.6 | 62.8 | 429.2 | 90.0 | 519.3 | |
| 15 | 10 | 2015 | 2.62 | 2.15 | 4.77 | 0.37 | 0.30 | 0.67 | 5.44 | 85 | 85 | 85 | 85 | 2.23 | 1.83 | 4.05 | 0.31 | 0.26 | 0.57 | 4.62 | 222.7 | 22.3 | 182.8 | 62.2 | 405.5 | 84.5 | 489.9 | 31.5 | 3.1 | 25.5 | 9.1 | 57.0 | 12.2 | 69.2 | 462.4 | 96.7 | 559.1 | |
| 16 | 11 | 2016 | 2.77 | 2.28 | 5.05 | 0.41 | 0.34 | 0.75 | 5.80 | 86 | 86 | 86 | 86 | 2.38 | 1.96 | 4.34 | 0.35 | 0.29 | 0.65 | 4.99 | 238.2 | 23.8 | 196.1 | 66.0 | 434.3 | 89.8 | 524.1 | 35.3 | 3.5 | 29.2 | 9.5 | 64.5 | 13.1 | 77.6 | 498.8 | 102.9 | 601.7 | |
| 17 | 12 | 2017 | 2.92 | 2.40 | 5.32 | 0.47 | 0.38 | 0.85 | 6.17 | 87 | 87 | 87 | 87 | 2.54 | 2.09 | 4.63 | 0.41 | 0.33 | 0.74 | 5.37 | 254.0 | 25.4 | 208.8 | 70.6 | 462.8 | 96.0 | 558.9 | 40.9 | 4.1 | 33.1 | 11.9 | 74.0 | 16.0 | 90.0 | 536.8 | 112.1 | 648.8 | |
| 18 | 13 | 2018 | 3.07 | 2.52 | 5.59 | 0.52 | 0.43 | 0.95 | 6.54 | 88 | 88 | 88 | 88 | 2.70 | 2.22 | 4.92 | 0.46 | 0.38 | 0.84 | 5.76 | 270.2 | 27.0 | 221.8 | 75.4 | 491.9 | ##### | 594.4 | 45.8 | 4.6 | 37.8 | 12.5 | 83.6 | 17.1 | 100.7 | 575.5 | 119.5 | 695.0 | |
| 19 | 14 | 2019 | 3.21 | 2.64 | 5.85 | 0.58 | 0.48 | 1.06 | 6.91 | 89 | 89 | 89 | 89 | 2.86 | 2.35 | 5.21 | 0.52 | 0.43 | 0.94 | 6.15 | 285.7 | 28.6 | 235.0 | 79.3 | 520.7 | ##### | 628.5 | 51.6 | 5.2 | 42.7 | 14.1 | 94.3 | 19.2 | 113.6 | 615.0 | 127.1 | 742.1 | |
| 20 | 15 | 2020 | 3.34 | 2.74 | 6.08 | 0.65 | 0.53 | 1.18 | 7.26 | 90 | 90 | 90 | 90 | 3.01 | 2.47 | 5.47 | 0.59 | 0.48 | 1.06 | 6.53 | 300.6 | 30.1 | 246.6 | 84.1 | 547.2 | ##### | 661.3 | 58.5 | 5.9 | 47.7 | 16.7 | 106.2 | 22.5 | 128.7 | 653.4 | 136.6 | 790.0 | Master Plan Stage |
| 25 | 20 | 2025 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 25 | 2030 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | 30 | 2035 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 35 | 2040 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note 1 Ld.: Laden, Ey: Empty

2 Empty container is balance between "In" and "Out". For example: 1.1*Export-Import=Import Empty 1.1*Load -Discharge= Empty
10% allowance is considered for empty to the larger one. 0.1*Export= Export Empty 0.1*Load=Load Empty

3 10 tons per unit TEU

4 FT: Forecasted general cargo traffic (Containerizable cargo) as indicated in Case 1-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

5 4*: Containerizable Cargo x Capture Ratio , 'Data in Transit Loaded' in Case 1-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

6 5*: Containerizable Cargo x Capture Ratio , 'Data in Transit Di9scharged' in Case 1-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

7 Containerization rate is as indicated in Case 1-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

# Table 3.6.15 Conatiner Cargo Calculation Sheet : Case 2 : Medium Scenario

Unit : 1,000 TEUs

| No. | No. | Year | Containerizable Cargo | | | | | | | Containerization Rate | | | | Containerized Cargo | | | | | | | Containerized Cargo | | | | | | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Exp. | Trade Imp. 10^6 t | S-ttl | Load. | Trans. Disc. 10^6 t | S-ttl | Total | Trade Exp. | Trade Imp. | Trans. Load. | Trans. Disc. | Exp. | Trade Imp. 10^6 t | S-ttl | Load. | Trans. Disc. 10^6 t | S-ttl | Total | Exp. Ld. teu | Exp. Ey. teu | Imp. Ld. teu | Trade Imp. Ey. teu | Ld. teu | Ey. teu | S-ttl | Load. Ld. teu | Load. Ey. teu | Trans. Disc. Ld. teu | Disc. Ey. teu | Ld. teu | Ey. teu | S-ttl | Total Ld. teu | Total Ey. teu | Total teu | |
| | | | t | t | t | t | t | t | t | % | % | % | % | t | t | t | t | t | t | t | 19 | 19' | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 27' | 28 | 29 | 30 | 31 | 32 | 33 | |
| | | | MD | MD | 1+2 | | | 4+5 | 3+6 | | | | | 1*8 | 2*9 | 12+13 | 4*10 | 5*11 | 15+16 | 14+17 | 12/10t | 10%x19 | 13/10t | 19-20 | 19+20 | 19'+21 | 22+23 | 15/10t | 25-27 | 16/10t | 1*25-2 | 25+27 | 26+27' | 28+29 | 22+28 | 23+29 | 31+32 | |
| | | 1991 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1992 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1993 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1994 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1995 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1996 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1997 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1998 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1999 | 1.12 | 0.92 | 2.04 | 0 | 0 | 0 | 2.04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | Base Year |
| | | 2000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2000 | 1.14 | 0.94 | 2.08 | 0 | 0 | 0 | 2.08 | 45 | 45 | 45 | 45 | 0.51 | 0.42 | 0.94 | 0.00 | 0.00 | 0.00 | 0.94 | 51.3 | 5.1 | 42.3 | 14.1 | 93.6 | 19.3 | 112.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 93.6 | 19.3 | 112.9 | |
| 1 | | 2001 | 1.18 | 0.97 | 2.15 | 0 | 0 | 0 | 2.15 | 49 | 49 | 49 | 49 | 0.58 | 0.48 | 1.05 | 0.00 | 0.00 | 0.00 | 1.05 | 57.8 | 5.8 | 47.5 | 16.1 | 105.4 | 21.9 | 127.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 105.4 | 21.9 | 127.2 | |
| 2 | | 2002 | 1.21 | 0.99 | 2.2 | 0 | 0 | 0 | 2.2 | 52 | 52 | 52 | 52 | 0.63 | 0.51 | 1.14 | 0.00 | 0.00 | 0.00 | 1.14 | 62.9 | 6.3 | 51.5 | 17.7 | 114.4 | 24.0 | 138.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 114.4 | 24.0 | 138.4 | |
| 3 | | 2003 | 1.24 | 1.02 | 2.26 | 0 | 0 | 0 | 2.26 | 56 | 56 | 56 | 56 | 0.69 | 0.57 | 1.27 | 0.00 | 0.00 | 0.00 | 1.27 | 69.4 | 6.9 | 57.1 | 19.3 | 126.6 | 26.2 | 152.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 126.6 | 26.2 | 152.8 | |
| 4 | | 2004 | 1.27 | 1.05 | 2.32 | 0 | 0 | 0 | 2.32 | 59 | 59 | 59 | 59 | 0.75 | 0.62 | 1.37 | 0.00 | 0.00 | 0.00 | 1.37 | 74.9 | 7.5 | 62.0 | 20.5 | 136.9 | 28.0 | 164.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 136.9 | 28.0 | 164.8 | |
| 5 | | 2005 | 1.31 | 1.07 | 2.38 | 0.11 | 0.09 | 0.20 | 2.58 | 63 | 63 | 63 | 63 | 0.83 | 0.67 | 1.50 | 0.07 | 0.06 | 0.13 | 1.63 | 82.5 | 8.3 | 67.4 | 23.4 | 149.9 | 31.6 | 181.6 | 6.9 | 0.7 | 5.7 | 2.0 | 12.6 | 2.6 | 15.2 | 162.5 | 34.3 | 196.8 | |
| 6 | 1 | 2006 | 1.35 | 1.11 | 2.46 | 0.13 | 0.11 | 0.24 | 2.70 | 66 | 66 | 66 | 66 | 0.89 | 0.73 | 1.62 | 0.09 | 0.07 | 0.16 | 1.78 | 89.1 | 8.9 | 73.3 | 24.8 | 162.4 | 33.7 | 196.0 | 8.6 | 0.9 | 7.3 | 2.2 | 15.8 | 3.0 | 18.9 | 178.2 | 36.7 | 214.9 | |
| 7 | 2 | 2007 | 1.39 | 1.14 | 2.53 | 0.15 | 0.12 | 0.27 | 2.80 | 70 | 70 | 70 | 70 | 0.97 | 0.80 | 1.77 | 0.11 | 0.08 | 0.19 | 1.96 | 97.3 | 9.7 | 79.8 | 27.2 | 177.1 | 37.0 | 214.1 | 10.5 | 1.1 | 8.4 | 3.2 | 18.9 | 4.2 | 23.1 | 196.0 | 41.2 | 237.2 | |
| 8 | 3 | 2008 | 1.43 | 1.18 | 2.61 | 0.17 | 0.14 | 0.31 | 2.92 | 73 | 73 | 73 | 73 | 1.04 | 0.86 | 1.91 | 0.12 | 0.10 | 0.23 | 2.13 | 104.4 | 10.4 | 86.1 | 28.7 | 190.5 | 39.1 | 229.7 | 12.4 | 1.2 | 10.2 | 3.4 | 22.6 | 4.7 | 27.3 | 213.2 | 43.8 | 257.0 | |
| 9 | 4 | 2009 | 1.48 | 1.21 | 2.69 | 0.20 | 0.17 | 0.37 | 3.06 | 77 | 77 | 77 | 77 | 1.14 | 0.93 | 2.07 | 0.15 | 0.13 | 0.28 | 2.36 | 114.0 | 11.4 | 93.2 | 32.2 | 207.1 | 43.6 | 250.7 | 15.4 | 1.5 | 13.1 | 3.9 | 28.5 | 5.4 | 33.9 | 235.6 | 49.0 | 284.6 | |
| 10 | 5 | 2010 | 1.52 | 1.25 | 2.77 | 0.23 | 0.19 | 0.42 | 3.19 | 80 | 80 | 80 | 80 | 1.22 | 1.00 | 2.22 | 0.18 | 0.15 | 0.34 | 2.55 | 121.6 | 12.2 | 100.0 | 33.8 | 221.6 | 45.9 | 267.5 | 18.4 | 1.8 | 15.2 | 5.0 | 33.6 | 6.9 | 40.5 | 255.2 | 52.8 | 308.0 | Short term Stage |
| 11 | 6 | 2011 | 1.58 | 1.30 | 2.88 | 0.25 | 0.21 | 0.46 | 3.34 | 81 | 81 | 81 | 81 | 1.28 | 1.05 | 2.33 | 0.20 | 0.17 | 0.37 | 2.71 | 128.0 | 12.8 | 105.3 | 35.5 | 233.3 | 48.3 | 281.6 | 20.3 | 2.0 | 17.0 | 5.3 | 37.3 | 7.3 | 44.6 | 270.5 | 55.6 | 326.1 | |
| 12 | 7 | 2012 | 1.63 | 1.34 | 2.97 | 0.28 | 0.23 | 0.51 | 3.48 | 82 | 82 | 82 | 82 | 1.34 | 1.10 | 2.44 | 0.23 | 0.19 | 0.42 | 2.85 | 133.7 | 13.4 | 109.9 | 37.1 | 243.5 | 50.5 | 294.1 | 23.0 | 2.3 | 18.9 | 6.4 | 41.8 | 8.7 | 50.5 | 285.4 | 59.2 | 344.6 | |
| 13 | 8 | 2013 | 1.69 | 1.39 | 3.08 | 0.31 | 0.25 | 0.56 | 3.64 | 83 | 83 | 83 | 83 | 1.40 | 1.15 | 2.56 | 0.26 | 0.21 | 0.46 | 3.02 | 140.3 | 14.0 | 115.4 | 38.9 | 255.6 | 53.0 | 308.6 | 25.7 | 2.6 | 20.8 | 7.6 | 46.5 | 10.1 | 56.6 | 302.1 | 63.1 | 365.2 | |
| 14 | 9 | 2014 | 1.75 | 1.44 | 3.19 | 0.34 | 0.27 | 0.61 | 3.80 | 84 | 84 | 84 | 84 | 1.47 | 1.21 | 2.68 | 0.29 | 0.23 | 0.51 | 3.19 | 147.0 | 14.7 | 121.0 | 40.7 | 268.0 | 55.4 | 323.4 | 28.6 | 2.9 | 22.7 | 8.7 | 51.2 | 11.6 | 62.8 | 319.2 | 67.0 | 386.2 | |
| 15 | 10 | 2015 | 1.82 | 1.49 | 3.31 | 0.37 | 0.30 | 0.67 | 3.98 | 85 | 85 | 85 | 85 | 1.55 | 1.27 | 2.81 | 0.31 | 0.26 | 0.57 | 3.38 | 154.7 | 15.5 | 126.7 | 43.5 | 281.4 | 59.0 | 340.3 | 31.5 | 3.1 | 25.5 | 9.1 | 57.0 | 12.2 | 69.2 | 338.3 | 71.2 | 409.5 | |
| 16 | 11 | 2016 | 1.90 | 1.56 | 3.46 | 0.41 | 0.34 | 0.75 | 4.21 | 86 | 86 | 86 | 86 | 1.63 | 1.34 | 2.98 | 0.35 | 0.29 | 0.65 | 3.62 | 163.4 | 16.3 | 134.2 | 45.6 | 297.6 | 61.9 | 359.5 | 35.3 | 3.5 | 29.2 | 9.5 | 64.5 | 13.1 | 77.6 | 362.1 | 75.0 | 437.1 | |
| 17 | 12 | 2017 | 1.99 | 1.63 | 3.62 | 0.47 | 0.38 | 0.85 | 4.47 | 87 | 87 | 87 | 87 | 1.73 | 1.42 | 3.15 | 0.41 | 0.33 | 0.74 | 3.89 | 173.1 | 17.3 | 141.8 | 48.6 | 314.9 | 65.9 | 380.9 | 40.9 | 4.1 | 33.1 | 11.9 | 74.0 | 16.0 | 90.0 | 388.9 | 82.0 | 470.8 | |
| 18 | 13 | 2018 | 2.08 | 1.71 | 3.79 | 0.52 | 0.43 | 0.95 | 4.74 | 88 | 88 | 88 | 88 | 1.83 | 1.50 | 3.34 | 0.46 | 0.38 | 0.84 | 4.17 | 183.0 | 18.3 | 150.5 | 50.9 | 333.5 | 69.2 | 402.7 | 45.8 | 4.6 | 37.8 | 12.5 | 83.6 | 17.1 | 100.7 | 417.1 | 86.2 | 503.4 | |
| 19 | 14 | 2019 | 2.18 | 1.79 | 3.97 | 0.58 | 0.48 | 1.06 | 5.03 | 89 | 89 | 89 | 89 | 1.94 | 1.59 | 3.53 | 0.52 | 0.43 | 0.94 | 4.48 | 194.0 | 19.4 | 159.3 | 54.1 | 353.3 | 73.5 | 426.8 | 51.6 | 5.2 | 42.7 | 14.1 | 94.3 | 19.2 | 113.6 | 447.7 | 92.7 | 540.4 | |
| 20 | 15 | 2020 | 2.28 | 1.87 | 4.15 | 0.65 | 0.53 | 1.18 | 5.33 | 90 | 90 | 90 | 90 | 2.05 | 1.68 | 3.74 | 0.59 | 0.48 | 1.06 | 4.80 | 205.2 | 20.5 | 168.3 | 57.4 | 373.5 | 77.9 | 451.4 | 58.5 | 5.9 | 47.7 | 16.7 | 106.2 | 22.5 | 128.7 | 479.7 | 100.4 | 580.1 | Master Plan Stage |
| 25 | 20 | 2025 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 25 | 2030 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | 30 | 2035 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 35 | 2040 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note 1 Ld.: Laden, Ey: Empty

2 Empty container is balance between "In-laden" and "Out-laden ". For example: 1.1*Export-import=Empty 1.1*Load -Discharge= Empty
10% allowance is considered for empty to the larger one. 0.1*Export= Export Empty 0.1*Load=Load Empty

3 10 tons per unit TEU

4 FT: Forecasted general cargo traffic (Containerizable cargo) as indicated in Case 2-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

5 4*: Containerizable Cargo x Capture Ratio , 'Data in Transit Loaded' in Case 2-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

6 5*: Containerizable Cargo x Capture Ratio , 'Data in Transit Di9scharged' in Case 2-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

7 Containerization rate is as indicated in Case 2-Total Traffic Demand Forecast ( Micro and Macro Analysis ) of Appendix 3.5.

**Figure 3.6.1 Maritime Traffic by Commodity: 1994-2020: Case 1, High** Unit: Million tons

| Commodity | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | *2000 | 2001 | 2005 | 2010 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cereals ( Bulk Grains)** | 0.45 | 1.20 | 1.73 | 0.72 | 1.33 | 1.76 | **0.72** | 2.08 | 2.94 | **4.66** | **6.73** |
| Foods Beverages Tobacco | 0.43 | 0.61 | 0.78 | 0.43 | 0.71 | 0.64 | **0.71** | 0.64 | 0.86 | **1.19** | **2.17** |
| Timber, charcoal | 0.26 | 0.30 | 0.37 | 0.51 | 0.55 | 0.64 | **0.75** | 0.77 | 1.13 | **1.13** | **0.68** |
| Natural/chemical fertilizer | 1.88 | 2.73 | 2.85 | 1.68 | 0.81 | 1.08 | **1.43** | 1.04 | 1.00 | **1.04** | **1.43** |
| Iron ore, scraps | 3.49 | 5.05 | 5.09 | 5.17 | 5.67 | 4.87 | **5.48** | 5.77 | 7.32 | **8.69** | **9.64** |
| Non ferrous ores | 0.88 | 0.85 | 1.16 | 1.12 | 0.98 | 1.20 | **2.23** | 1.35 | 1.95 | **1.95** | **1.17** |
| Solid fuel (coal,coke etc) | 2.55 | 3.21 | 3.32 | 4.02 | 2.72 | 1.84 | **1.13** | 1.76 | 1.90 | **2.11** | **2.55** |
| Crude oil | 8.08 | 8.66 | 7.87 | 7.07 | 6.70 | 3.21 | **2.61** | 8.97 | 10.37 | **12.31** | **16.86** |
| Oil and gas products | 4.82 | 5.20 | 5.37 | 4.68 | 3.77 | 2.21 | **2.72** | 4.44 | 4.09 | **3.84** | **4.04** |
| Chemical products | 0.92 | 0.91 | 0.87 | 0.95 | 0.76 | 0.75 | **1.25** | 0.74 | 0.91 | **0.67** | **0.36** |
| Chalk, cement and | 2.22 | 2.33 | 1.88 | 2.02 | 1.73 | 1.82 | **1.81** | 1.73 | 1.41 | **1.07** | **0.64** |
| Ferrous/non ferrous metals | 1.89 | 1.83 | 1.24 | 2.01 | 1.69 | 1.45 | **1.17** | 1.45 | 1.68 | **2.00** | **2.00** |
| Manufactured products | 0.36 | 0.58 | 0.73 | 0.54 | 0.75 | 0.71 | **0.03** | 0.75 | 1.00 | **1.39** | **2.54** |
| Other cargoes(fruits,seeds oil, etc) | | | | | | 0.77 | **1.58** | 0.73 | 1.00 | **1.39** | **2.54** |
| **Total Maritime Traffic** | **28.23** | **33.46** | **33.26** | **30.92** | **28.17** | **22.95** | **23.62** | **32.22** | **37.56** | **43.44** | **53.35** |

Notes: 1. Data to 2000 are actual records.
2. Design capacity of grain terminal should be a sum of above plus annual crop fluctuation of two million tons.
3. Traffic for Case 2: See Table3.6.3 or Appendix IIA.

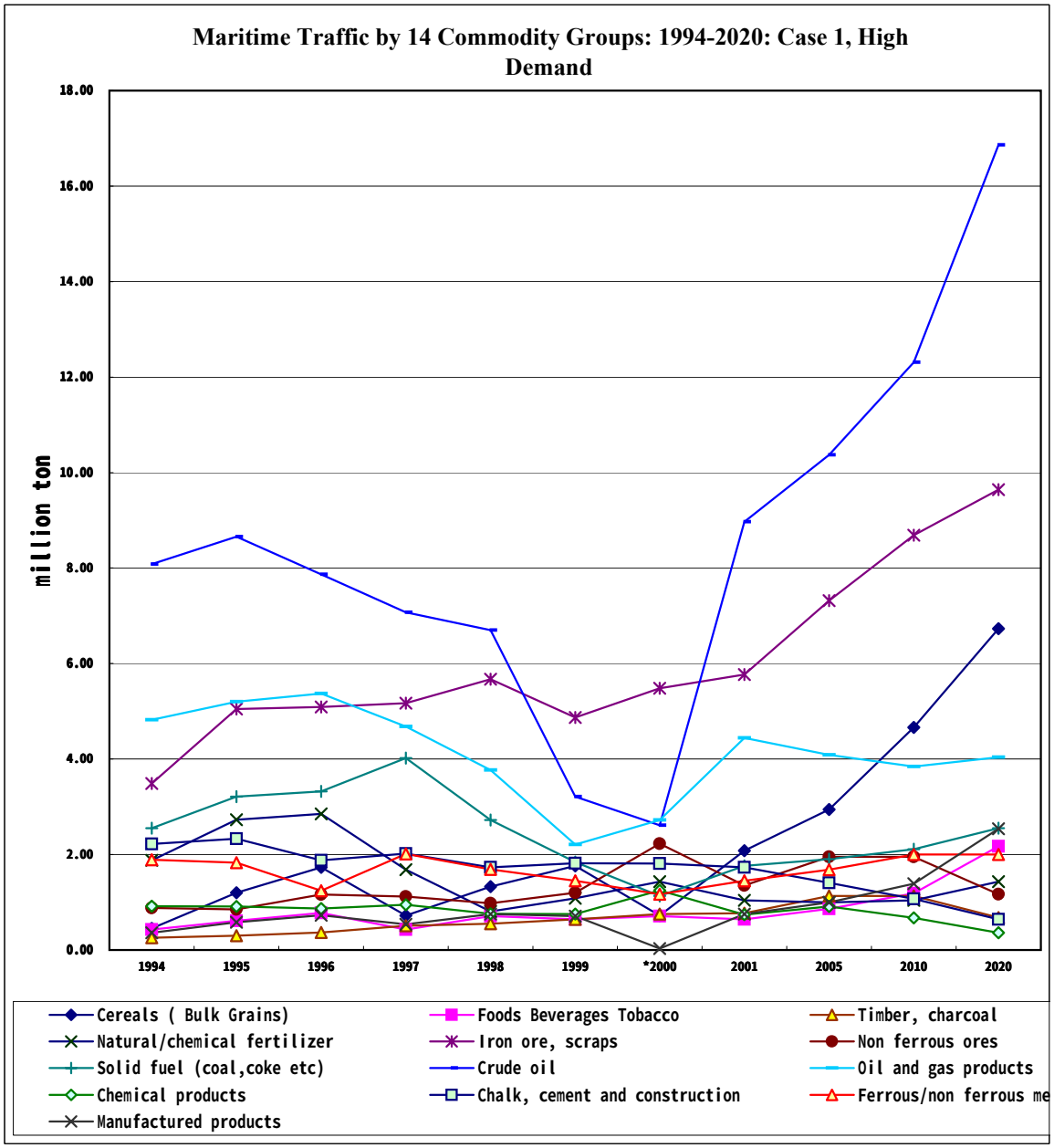


**Figure 3.6.2 Records and Forecasts of Maritime Traffic for Food, Timber & Manufactured Goods, Case 1: 1994-2020**

Unit: Million tons

| Commodity | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | *2000 | 2005 | 2010 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cereals ( Bulk Grains ) | 0.45 | 1.20 | 1.67 | 0.72 | 1.33 | 1.76 | 0.72 | 2.94 | 4.66 | 6.73 |
| Foods Beverages Tobacco | 0.43 | 0.61 | 0.78 | 0.43 | 0.71 | 0.64 | 0.71 | 0.86 | 1.19 | 2.17 |
| Timber, charcoal | 0.26 | 0.30 | 0.37 | 0.51 | 0.55 | 0.64 | 0.75 | 1.13 | 1.13 | 0.68 |
| Natural/chemical fertilizer | 1.88 | 2.73 | 2.85 | 1.68 | 0.81 | 1.08 | 1.43 | 1.00 | 1.04 | 1.43 |
| Manufactured products | 0.36 | 0.58 | 0.73 | 0.54 | 0.75 | 0.71 | 0.03 | 1.00 | 1.39 | 2.54 |
| Other cargoes (fruits,seeds oil, etc) | | | | | | 0.77 | 1.58 | 1.00 | 1.39 | 2.54 |
| **Maritime Traffic for Food, Timber & Manufactured Goods** | **3.38** | **5.42** | **6.40** | **3.88** | **4.15** | **5.60** | **5.22** | **7.93** | **10.80** | **16.09** |

Note: 1. Data to 2000 are actual records.
2. Traffic for Case 2: See Table3.6.3 or Appendix IIA.
3. Design capacity of grain terminal should be a sum of above plus annual crop fluctuation of two million tons.

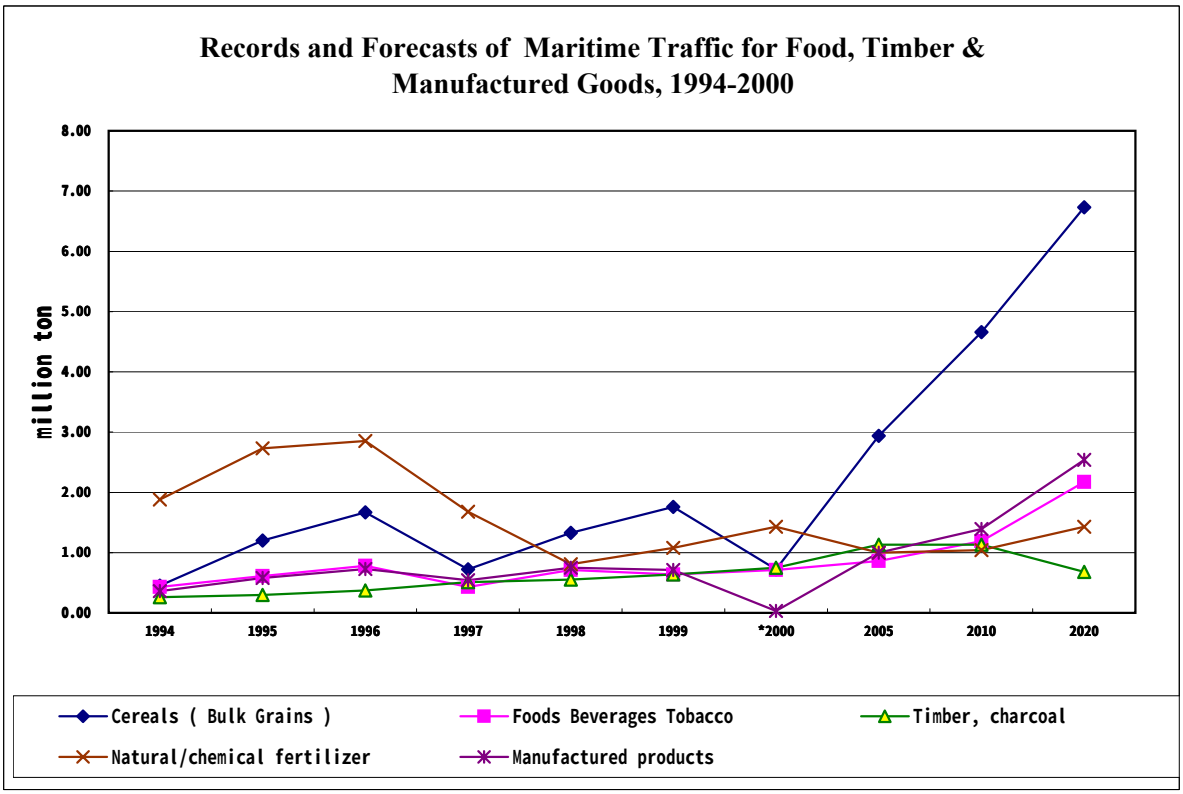


**Figure 3.6.3 Records and Forecasts of Maritime Traffic for Three Items of Chemical Commodities, Case 1: 1994-2020**

Unit: Million tons

| Commodity | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | *2000 | 2005 | 2010 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| Natural/chemical fertilizer | 1.88 | 2.73 | 2.85 | 1.68 | 0.81 | 1.08 | 1.43 | 1.00 | 1.04 | 1.43 |
| Chemical products | 0.92 | 0.91 | 0.87 | 0.95 | 0.76 | 0.75 | 1.25 | 0.91 | 0.67 | 0.36 |
| Chalk, cement and construction | 2.22 | 2.33 | 1.88 | 2.02 | 1.73 | 1.82 | 1.81 | 1.41 | 1.07 | 0.64 |
| Maritime Traffic for three Items of Chemicals Commodities | 5.02 | 5.97 | 5.60 | 4.65 | 3.30 | 3.65 | 4.49 | 3.32 | 2.78 | 2.43 |

Notes. 1. Data to 2020 are actual records.
2. Traffic for Case 2: See Table3.6.3 or Appendix IIA.

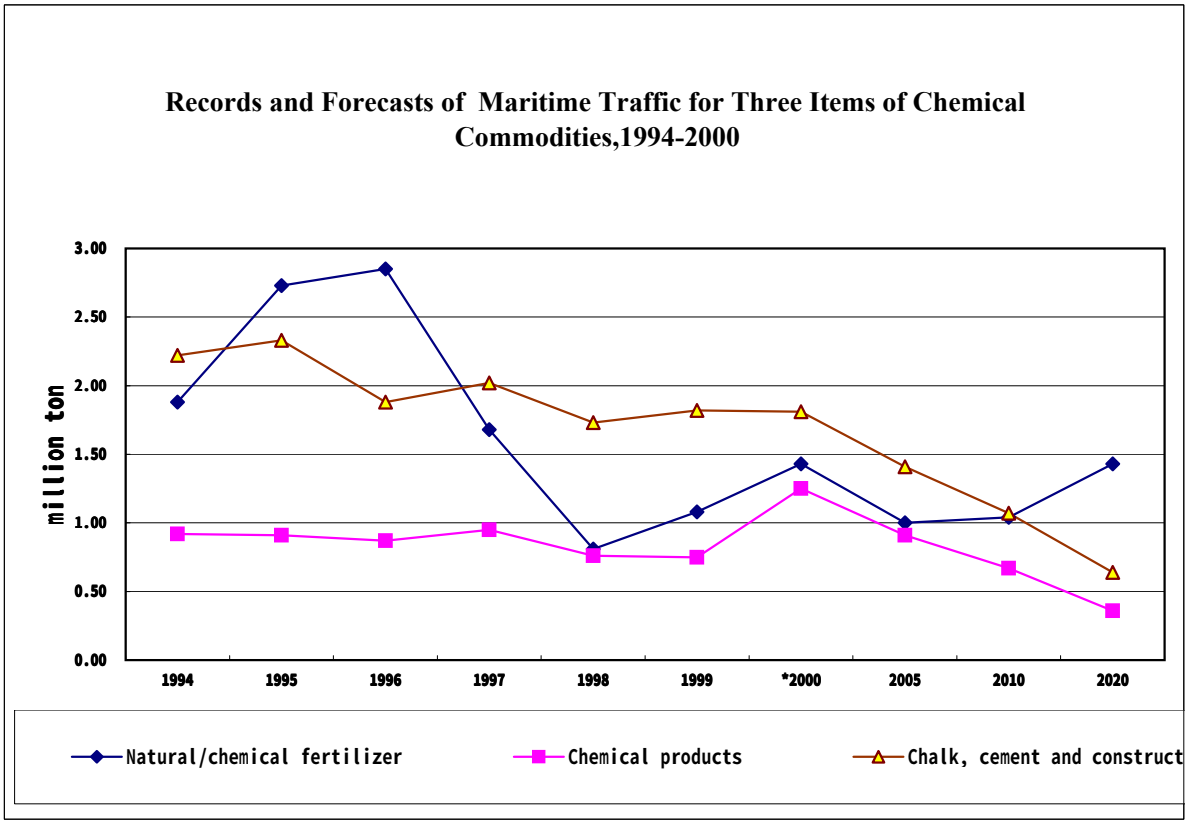


**Figure 3.6.4 Records and Forecasts of Maritime Traffic for Three Items of Ferrous/Non Ferrous Metals, Case 1: High, 1994-2020**

Unit: Million tons

| Commodity | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | *2000 | 2005 | 2010 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| Iron ore, scraps | 3.49 | 5.05 | 5.09 | 5.17 | 5.67 | 4.87 | 5.48 | 7.32 | 8.69 | 9.64 |
| Non ferrous ores | 0.88 | 0.85 | 1.16 | 1.12 | 0.98 | 1.20 | 2.23 | 1.95 | 1.95 | 1.17 |
| Ferrous/non ferrous metals | 1.89 | 1.83 | 1.24 | 2.01 | 1.69 | 1.45 | 1.17 | 1.68 | 2.00 | 2.00 |
| Maritime Traffic for Three Items of Ferrous/Non Ferrous | 6.26 | 7.73 | 7.49 | 8.30 | 8.34 | 7.52 | 8.88 | 10.95 | 12.64 | 12.81 |

Notes. 1. Data to 2000 are actual records.
2. Traffic for Case 2: See Table3.6.3 or Appendix IIA.

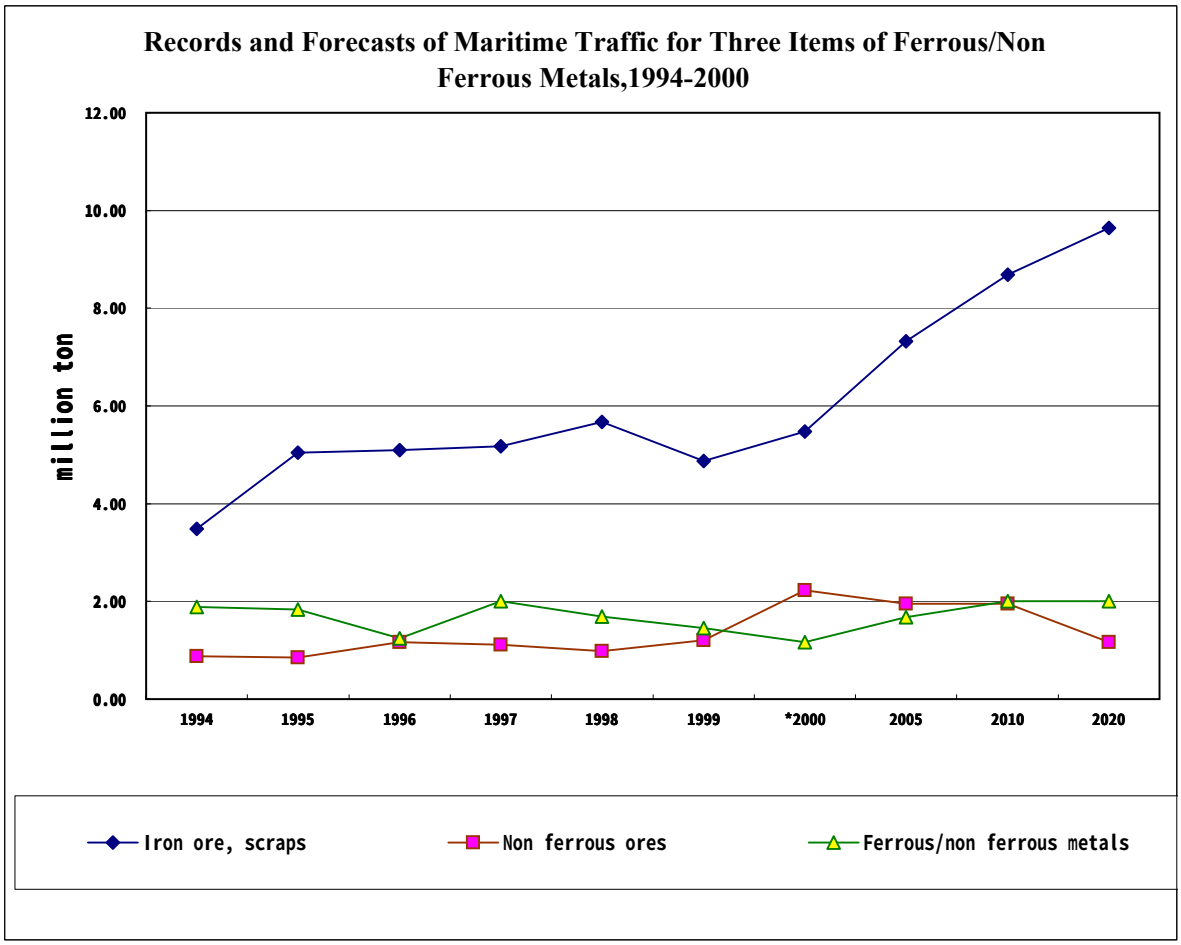
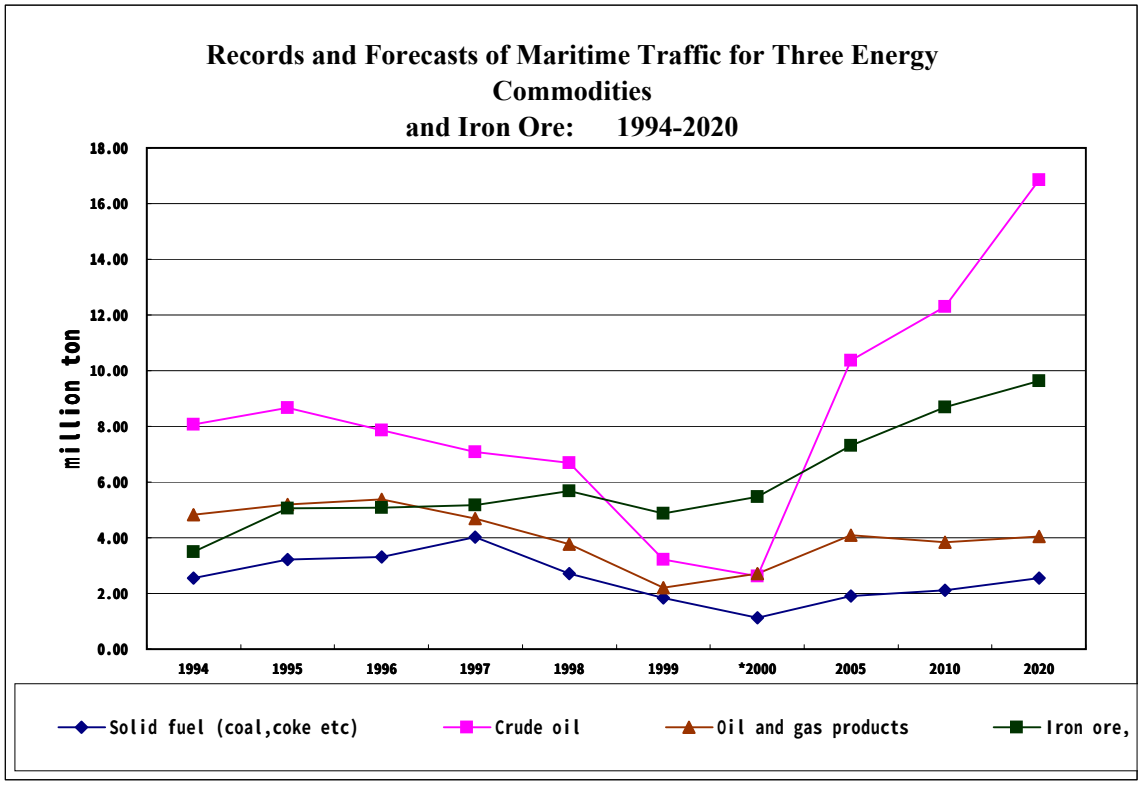


**Figure 3.6.5 Records and Forecasts of Maritime Traffic for Three Energy Commodities and Iron Ore: 1994-2020**

Unit: Million tons

| Commodity | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | *2000 | 2005 | 2010 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| Solid fuel (coal,coke etc) | 2.55 | 3.21 | 3.32 | 4.02 | 2.72 | 1.84 | 1.13 | 1.90 | 2.11 | 2.55 |
| Crude oil | 8.08 | 8.66 | 7.87 | 7.07 | 6.70 | 3.21 | 2.61 | 10.37 | 12.31 | 16.86 |
| Oil and gas products | 4.82 | 5.20 | 5.37 | 4.68 | 3.77 | 2.21 | 2.72 | 4.09 | 3.84 | 4.04 |
| Iron ore, scraps | 3.49 | 5.05 | 5.09 | 5.17 | 5.67 | 4.87 | 5.48 | 7.32 | 8.69 | 9.64 |
| **Maritime Traffic for Four Energy Commodities:** | **18.94** | **22.12** | **21.65** | **20.94** | **18.86** | **12.13** | **11.94** | **23.68** | **26.95** | **33.09** |

Notes. 1. Data to 2000 are tentative records.



## 3.7 Review of Microscopic Demand Forecast

### 3.7.1 Macroscopic Demand and Microscopic Demand

As seen in the forecast data, both macroscopic demand and microscopic demand were carried out accordingly. Relation between the macroscopic demand Case 1: High Demand Scenario and the microscopic- demand for **Case 1** is reviewed. Findings in this review are summarized as follows:

a) Macroscopic demand shows a radical increase than that of microscopic demand.
b) Crossing point is seen in year 2015, indicating the macroscopic demand is almost the same figure with the microscopic demand.
c) Before this year, the macroscopic demand is lower than that of the microscopic demand, by 30%.
d) After this period, the macroscopic demand exceeding those of the microscopic demand.
e) Maximum difference is observed at 2020 in 15% larger than that of the microscopic demand.

Fluctuation provided in the **Case 2: Medium Demand Scenario** shows similar trends to those of **Case 1.**

Refer to Figure 3.7.1, it indicates the change between Macro-Case 1 and Micro-Case 1. This figure also shows the fluctuation of Macro-Case 2 and Micro-Case 2. Data for both 1995 and 1999 are actual records reported by CPA.
Figure 3.3.2 indicates comparative data of traffic volume estimated by the JICA study team and IPTANA, the most experienced transport consultants in Romania.

### 3.7.2 Conclusion

Difference in forecasts between the macroscopic demand and the microscopic demand under Case 1: High Demand Scenario is about 15 to 30% on average between 2000 and 2020. Deviation is rather large; however, it should be accepted since the statistic data indicate both a large change and formation in the domestic industries and economic activities. It is assumed transition from the planned economy to the market mechanism will need more years to stabilize.

Balance in the **Case 2: Medium Demand Scenario** shows similar trends to **Case 1.**

It is concluded that the relation between the macroscopic demand and the microscopic demand is reasonable. According to the traffic demand forecast for on-going container terminal at the South Pier 2, Medium Case was selected as of the most possible future traffic scenario. This Medium Case is the same characteristics with Case 1 of the Master Plan Study.

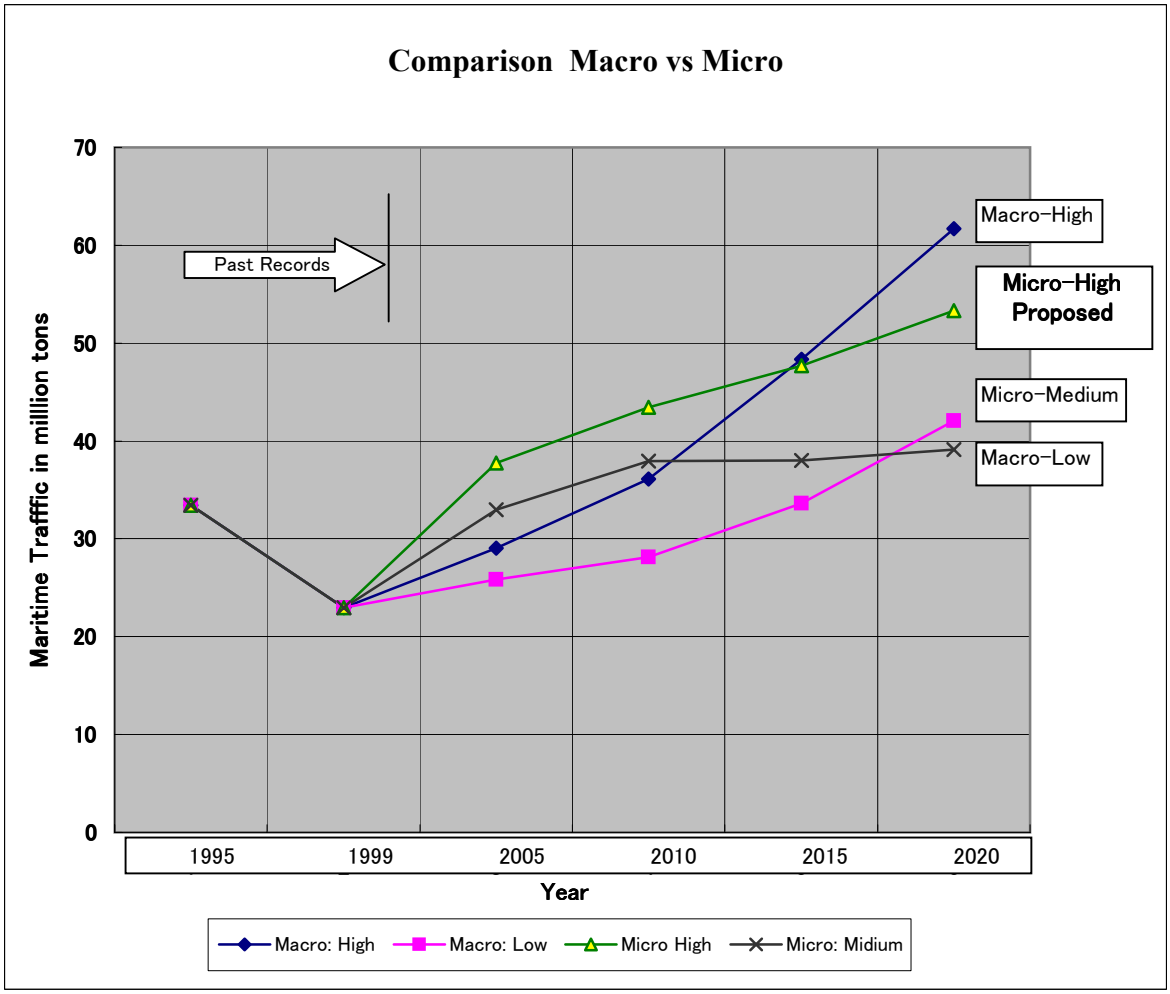
It is also concluded that the **Case 1** demands should be selected for this study.

## Figure 3.7.1 Review of Proposed Microscopic Data by Macroscopic Data

Unit: Million tons

| Year | **Macro** Forecasts Case 1: High Scenario | 2. **Macro** Forecasts Case 2: Low Scenario | 3. **Micro** Forecasts Case 1: High Scenario | 4. **Micro** Forecasts Case 2: Medium Scenario |
|---|---|---|---|---|
| **1995** | 33.46 | 33.46 | 33.46 | 33.46 |
| **1999** | 22.95 | 22.95 | 22.95 | 22.95 |
| **2005** | 29.04 | 25.85 | 37.75 | 32.94 |
| **2010** | 36.12 | 28.16 | 43.44 | 37.95 |
| **2015** | 48.34 | 33.60 | 47.67 | 38.01 |
| **2020** | 61.69 | 42.08 | 53.35 | 39.12 |

Notes 1. Data in 1995 and 1999 are actual records
2. Data after 2005 are forecasted by study team

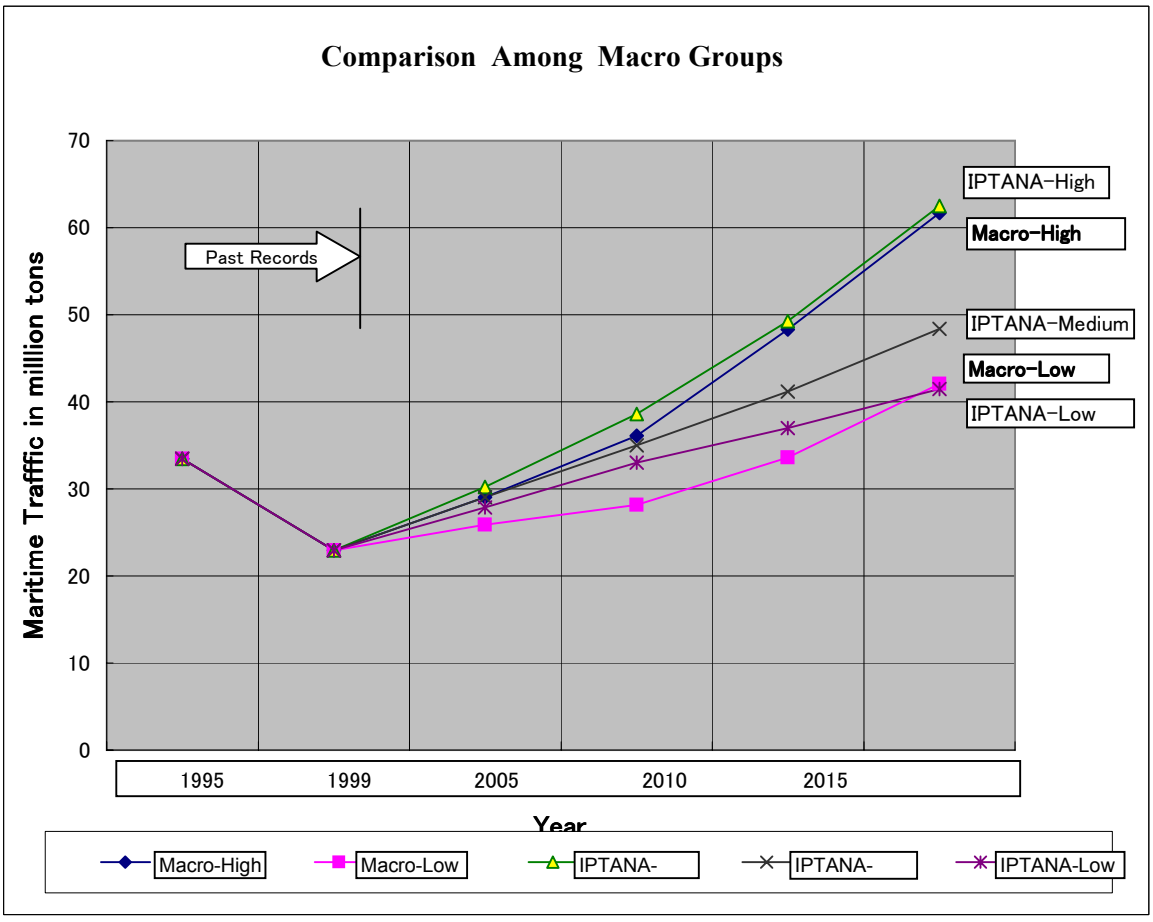


## Figure 3.7.2 Review of Proposed Macroscopic Data by Reference Dat:

Unit: Million tons

| Year | JICA Study Team | | Reference Forecass by IPTANA | | |
|---|---|---|---|---|---|
| | **Macro** Forecasts Case 1: High Scenario | 2. **Macro** Forecasts Case 2: Low Scenario | 3. Macro Forecasts IPTANA High Scenario | 4. Macro Forecasts IPTANA Medium Scenario | Forecasts IPTANA Low Scenario |
| **1995 record** | 33.46 | 33.46 | 33.46 | 33.46 | 33.46 |
| **1999 record** | 22.95 | 22.95 | 22.95 | 22.95 | 22.95 |
| **2005** | 29.04 | 25.85 | 30.23 | 29.04 | 27.89 |
| **2010** | 36.12 | 28.16 | 38.60 | 35.00 | 33.00 |
| **2015** | 48.34 | 33.60 | 49.30 | 41.20 | 37.00 |
| **2020** | 61.69 | 42.08 | 62.50 | 48.40 | 41.50 |

Notes 1. Data in 1995 and 1999 are actual records
2. Data1,2 &3 were forecasted by IPTANA, experienced Transport Consultants in Romania.



## 3.8 Monitoring Major Economic Indication

### 3.8.1 Major Economic Indicators

As seen in the traffic forecast study and related chapter, there are many economic indicators to trace the past records and forecasting future trends quantitatively. One of the important indicators should be GDP. This is a core figure in this study to represent the general size of the Romanian economy and economies of surrounding countries.

Production records and consumption statistics are also important to estimate the surplus balances which may constitute import or export demand. Transshipment and transit cargoes may be related with these balances in neighboring countries, for example: Grain export from Hungary.
However, the most important factors should be those related to industrialization of the Romanian domestic industries including the agriculture industries and manufacturing industries. Foreign investment by sector will be one of indicators for the future.

It is stressed that the major cargoes through the Constantza Port should be the domestic ones (or trade cargo) in addition to transshipment and transit cargoes from / to neighboring countries.

### 3.8.2 Monitoring Major Economic Indicators

First of all, the annual cargo statistics should be collected and analyzed by CPA and MOT as routine work. In addition, major economic indicators as shown in the previous subsection should be traced and monitored too.

This monitoring should be conducted by CPA and noted when any indicator deviates largely from the date used in the forecast works. In this case, an economist should trace the basic reason of such change, and if necessary, the previously carried out forecast may be modified accordingly.

### 3.8.3 Review of Transit Cargoes

Transit cargoes share a part of exports and will affect future traffic demand. Among the total cargoes of 22.95 million tons, transit cargoes were 1.15 million sharing 5.0 % in 1999. It is expected that this share will increase to about 10 % in 2010.

In order to review the forecast traffic for the future, outline review of the existing transit cargoes was carried out.

Refer to Part II Chapter 4, in which the volume of transit cargo to/from neighboring countries are estimated by the port planners in the study team who visited the other countries as a part of investigation. Data analyzed by them was reviewed by the transport economist and selected the essence of trend of transit. However those data are not enough accuracy to apply to the cargo traffic forecast.

Taking this situation into account, the study team carried out the additional analysis for the Transit Grain since a grain terminal was selected to be the first priority project among the those of Short term Development Projects. Refer to Section 3.10.

### 3.8.4 Follow-up Monitoring

GDP is the economic outputs which indicates the performance undertaking by constructive activities of Romania industries. It is also an economic indicator which might be affected by various parameters. At the very beginning of this chapter, six major factors to determine the traffics were introduced as so important information and key decision to the traffics as follows:

**(1) Port Development Potential**
**(2) Industrial Development Plan in Romania**
**(3) Socio-economic Frame of Romania and Surrounding Countries**
**(4) Inter-modal Transport Study**
**(5) Translation of above to Input Data for traffic demand forecast**
**(6) Undertaking Traffic Demand Forecast**

Soon or later, Romania will fortunately join with EU. This new environment will provide Romania with a large chance to develop. However it is prudent to imagine affluence of opposite side effects also. This indicates that new era will generate not only advantages but also disadvantages.

Romania should deal a lot with EU. It is clear that all the trade items are not always increase. Development of infrastructure including reopening the canal is also decisive elements.

## 3.9 Interpretation of Traffic Demand in Port Plan

Port development plan should be met with the future requirements, one of the major item of which is the traffic volume. Although Constantza Port has a large physical capacity in terms of port area, breakwaters, berths and cargo handling capacity, some promised cargo faces to the limit of existing capacity. Bulk grain and containerized cargo are belong to this and are the most important two which require the urgent development. Improvement of inner-port access roads is also urgently required to carry out based on the road traffic which indirectly relates with the maritime traffics.

New development and improvement of facilities will be carried out only when the maritime traffic is properly translated into the terms by which the facility design can be done. In this mean, maritime traffics should be interpreted or converted to the technical quantity by which the port planners can design the port facilities.

**(1) Inner-port Access Road Improvement**

Maritime traffic (normally annual traffic volume as seen in this report) will provide a daily maximum and hourly maximum using the peak factors.

**(2) Container Terminal Development**

Mother cargo body to the container terminal is the general cargo (break-bulk or conventional cargo). General cargo volume will be divided into containerizable cargo or non-containerizable cargo. Then containerizable cargo volume will be further sub-divided into containerized cargo and non-containerizable cargo.
Then containerized cargo will be divided by unit load per container box (for example 10ton/TEU) for estimating the laden containers.

Finally, number of empty containers will be estimated as of balance of box between export laden containers and import laden containers.
In this study, the transport economist estimated these all.

**(3) Bulk Grain Terminal Development**

Bulk grain is one of limited commodities which are assumed rapid increase in the future. Major bulk grain through the Port of Constantza is exports. Export volumes are estimated combining the Romanian exports and transit exports by the neighboring countries. Maritime bulk grain traffic is given as annual volume. This is so-called " Net Volume " since which contains only the historical average volume. However, grain harvest changes every year by the climatic conditions and trade volume is affected by international grain market demand.
Design capacity of grain terminal should be included not only the Net Volume but also a standard fluctuation from the average.

For example, Grain Terminal Capacity ( all port in 2010 )

| | | |
|---|---|---|
| **Net Volume** | **4.41** | **million tons** |
| **Fluctuation** | **1.99** | **million tons** |
| **Total** | **6.40** | **million tons** |

## 3.10 Review and Detailed Study on Bulk Grain Demand Forecast

In the Master Plan Study, it was concluded that the Priority Projects of the Feasibility Study would be the Grain Terminal Plan and the Barge Terminal Plan. In this context, the works as required for the traffic demand forecast will be focused on the bulk grain issue.

Since the major trade direction of bulk grain including transit cargo is absolutely the exports. Review study covers the export demands.

Transit bulk grain cargo shares a large part and it is transported by barges through the neighboring countries. Thus the barge traffic demand will be derived based on the traffic demand by kinds of cargo that are to be transported by barge and taking into account the modal split ratio described in another section.

### 3.10.1 Outline of Traffic Demand Forecast Review : Bulk Grain Exports

The contents of the traffic demand forecast review presented in the Feasibility Study for bulk grain exports are divided into the two steps as follows:

**(1) Step-1**

**1) Comparison of the Bulk Grain Traffic Demand Forecast as between the World Bank Study and the JICA Master Plan.**

Review of grain traffic demand forecast by the World Bank was carefully conducted with regard to production, consumption and surplus balance by comparing actual and forecast figures for the related countries. On the other hand, the forecast performed by the JICA Master Plan Study was issued with regard to the production, consumption and surplus balance for Romania. These reviews show that the total traffic demand forecast by the World Bank Study is directly applied to comparison of the required handling capacities. On the other hand, the traffic demand issued by the JICA Master Plan Study is classified into the traffic demand as the median value (in other words net traffic demand) and annual fluctuation. The required handling capacity is forecast on the basis of net traffic demand and the upper limits of the annual fluctuation.

**2) Median Value Based on Lower and Upper Limits and Net Traffic Demand**

As a part of the Feasibility Study, a detailed and careful analysis was conducted with regard to the lower and upper limits on the basis of historical production performance as well as consumption and export from Romania. The upper limit of the grain traffic

demand was forecast for trade (export and import) and transit operations by taking account of exports from Romania and Hungary to determine the required handling capacity. Actually the net traffic demand is considered to be the average or median value of grain traffic demand, excluding annual fluctuation.

### 3) Comparison for Net Traffic Demand of Transit Between the World Bank and the JICA Master Plan

In order to make a comparison with the traffic demand forecast by the JICA Master Plan, the total demand forecast by the World Bank was divided into trade and transit on the basis of the annual fluctuation as well as estimates by the JICA Master Plan. The result shows that the trade (export) was found not to produce a big difference, whereas the transit traffic which was forecasted by the JICA Master Plan came up with extremely low figures when compared to the ones of the World Bank.

## (2) Step-2

### 1) Review of Export Traffic Demand for Hungary and Romania

The review of export forecast from Romania and Hungary has been performed with emphasis on the exports from Hungary because the share of transit exported from Hungary proves to be the most important of all transit volumes. Actually the production, consumption and surplus balance were studied on the basis of their performance over the past two years (1999-2000).

By taking into consideration that Romania is basically an exporting country of grains, imports occur only in the year of a bad harvest and the imported volume of grains is small. Consequently, the forecast volume in the Feasibility Study does not include the imports to Romania. But the traffic demand for imports is taken into account for estimating the required handling capacity.

### 2) Demand Forecast of Transit Cargoes

The throughput (traffic demand) for the Port of Constantza was forecast using the same assumption as the World Bank. This throughput was divided into trade and transit by assuming that the share of total exports from three countries is the same as export throughput of the Port of Constantza. Hence, the forecast traffic demand is the total traffic demand. Thereafter this total traffic demand was classified into net traffic and forecast annually fluctuations.

### 3) Existing Capacity and Required Capacity

By taking into account the existing handling capacity which was revised by the Feasibility Study, the required handling capacity was determined on the basis of the forecast net traffic demand for designing the facility.

### 4) The Case of Traffic Demand Forecast in the Feasibility Study

There are two Cases in the traffic demand forecast in the Mater Plan Study but the volumes of forecast traffic demand are the same already reported in the Interim Report. The traffic demand forecast in the Feasibility Study is considered as "Case-1" and "Case-2" the same in the Master Plan Study.

## 3.10.2 Review of the Grain Forecast by the World Bank Study and by the JICA Master Plan

### (1) Approach to Review the Grain Forecast for 2010

The approach of reviewing the World Bank grain forecast for 2010 by is shown in Figure 3.10.1.

### 1) An Overview of Romania's Agriculture Sector

#### a. Share of Agriculture Sector in National Economy

The agriculture and forestry industry contributed about 20% of the total GDP in 1995. Even after taking account of economic restructuring that has been taking place in Romania since 1989, this share of the national output has declined gradually to about 11.4% in 2000. In terms of monetary values, the sector contributed an increasing output of about 90,929 billion lei by the year 2000.

**Table 3.10.1 Share of Agriculture Sector in Romania GDP, 1994-2000**

| Sector/ Industry | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|
| Agriculture & Forestry | 19.9% | 19.8% | 19.2% | 18.0% | 14.6% | 13.9% | 11.4% |
| Construction and Industry | 42.7% | 39.5% | 39.8% | 36.1% | 32.8% | 32.6% | 32.4% |
| Services* | 29.7% | 33.0% | 34.6% | 37.9% | 42.5% | 43.1% | 46.6% |
| Taxes, less subsidies | 7.7% | 7.7% | 6.5% | 8.0% | 10.1% | 10.4% | 9.6% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

* Include trade, transport, telecommunications, and public administration and adjusted for imputed output of banking services

**Table 3.10.2 Contribution of Agriculture Sector to GDP in Values, 1994-2000**

(In billion lei)

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|
| Agriculture& Forestry | 9897.6 | 14269.2 | 20949.1 | 45349.6 | 53681.9 | 72594.8 | 90929.3 |

Source: Romania Statistical Yearbook 1999 and National Bank of Romania Annual Report.

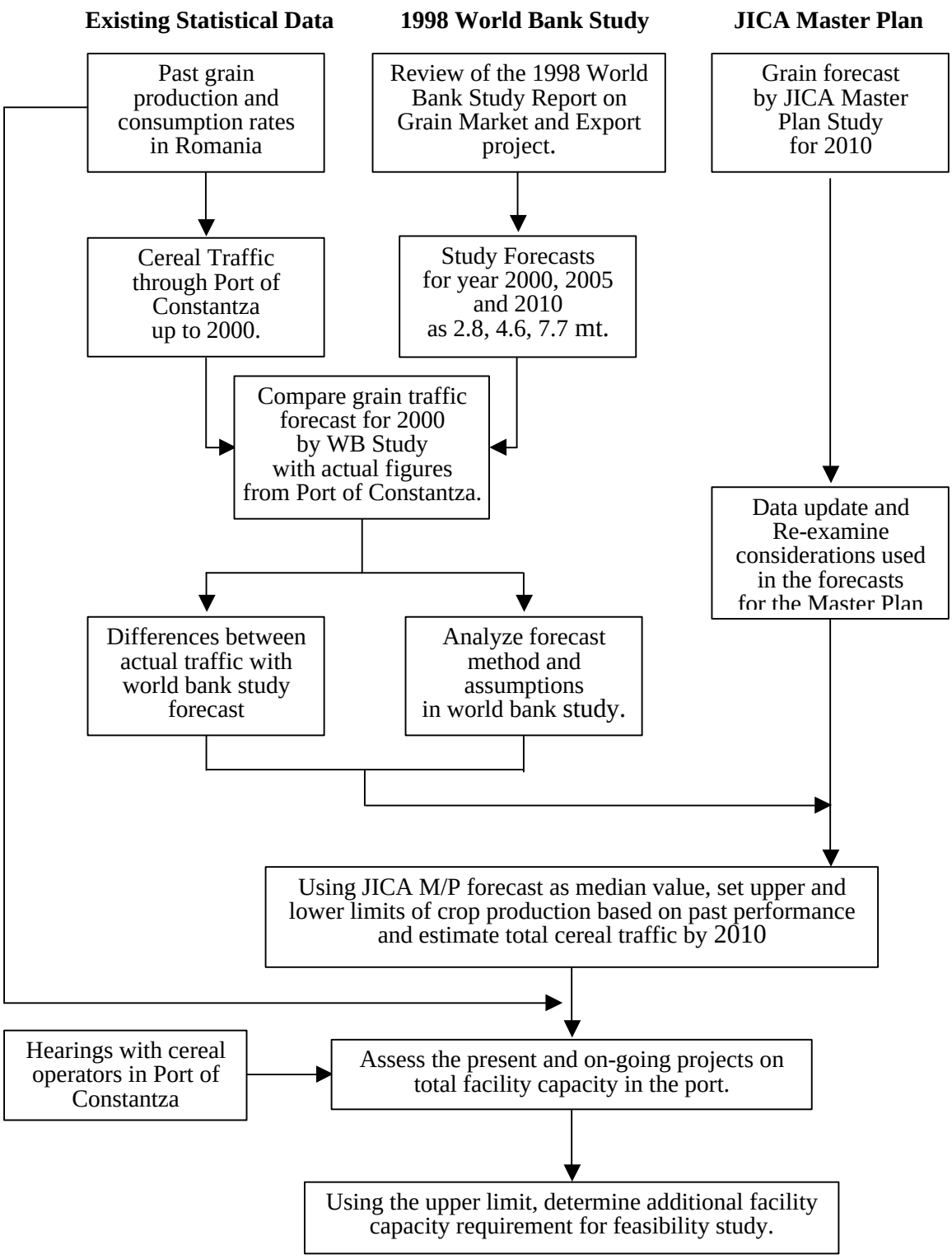



**Figure 3.10.1 Flowchart on Setting of Future Grain Traffic Volume for Feasibility Study**

## b. Major Agricultural Crops

As can be seen in the following Table, the grains production of 1993, 1996, 1998, 1999 and 2000 fell below the domestic demand of about 18 - 19 million tons. The year 2000 was particularly poor in grain production due to a severe summer draught which adversely affected the maize crop. On the other hand for the year 2001, Romania may have to resort to imports in order to meet the domestic demand since the 2000 harvest of
10.5 million tons has fallen far below the basic domestic consumption level - a situation similar to 1994.

**Table 3.10.3 Agriculture Production by Crop Category in Romania, 1993-2000**

(In million ton)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999* | 2000* |
|---|---|---|---|---|---|---|---|---|
| Grains | 15.49 | 18.18 | 19.88 | 14.20 | 22.11 | 15.45 | 17.04 | 10.48 |
| Maize | (7.99) | (9.34) | (9.92) | (9.61) | (12.69) | (8.62) | (10.93) | (4.90) |
| Wheat &Rye | (5.35) | (6.19) | (7.71) | (3.16) | (7.19) | (5.21) | (4.68) | (4.46) |
| Barley & others | (2.15) | (2.65) | (2.25) | (1.43) | (2.23) | (1.62) | (1.43) | (1.12) |
| Potatoes | 3.71 | 2.95 | 3.02 | 3.59 | 3.21 | 3.32 | 3.96 | 3.47 |
| Oil Seeds | 0.82 | 0.87 | 1.06 | 1.22 | 1.00 | 1.32 | 1.61 | 0.87 |
| Veget. &Others | 5.37 | 6.05 | 6.30 | 6.38 | 5.90 | 5.99 | 7.45 | 6.36 |
| **Sub-total** | **25.39** | **28.05** | **30.26** | **25.39** | **32.22** | **26.08** | **30.06** | **21.18** |
| Fodder | 20.22 | 19.41 | 19.56 | 19.40 | 19.89 | 18.37 | nd | nd |
| **Total** | **45.61** | **47.46** | **49.82** | **44.79** | **52.11** | **44.45** | | |

Source: Romania Statistical Yearbook, 1999; *chamber of commerce & industry, Constantza

## c. Land for Grain Cultivation

Out of the total 5.7 million ha of grain cropland in 2000, about 3 million ha was devoted to maize, 2.0 million ha to wheat and rye and the remaining 0.7 million ha was devoted to other grains, notably barley and sorghum. See the table below.

**Table 3.10.4 Land Area Devoted to Grain Production in Romania, 1993-2000**

(Million ha)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999* | 2000* |
|---|---|---|---|---|---|---|---|---|
| Grain | 6.40 | 6.56 | 6.44 | 5.84 | 6.32 | 5.92 | 5.37 | 5.66 |
| Maize | (3.07) | (2.98) | (3.11) | (3.28) | (3.04) | (3.13) | (3.01) | (3.06) |
| Wheat & Rye | (2.31) | (2.45) | (2.50) | (1.80) | (2.42) | (2.03) | (1.69) | (1.95) |
| Barley & others | (1.02) | (1.13) | (0.83) | (0.77) | (0.86) | (0.76) | (0.67) | (0.65) |
| Potatoes | 0.25 | 0.25 | 0.24 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 |
| Oil Seeds | 0.70 | 0.66 | 0.81 | 1.01 | 0.87 | 1.16 | 1.24 | 1.07 |
| Others | 1.78 | 1.72 | 1.70 | 1.74 | 1.58 | 1.61 | nd | nd |
| Total Area | 9.13 | 9.19 | 9.19 | 8.85 | 9.03 | 8.95 | | |

Source: Romania Statistical Yearbook, 1999; *chamber of commerce & industry, Constantza.
Note :n.d.= no data

## d. Average Yields of Grains in Romania

The average yields of the major grains produced in Romania remain modest when compared to other European countries after 1989. The yields of maize, the major crop in Romania, fluctuated between 2.6 to 3.6 ton/ha. The yield for year 2000 was particularly

poor, that is only 1.6 ton/ha, due to the summer draught. Actual yields before 1989, particularly in the period 1980-85 were in fact higher, where the farms were larger and the production was systematically collected and handled. Yields are expected to improve in the near future, given that no exceptional weather conditions are expected, but they will largely depend on the success of Romanian's land reform and on other rural development programs.

**Table 3.10.5 Average Yield Per Ha of Cultivated Land in Romania, 1993-98**

(Ton/ha)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|
| Maize | 2.61 | 3.13 | 3.18 | 2.93 | 4.17 | 2.76 | 3.63 | 1.60 |
| Wheat/Rye | 2.32 | 2.54 | 3.08 | 1.76 | 2.96 | 2.56 | 2.78 | 2.28 |
| Barley | 2.44 | 2.72 | 3.12 | 2.15 | 3.02 | 2.39 | 2.45 | 2.11 |
| Sorghum | 0.98 | 0.94 | 0.76 | 0.59 | 0.91 | 1.57 | N.D. | nd |
| Oats | 1.52 | 1.49 | 1.69 | 1.24 | 1.49 | 1.58 | nd | nd |
| Rice | 3.04 | 3.28 | 3.90 | 2.71 | 2.68 | 2.98 | ND | nd |

Source: Romania Statistical Yearbook, 1999,

* Data from the Chamber of Commerce and Industry, Constantza, nd = no data

### e. Domestic Consumption of Grains in Romania

The grain consumption of Romania remain stable and per capita consumption averages about 163kg. The total human consumption of grains is about 3.7 million tons a year. The per capita meat, milk and dairy products consumption also remain fairly stable. About 1.1 million tons of meat and 4.2 million liter of milk (and dairy products) are consumed yearly.

**Table 3.10.6 Domestic Consumption of Grains, Meats, Milk and Dairy Products in Romania, 1993-1998**

| Category | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Average |
|---|---|---|---|---|---|---|---|
| Population(mil person) | 22.75 | 22.73 | 22.68 | 22.60 | 22.54 | 22.50 | |
| Grain(kg/person) | 159.6 | 158.6 | 162.4 | 160.6 | 169.8 | 166.7 | 162.95 |
| Meat(kg/person) | 47.7 | 45.5 | 47.8 | 47.2 | 45.1 | 48.0 | 46.88 |
| Milk & Dairy(liter/person) | 176.9 | 179.5 | 188.6 | 192.7 | 192.4 | 194.4 | 187.42 |
| Total grain (million ton/yr) | 3.63 | 3.61 | 3.68 | 3.63 | 3.83 | 3.75 | 3.69 |
| Meat(million ton/yr) | 1.09 | 1.03 | 1.08 | 1.07 | 1.02 | 1.08 | 1.06 |
| Milk & dairy(mil.liter/yr) | 4.02 | 4.08 | 4.28 | 4.36 | 4.34 | 4.37 | 4.24 |

Source: Romania Yearbook of Statistics, 1999

From the table above, although there is a small increase in the per capita consumption of grains by the population, this increase is not big. Moreover, there is a slight decrease in the total population in the last two years, hence, any marginal increase in the domestic demand would have likely been nullified. It is reasonable to assume that the human consumption of grain in Romania remains fairly stable, that is at about 4.0 million tons a year.

The World Bank study has estimated that animal consumption of grains that is for the production of meat, milk and dairy eggs is about 14-15 million tons a year. The total grain domestic consumption, of both human and animal populations in Romania is therefore maintaining about 18 - 19 million tons a year.

## (2) Review of the 1998 World Bank Report on 'Romania Grain Market and Export Project - Preparation Study for Maritime and River Infrastructure Component'.

### 1) Forecasting Method on Total Grain Traffic through Port of Constantza by the World Bank Study

Of particular interest for this Feasibility Study dealing with the development of a grain terminal from the short term up to 2010 is the forecast of the potential grain export volume via the port of Constantza in the world bank report.

The method of forecasting potential grain export from Romania, Hungary and Yugoslavia that was used in the World Bank Study is based on the following steps:

a. Grain productions in the three countries for 2000, 2005 and 2010 were first estimated based on yields per ha and according to the total grain production land areas. As land area allocated for the grain production is fairly stable, future increase in total production will depend mainly on the increases in yield per ha.

b. Grain consumption was then estimated based on human consumption and secondarily consumption of animals that are bred to produce meat, milk and dairy products. The consumption was estimated to only marginally increase in these countries. The potential export volumes were computed from the total production minus consumption.

c. The study also examined world grain demand, based on the future estimated world population. Due to the lower world grain demand, the report revised the growth rates for world grain demand and hence estimated the demand for wheat as 107 million tons and secondary grains as 120 million tons by 2010. The totals were then classified for 6 importing regions (Eastern Europe, Black Sea, Middle East, Far East, North Africa and others).

d. The potential export volume of grain from Romania, Hungary and Yugoslavia was also distributed among these 6 regions based on several assumptions. The study pointed out that the assumption of having to fulfill the needs of the neighboring regions and the increasing demand for other remote regions long run would result in improved grain quality and having the near-term demand fulfilled. The study also estimated that the fastest growth in grain demand in 2010 would come from the Far East which would call for larger capacity ships.

e. The potential of Constantza was established in the report by doing an analysis on the advantages of Danube River transport compared to land transport. It is so concluded that while the Adriatic port of Trieste is more advantageous in terms of distance to

Hungary, Constantza is still the more advantageous for the three countries of Romania, Hungary and Yugoslavia, particularly if the lower cost of the river transport over long distances is considered. Hence the study has forecast that Constantza will handle the majority of the potential grain export volume that will be coming from these three countries.

**2) Fluctuations in Grain Export Traffic from Constantza**

Unfortunately, grain production depends on many unpredictable variables, of which factors like weather and world demand are the most volatile. The 1997 and 1998 grain production of Romania and Hungary was moderate, but the 2000 harvest dropped deeply due to bad weather, that is flooding in spring and drought in summer. Also the production in Yugoslavia was modest as the country was just beginning to recover from the war. As pointed out by the World Bank Study, despite the fact that the off-silo grain prices in Romania are still low, the costs for transfer, storage and handling are still high. Unless the latter cost component is reduced by modernizing the related facilities, the demand for Romanian grain may be dampened when there are bumper crops in other parts of the world.

Actual grain traffic via the Port of Constantza (both maritime and river) for years 1996 to 2000 were 2.52, 1.10, 2.55, 2.43 and 1.01 million tons respectively, actually showing large fluctuations. Total grain traffic through the port of Constantza in the last few years has not increased as much as was anticipated in the World Bank Study. Although Romania maintained its status as a net grain exporter throughout this period, the volume hovered around as low as 0.5 (year 2000) and up to a high of 1.2 million tons (year 1996).

Actual total grain traffic through the Port of Constantza in 2000 was only about 1.01 million tons (71% by maritime and 29% by river). The World Bank Study was however hoping for a volume of 2.8 million tons by 2000. Actual grain traffic in 2000 was in fact lower than the low case scenario estimated by the World Bank Study. The key point to bear in mind is the volatile nature of grain exports, which greatly depended on the weather, on situations in neighboring countries and also on other external factors. The World Bank Study, for instance, obviously hoped for a full restoration of navigability on the Danube to provide barge grain transport from Yugoslavia and Romania.

**Table 3.10.7 Actual Total Grain Traffic through Port of Constantza 1996-2000**

(Million ton)

| Item | 1996 | 1997 | 1998 | 1999 | 2000* |
|---|---|---|---|---|---|
| Total grain traffic | **2.52** | **1.10** | **2.55** | **2.43** | **1.01** |
| *-Maritime* | *1.67 (66.3%)* | *0.72 (65.5%)* | *1.33 (52.1%)* | *1.76 (72.4%)* | *0.72 (71.3%)* |
| *-River* | *0.85 (33.7%)* | *0.38 (34.5%)* | *1.22 (47.9%)* | *0.67 (27.6%)* | *0.29 (28.7%)* |
| Maritime | | | | | |
| Exp./Import | 1.19 | 0.59 | 0.62 | 1.04 | 0.52 |
| Transit | 0.48 | 0.13 | 0.71 | 0.72 | 0.20 |
| Forecasted total grain traffic by World Bank study | | | | | (2.00) **2.80** (3.50) |
| Difference | | | | | **- 1.79** |

Source: JICA Study Interim report, 2000

* Actual export figures for 2000 obtained from CPA.

However in actual fact even in recent years, certain sections of the Danube are not yet fully restored. Moreover, the year 2000 was a particularly bad year for grain production in Romania and Hungary.

Hence, it can be safely said that the forecast volume of about 4.6 and 7.7 million tons for 2005 and 2010 appearing in the World Bank Study will be very difficult if not impossible to achieve. These figures can no longer be applied without being revised.

### (3) Grain Traffic Forecast in the JICA Master Plan Study

When compared with the forecasts of the World Bank Report, the grain traffic volume through the Port of Constantza that was estimated by the JICA Master Plan may be considered as slightly conservative. This is caused by the following prevalent factors that JICA Study Team had taken into account when doing the forecasting:

1) Due to the prolonged Balkan civil war and after the bombing of bridges along the Danube river, many sections require expensive removal of fallen bridges before the navigability of the river can be fully restored. Logistically and financially, such a task requires time, political commitment and international cooperation from all countries bordering the Danube. Although it is obvious that all countries bordering the Danube would benefit from its restoration, the costs sharing needed to clear up the river may require significant diplomacy and negotiation.
2) The average yield per hectare of cultivated land in Romania will increase, but only gradually over time since the transitional period of the Romanian economy will probably require more time before it reaches its take-off point. The land reform that aims to optimize farm sizes is still progressing, also slowly. Moreover, the use of advanced fertilizers and farm machinery needed to increase yields requires larger

credit and investment which many of the present small farms in Romania still can not afford. The total amount of arable land for crops and the population size in Romania are fairly stable and the major factors that would affect the output will therefore be the weather conditions and the use of advanced fertilizers and machinery.

3) The Adriatic Sea ports are the true rivals of the Port of Constantza as they are well positioned at shorter distances to the other modes of transport that connect them to Western Europe and it may be said that they are directly competing with Constantza for the same hinterland of the CEEC. The Port of Constantza is however advantageously positioned for grain export to Asia, Middle East and central Asian countries and from three neighboring countries via the Danube waterway. The Adriatic Sea ports are still bringing much competition to Constantza for exports to the North African countries which are nearer. Therefore a more modest volume of grain export from neighboring countries (Hungary and Yugoslavia) must be adopted in order to be more realistic in port facility planning.

The forecast of 2.51 million tons for grain maritime traffic in 2010 through the Port of Constantza can be considered as a realistic estimation, given the above factors and considerations. This figure however should be treated as median or average, as discussed above, since the grain traffic can greatly vary from year to year depending on the harvest, which in its turn heavily depends on weather conditions, the world supply and demand, and on the output from the three neighboring countries.

The annual estimated 2.51 million tons of maritime traffic for 2010, as assumed by the JICA Master plan study, consists of **1.88 million tons in trade for Romania and 0.63 million tons in transit traffic from the two neighboring countries** (the actual figures for year 2000 are 0.52 and 0.20 million tons respectively). As the grain import of Romania is predicted to be modest in the short term, this 1.88 million tons will mostly be exported, that is about 1.5 million tons. This means that the average annual harvest would have to be better if not on **par** with that in 1995 (i.e. about 20.5 million tons) assuming that domestic consumption by humans and farm animals would remain fairly stable (at about 18 to 19 million tons a year). This level is an average figure since in a good year it may in fact be higher. Hence, the need to use the estimated upper limit that is considered reasonable for the planning of grain handling facilities in the Port of Constantza up to the year 2010.

### (4) Estimating the Upper and Lower Limits of Grain Production in Romania

Grain production of Romania fluctuated unpredictably throughout the period from 1993 to 2000, as can be seen in Figure 3.10.2 below. The production ranged from a high point of 22.2 million tons in 1997 to a lower one of 10.5 million tons in 2000. An average figure of about 17.7 million tons was produced within this period.

For the purpose of facility design, the average forecast value of grain should as a rule not be used since such a value may go up during a good harvest year, and then Romania would again have to face with logistical problems with regards to storage, transport and handling the excess grain. In order to prepare for such a problem, like the one Romania experienced in 1996 after a bumper crop in the summer of 1995, an upper limit in the forecast has to be set up to determine the required grain handling facility capacity in the Port of Constantza for the year 2010.

In the period of 1993-2000, for example, the highest level could be as much as 22.1 million tons and the lowest level 10.1 million tons. Assuming that these two records are exceptional, the range is taken as situated between the second highest and second lowest levels. Assuming too high a value for the upper limit will run the risk of over-designing the handling facility.

Second highest production between 1993-2000 : 19.88 million tons (1995)
Second Lowest production between 1993-2000: 14.20 million tons (1996)
Range is estimated to be +2.8 or -2.8 million ton.

Assuming that this range will also apply up to 2010, and since the estimated average production of 2010 will have to be about 20.5 in order to have an export potential of 1.5 million tons, the range of production will be between 23.3 million tons and 17.7 million tons. Therefore the upper limit for export will be 4.3 million tons (23.3-19.0). During a poor harvest year, if the production falls to 17.7 million, and taking into account the 19.0 million ton domestic demand, the export level will be 0 million ton, and a possible import of 1.3 million tons will be needed.

This estimated fluctuation in regards to crop production, is further examined or verified based on average yield and the assumption that the land area devoted to crops will remain fairly constant, that is at about 6 million ha. In regards to the upper limit of 23.3 million tons, an average yield of 3.88 ton/ha has to be achieved. On the other hand when coming to the median value of 20.5 million tons, an average yield of 3.42 ton/ha has to be achieved. Looking at the past record of grain productivity, these figures look very realistic and no doubt will be achievable in Romania in the near future.

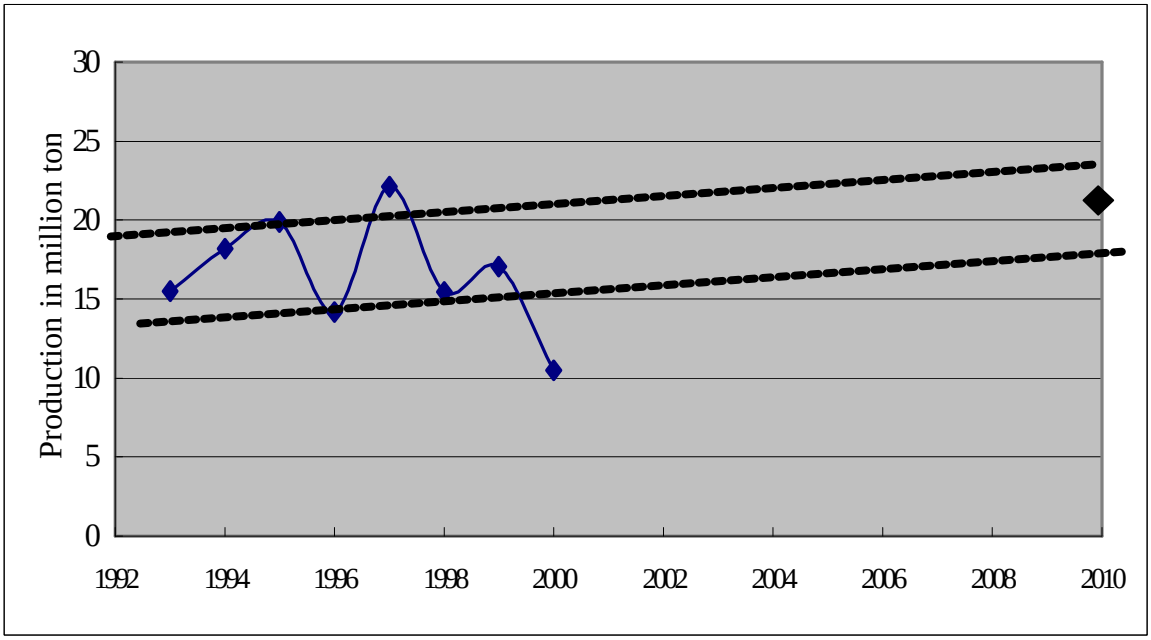



**Figure 3.10.2 Fluctuation in Grain Production in Romania (1993-2000) and Setting the Fluctuation Range to 2010.**

**Table 3.10.8 Average Yield Per ha of Three Major Crops for Romania**

(Ton/ha)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2010 |
|---|---|---|---|---|---|---|---|---|---|
| Average yield for maize, wheat & rye, and barley | 2.46 | 2.80 | 3.13 | 2.28 | 3.38 | 2.57 | 2.95 | 2.00 | 3.88*<br>**3.42**<br>2.95** |

* Upper value, ** lower value

However, the excess grain production from Romania should not be assumed as totally allocated for export. Although the potential to export all this excess is possible, it is more realistic to also look at other external factors, such as world demand, price competition with other producers, as well as the need to replenish Romanian national grain reserves. A factor of 0.7 is thus assumed for estimating the export of the excess grain production from Romania.

With regards to imports, the Master Plan Study estimated a volume of about 0.38 million tons. The growth of this category mostly depends on the demand of other types of grains in Romania, improvement in the economy, and also on the harvest of the previous year. The range, as estimated in the study, is 0 ~ 0.75 million ton. During a good harvest year, imports will fall. For the purpose of facility planning, the upper limit for the export portion is used- and the lower limit for the import portion shall be used. Therefore for calculating facility requirements, a lower import value of about 0.25 is assumed.

The transit portion of the forecast traffic is 0.63 million tons. Taking this figure as the median value, during a good harvest year in Hungary, for example, a higher grain transit traffic

through the Port of Constantza can also be expected. Nevertheless, the transit figure range is more difficult to predict since it depends on many factors such as the navigability of the Danube by the year 2010, the competitions from other ports and other modes of transport. For this very reason, the master plan study has predicted that this figure will fluctuate between 0 ~ 1.25 million ton.

Using the assumed factor of 0.7 for export of total excess grain, the potential export volume is estimated as 3.0 million tons (4.3 x 0.7) . Therefore the upper limit of the potential grain traffic through Constantza is estimated to be 4.5 million tons (3.0+0.25+1.25) by year 2010.

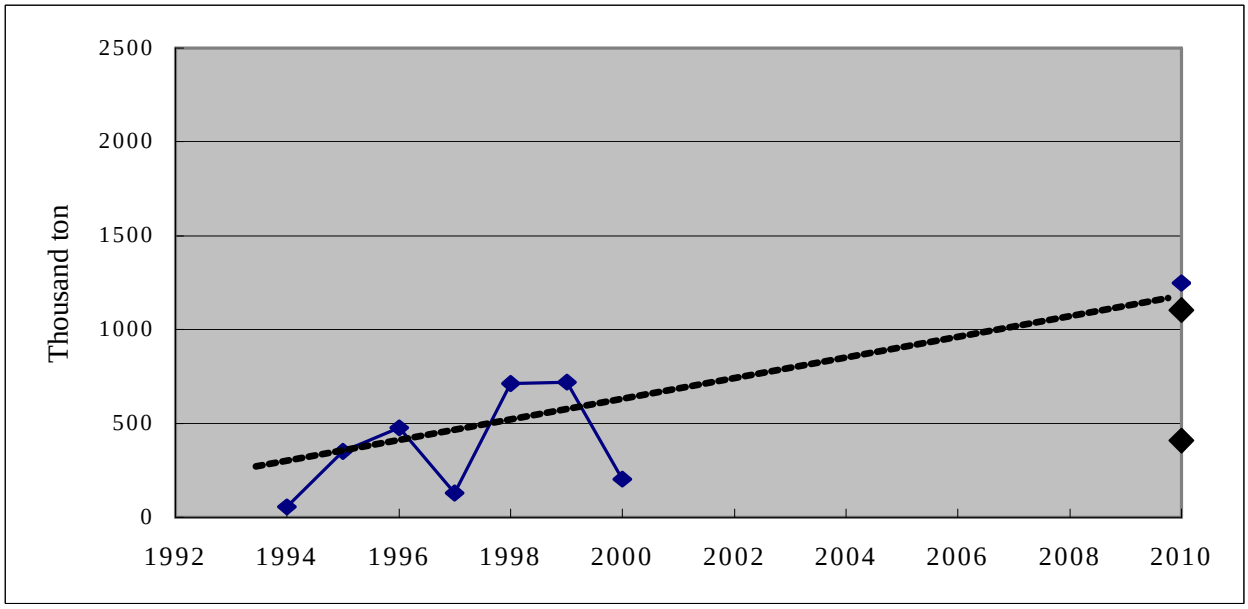



**Figure 3.10.3 Past Trend of Transit Grain Cargo and Future Forecast**

**Table 3.10.9 Estimated Upper Limit of Expected Grain Traffic by 2010**

| | Median value predicted in the Master Plan | Estimated upper and lower grain production | Upper limit to be used for design of facility | Adjust by factor for export to total excess production (0.7) |
|---|---|---|---|---|
| Export | 1.5 mil. ton | +2.8<br>- 2.8 | + 4.3 | +3.0 |
| Import | 0.38 | | + 0.75<br>+ 0.25* | <br>+0.25 |
| Transit | 0.63 mil. ton | | + 1.25 | +1.25 |
| Total | 2.51 mil. ton | | | +4.5 |

* During a good harvest year, as export increased, import will fall. Thus the lower limit of import is assumed.

### (5) Review Summary of the Grain Forecast

1) The World Bank Study on Romania's Grain Market and Export Project focused on analyzing the export potential of grains from Romania as well as from Hungary and Yugoslavia. The forecast is basically based on an optimistic view of the yield per ha of grain cultivation in the three countries and on the major role of the Port of Constantza in handling the forecasted potential grain export to the markets of the CAC, Middle East, Far East and North African countries. The study forecast future grain traffic (median value) of about 7.7 million tons a year, of which 4.3 million tons or 56% are in fact the transit cargo from Hungary and Yugoslavia and only 3.4 million tons, is from Romania. This optimistic view of the transit traffic volume is based on the optimistic view on the full reopening of the Danube waterway, as well as on the high yields and advantages of Constantza over other competing ports.

2) The World Bank study was conducted in 1997, at a time when the grain production in Romania and Hungary was good, and Romania had barely overcome the unprecedented logistic problem in exporting its excess grains from the 1995 summer harvest, that proved to be exceptionally good. The war in Yugoslavia is also coming to an end and the prospects of reopening the Danube look good. Given such a background, it is understandable that an optimistic scenario was adopted for the Study.

3) While the World Bank Study focused only on grains and using a microscopic-economic approach, the JICA Constantza Master Plan Study on the other hand, considered the total cargo traffic going through the port, and hence used both the macro and micro-economic approaches in the forecasting. The JICA Study forecast that the grain traffic growth through the Port of Constantza would be modest in the year 2010 and 2020. The JICA Study's conservative forecast was based on the premise that the restoration of the Danube navigability will take time, while the per ha yield of grain cultivated land will only gradually increase due to delays in land reforms and optimization of farm size. The JICA Study also was aware of the 1997-1999 contraction of Romania's economy, as seen in the results of the transition period, that is restructuring the economy, as well taking into account the general slump in the rest of the world in this period.

4) The grain traffic that has been forecast in the Master Plan, that is about 2.51 million tons a year, is the median or average value expected by 2010. As this paper reveals, the total potential grain traffic through Constantza during a good harvest year is estimated as high as 4.5 million tons a year, of which 3.0 million tons are exported from Romania, 1.25 million tons are the transit from and to third countries and 0.25 million tons are imported to Romania. The grain export share from Romania does not really vary greatly from the World Bank Study. The major difference is the different outlook and estimations in the transit traffic from Hungary and third countries. The

World Bank study foresees a volume of 4.3 million tons from Hungary and Yugoslavia by 2010, while the JICA study estimates only a modest volume, that is 1.25 million tons a year.

5) For facility planning, the world bank study used its median forecast of 7.7 million tons a year and proposed a new 5.0 million ton grain terminal after assessing the existing capacity of 2.7 million tons. On the other hand, in the JICA study, the upper case value of the 4.5 million ton total potential volume is used for facility planning. The rationality is to make sure that the Port of Constantza will always be ready to handle the export-bound grain during a bumper crop year.

The World Bank and JICA Master Plan Study forecasts of grain traffic in Port of Constantza and estimation of median value of grain traffic demand (Case1:High) are summarized in Table 3.10.10and Table 3.10.11 respectively.

## Table 3.10.10 Summary Table of World Bank and JICA Master Plan Study Forecasts of Grain Traffic in Port of Constantza

| **World Bank Study,1998** | **JICA Master Plan Study, 2000** |
|---|---|
| **Forecasted Grain Traffic (million tons)**<br>Year 2000 2005 2010<br>High case 3.5 5.5 9.6<br>Median 2.8 4.6 7.7<br>Low 2.0 3.6 6.0 | **Forecasted Grain Traffic (million- .tons)**<br>Year 2010<br>High case 4.5<br>Median 2.5 |
| **Composition:**<br>For the median value of 7.7 million tons a year,<br>3.4 million tons ----- from/to Romania<br>4.3 million tons or 56% ----- transit from Hungary, Yugoslavia | **Composition:**<br>For the high case value of 4.5 million tons,<br>3.25 million tons ------ from/to Romania<br>1.25 million tons ----- transit from third countries. |
| **Approach:** Micro-economic approach | **Approach:** Macro and Micro economic Approaches |
| **Assumptions** | **Assumptions:** |
| **1. Yield per ha of grain land: Optimistic Increase**<br>2010<br>Maize 4.5 ton/ha ~ 5.0 ton/ha<br>Wheat 4.0 ton/ha ~ 4.4 ton/ha<br>average 4.3 ton/ha ~4.7 ton/ha<br>(achieving levels as in Italy and France) | **1. Estimated ranges for**<br>**Export: 1 - 4 million tons a year**<br>**Import: 0 - 0.75 million tons a year**<br>**Transit: 0 - 1.25 million tons a year**<br>(export depends on grain production with gradual increases in yield due to delay in land reforms; transit traffic depends on reopening of Danube, accession to EU, etc) |
| **2. Area under grain - stable at 6 million ha** | **2. Area under grain - stable at 6 mil ha.** |
| **3. Production:**<br>Production thus estimated to be<br>25.6 million tons in 2010 (median value) | **3. Production:**<br>Production for median value estimated<br>to be 20.5 million tons.<br>(range 17.7~23.3 million tons a year)<br>Yield for this production is estimated as<br>3.42 ton/ha (range 3.0 ~ 3.9 ton/ha) |
| **3. Domestic consumption fairly stable with gradual increases**<br>Estimated as 19.7 - 21.7 million tons in 2010 | **3. Domestic consumption stable**<br><br>Estimated as 18-19 million tons in 2010 |
| **4. Navigability of Danube:**<br>Re-open with optimistic time frame thus<br>a high figure of 4.3 million tons a year. | **4. Navigability of Danube:**<br>Re-open but may take some time thus<br>a conservative figure of 1.25 million tons. |
| **5. Share of traffic by Constantza for transit grain from Hungary and Yugoslavia:**<br><br>Major and optimistic share 68.8%<br>(little competition from Adriatic sea ports) | **5. Share of traffic by Constantza for transit grains from Hungary and Slovakia, Yugoslavia:**<br><br>Modest share (19.8% if assuming equal total export potential as in World Bank Study of 6.3 million tons)<br>( in view of delay in restoration of Danube waterway and stiff competition from other ports esp. Adriatic sea ports) |
| **6. Median value 7.7 million tons is used for facility planning** | **6. Upper limit 4.5 million tons to be used for facility planning** |

**Table 3.10.11 Estimation of Median Value of Grain Traffic Demand (Case1:High)**

(Unit: Million Tons)

| | | Median Value (Net Traffics) | Allowance to the annual fluctuation ( Due to average change by climatic condition and etc,. ) | Total ( Required Total Facility Capacity) |
|---|---|---|---|---|
| **1.World Bank Study in 1997** | | | | |
| (1) Grain Traffics in 2010 | | | | |
| | Trade | 3.40 | | |
| | Transit | 4.30 | | |
| | Total | 7.70 | | |
| (2) Required Total Facility Capacity of Grain Terminal | | | | |
| | Trade | 3.40 | 0 | 3.40 |
| | Transit | 4.30 | 0 | 4.30 |
| | Total | 7.70 | 0 | 7.70 |
| (3) **Estimated Net Traffic using allowance of fluctuation estimated by JICA** . | | | | |
| | Trade | **3.40 – 1.37 = 2.03** | *1.37 | **3.40** |
| | Transit | **4.30 – 0.62 = 3.68** | *0.62 | **4.30** |
| | Total | **5.71** | *1.99 | **7.70** |
| **2. JICA Preliminary Traffic Study in 2000** | | | | |
| (1) **Grain Traffics Estimated by JICA in 2010** | | | | |
| | Trade | **1.88** | | |
| | Transit | **0.63** | | |
| | Total | **2.51** | | |
| (2) **Designing Facility Capacity of Grain Terminal** | | | | |
| | Trade | **1.88** | *1.37 | **1.88 + 1.37 = 3.25** |
| | Transit | **0.63** | *0.62 | **0.63 + 0.62 = 1.25** |
| | Total | **2.51** | *1.99 | **4.50** |

## 3.10.3 Revision of Traffic Demand Forecast of Transit in the Feasibility Study

### (1) Estimates of Annual Fluctuation for Total Traffic Demand by the World Bank Study

The traffic demand forecast by the JICA Master Plan Study basically excludes the annual fluctuation that was mentioned above as the median value, where the annual fluctuation takes account of the lower and upper limits, and the upper limits are applied to setting up the capacity to cope with maximum traffic demand. On the other hand, the traffic demand forecast by the World Bank is not separated into median value and lower and upper limits; it is directly applied to determining the capacity to cope with total traffic demand as a maximum.

The median traffic demand value (net traffic demand) by the World Bank was estimated for trade and transit that is derived by subtracting the annual trade fluctuation, which was estimated by the JICA Master Plan Study, from the total trade and transit forecast by the World Bank. The result is shown in Table 3.10.11. According to these results, trade demand is about 2.03 million tons for the World Bank and 1.88 million tons for the JICA Study while the transit demand is about 3.68 million tons for the World Bank and 0.63 for the JICA Study. A distinct and large gap can be observed in regards to traffic transit demand between the two approaches. This big difference could not be disregarded. Thus the JICA Study team would

consider revising the traffic demand forecast of transit on the basis that it was determined by the World Bank.

### (2) Revision of Future Production and Consumption for Hungary and Romania

#### a. Production

(a) Historical Performance

The countries that would export their grain production through the Port of Constantza are mainly Hungary and F.R. Yugoslavia. Hungary especially has predominantly exported its grain production through the Port of Constantza as transit cargo. Thus forecasting focused on the production of Hungary.

The production of Hungary has recorded some slight fluctuation since 1986 to 1999 from about 14.3 million tons (1986-1990) to 11.4 million tons (1990-1999). From the long-range view point, grain production of Hungary has shown only a slight decrease. (See Table 3.10.12)

The total production of grains is basically decided by the average yields and cultivated area. The average yields of wheat, barley and others have decreased, but that of maize shows some increase. (See Table 3.10.13) On the other hand, the cultivated area has totally decreased from about 2.8 million ha. (the average of 1986-1990) down to 2.3 million ha. in 1999. Especially, the cultivated area of wheat shows a drastic decrease from 1.3 million ha. to 0.7 million ha.(See Table 3.10.14)

**Table 3.10.12 1Production of Grains in Hungary**

(Unit: 1,000tons)

| Crop | Average of 1986- 1990 | Average of 1991- 1995 | 1997 *1) | 1998 | 1999 |
|---|---|---|---|---|---|
| Wheat | 6,261 | 4,394 | 5,000 | 4,895 | 2,638 |
| Maize | 6,449 | 5,127 | 5,600 | 6,143 | 7,149 |
| Barley & Others | 1,572 | 1,934 | 1,700 | 1,967 | 1,589 |
| Total | 14,282 | 11,455 | 12,300 | 13,005 | 11,376 |

Source : Statistical Yearbook of Hungary,1999, Budapest 2000, Hungarian Statistical Office
Note :*1) Forecast by International Cereals Council reported in "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure Component ",Final Report Vol.1, 51 2304/Jan. 1998, World Bank

**Table 3.10.13 Average Yields of Grains in Hungary**

(Unit: ton/hectare)

| Crop | Average of 1986-1990 | Average of 1991- 1995 | 1997 *1) | 1998 | 1999 |
|---|---|---|---|---|---|
| Wheat | 4.88 | 4.25 | 4.50 | 4.14 | 3.59 |
| Maize | 5.63 | 4.41 | 5.00 | 5.95 | 6.38 |
| Barley & Others *2) | 3.70 | 3.55 | 3.70 | 4.37 | 3.18 |

Source : Statistical Yearbook of Hungary,1999, Budapest 2000, Hungarian Statistical Office

Note :*1) Forecast by International Cereals Council reported in "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure Component ", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

*2) Average yield of Barley & Others were estimated by JICA Study Team.

**Table 3.10.14 Growth in Areas Cultivated for Grains in Hungary by the World Bank**

(Unit: 1,000 hr.)

| Crop | Average of 1986- 1990 | Average of 1991- 1995 | 1995 | 1998 *1) | 1999 *1) | Forecasted by the World Bank *2) | | | Assumed by the JICA Study Team *3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Wheat | 1,300 | 1,000 | 1,100 | 1,182 | 735 | 1,200 | 1,200 | 1,200 | 1,100 | 1,100 | 1,100 |
| Maize | 1,100 | 1,100 | 1,050 | 1,032 | 1,121 | 1,100 | 1,100 | 1,100 | 1,050 | 1,050 | 1,050 |
| Barley & Others | 350 | 500 | 450 | 450 | 450 | 500 | 500 | 500 | 450 | 450 | 450 |
| Total | 2,750 | 2,600 | 2,600 | 2,665 | 2,305 | 2,800 | 2,800 | 2,800 | 2,600 | 2,600 | 2,600 |

Source : "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank for Maritime and River Infrastructure

Note : *1) Calculated by the JICA Study Team by assumption that the areas cultivated are averaged during 1986-1998

*2) Forecasted by European Commission reported in the report mentioned in the source.

*3) Assumed by the JICA Study Team by taking account of more conservative areas cultivated than the one of the World Bank

(b) Forecasting of Production

The average yield and the cultivated area of grains of Hungary are forecast by the World Bank on the basis of the agricultural growth scenario (low and high) shown in Table 3.10.14 and Table 3.10.15 respectively. The forecast production is shown in Table 3.10.5.16. By taking account of the historical performance of these production factors mentioned above, the values that were forecast by the World Bank seem not to be overestimated, but rather optimistic. These indicators should be revised from a more conservative point of view and by assuming a more realistic agricultural activity in Hungary.

Table 3.10.17 shows the production forecast of grains in Romania and Table 3.10.18 shows the total production of grains of Romania and Hungary by the World Bank. From this data, the approximate share of grain traffic demand by kind of crop can be estimated. Judging from the average value, the wheat and maize would take almost the same share of 42.4% and 42.5% respectively, whereas barley and others have only 15.1%. These figures are necessary to estimate the handling capacity by kinds of commodity. But these figures are only used in the World Bank Study. They will be calculated on the basis of the revised grains production of Hungary to be entered in the JICA Feasibility Study, as explained in the following approach.

## Table 3.10.15 Forecast for Average Yields of Grains in Hungary by the World Bank

(Unit: ton/hectare)

| Crop | Scenario -1 (Low Growth) | | | Scenario -2 (High Growth) | | |
|---|---|---|---|---|---|---|
| | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Wheat | 4.60 | 4.85 | 5.10 | 4.70 | 5.20 | 5.70 |
| Maize | 5.10 | 5.35 | 5.60 | 5.20 | 5.70 | 6.20 |
| Barley & Others | 3.80 | 4.05 | 4.30 | 3.90 | 4.40 | 4.90 |

Source : "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

## Table 3.10.16 Forecast for Production of Grains in Hungary by the World Bank

| | Crop | Scenario -1 (Low Growth Scenario) | | | Scenario -2 (High Growth Scenario) | | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Production (1,000tons) | Wheat | 5,520 | 5,820 | 6,120 | 5,640 | 6,240 | 6,840 | 5,580 | 6,030 | 6,480 |
| | Maize | 5,610 | 5,885 | 6,160 | 5,720 | 6,270 | 6,820 | 5,665 | 6,078 | 6,490 |
| | Barley & Others | 1,900 | 2,025 | 2,150 | 1,950 | 2,200 | 2,450 | 1,925 | 2,113 | 2,300 |
| | Total | 13,030 | 13,730 | 14,430 | 13,310 | 14,710 | 16,110 | 13,170 | 14,220 | 15,270 |
| Structure (%) | Wheat | 42.4 | 42.4 | 42.4 | 42.4 | 42.4 | 42.5 | 42.4 | 42.4 | 42.4 |
| | Maize | 43.1 | 42.9 | 42.7 | 43.0 | 42.6 | 42.3 | 43.0 | 42.7 | 42.5 |
| | Barley & Others | 14.6 | 14.7 | 14.9 | 14.7 | 15.0 | 15.2 | 14.6 | 14.9 | 15.1 |
| | Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source : "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

## Table 3.10.17 Forecast for Production of Grains in Romania by the World Bank

| | Crop | Scenario -1 (Low Growth Scenario) | | | Scenario -2 (High Growth Scenario) | | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Production (1,000tons) | Wheat | 7,820 | 8,140 | 8,400 | 7,820 | 8,580 | 9,240 | 7,820 | 8,360 | 8,820 |
| | Maize | 10,800 | 12,000 | 12,600 | 10,800 | 12,900 | 14,000 | 10,800 | 12,450 | 13,300 |
| | Barley & Others | 2,500 | 3,000 | 3,500 | 2,500 | 3,000 | 3,500 | 2,500 | 3,000 | 3,500 |
| | Total | 21,120 | 23,140 | 24,500 | 21,120 | 24,480 | 26,740 | 21,120 | 23,810 | 25,620 |
| Structure (%) | Wheat | 37.0 | 35.2 | 34.3 | 37.0 | 35.0 | 34.6 | 37.0 | 35.1 | 34.4 |
| | Maize | 51.1 | 51.9 | 51.4 | 51.1 | 52.7 | 52.4 | 51.1 | 52.3 | 51.9 |
| | Barley & Others | 11.8 | 13.0 | 14.3 | 11.8 | 12.3 | 13.1 | 11.8 | 12.6 | 13.7 |
| | Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source : "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

Table 3.10.19 shows the revised average yields of grains which were assumed by taking account of recent performance, except for maize. The yield growth for a five-year interval is 0.25 ton/ha for the low growth scenario and 0.5 ton/ha for the high growth scenario, both of which are based on the same assumptions as the World Bank. On the other hand, the future cultivated area indexes were revised as shown in Table 3.10.14. From these revised average yields and cultivated area, the future production of Hungary was forecast as shown in Table 3.10.20.

**Table 3.10.18 Total Production of Grains in Hungary & Romania by the World Bank**

| | Crop | Scenario -1 (Low Growth Scenario) | | | Scenario -2 (High Growth Scenario) | | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Production (1,000tons) | Wheat | 13,340 | 13,960 | 14,520 | 13,460 | 14,820 | 16,080 | 13,400 | 14,390 | 15,300 |
| | Maize | 16,410 | 17,885 | 18,760 | 16,520 | 19,170 | 20,820 | 16,465 | 18,528 | 19,790 |
| | Barley & Others | 4,400 | 5,025 | 5,650 | 4,450 | 5,200 | 5,950 | 4,425 | 5,113 | 5,800 |
| | Total | 34,150 | 36,870 | 38,930 | 34,430 | 39,190 | 42,850 | 34,290 | 38,030 | 40,890 |
| Structure (%) | Wheat | 39.1 | 37.9 | 37.3 | 39.1 | 37.8 | 37.5 | 39.1 | 37.8 | 37.4 |
| | Maize | 48.1 | 48.5 | 48.2 | 48.0 | 48.9 | 48.6 | 48.0 | 48.7 | 48.4 |
| | Barley & Others | 12.9 | 13.6 | 14.5 | 12.9 | 13.3 | 13.9 | 12.9 | 13.4 | 14.2 |
| | Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source : "Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

The production of Romania should also be revised for the forecast, but at the same time it was already analyzed for the purpose of estimating the upper and lower limits of grain production, that is by taking account of the annual fluctuation. In this study, the same production is used for the following reasons:

(i) Recent Trend of Production

The grain production of Romania has drastically fallen from 17.0 million tons in 1999 to 10.5 million tons in 2000. This drastic production decrease was caused mainly by maize, as its production has decreased from 10.9 million tons to 4.5 million tons in 2000. On the other hand, a good harvest is expected for 2001. According to the Ministry of Agriculture statement 43% of the harvested production of wheat is 3.2 million tons and the total production is expected to be as high as 7.4 million tons. If the production of maize will return to the 1999 level, the total production of these two crops could be as high as 20 million tons.

(ii) Forecast Level of Production

According to the forecast for wheat and maize production for 2000 estimated by the World Bank, this would be about 7.8 million and 10.8 million respectively. The forecasting year is actually not 2001, but 2000, where the production level is expected to be almost the same as of 2001. From the long-term viewpoint, these forecasting approaches are not overly optimistic on the long-term viewpoint. .

Table 3.10.21 shows the total production of grains of Hungary and Romania. Production share was calculated by kind of crops . Average shares for 2010 are as follows: wheat36.8%, maize 49.4% and barley & others 13.8%. These shares are the basis of estimation of the shares of grain traffic demand and for determining the required handling capacity by kind of crop.

**Table 3.10.19 Revised Average Yields of Grains in Hungary**

(Unit: ton/hectare)

| Crop | Scenario -1 (Low Growth) | | | Scenario -2 (High Growth) | | |
|---|---|---|---|---|---|---|
| | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Wheat | 4.40 | 4.65 | 4.90 | 4.50 | 5.00 | 5.50 |
| Maize | 5.10 | 5.35 | 5.60 | 5.20 | 5.70 | 6.20 |
| Barley & Others | 3.50 | 3.75 | 4.00 | 3.60 | 4.10 | 4.60 |

Source :The JICA Study Team

**Table 3.10.20 Revised Production of Grains in Hungary**

| | Crop | Scenario -1 (Low Growth Scenario) | | | Scenario -2 (High Growth Scenario) | | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Production (1,000tons) | Wheat | 4,840 | 5,115 | 5,390 | 4,950 | 5,500 | 6,050 | 4,895 | 5,308 | 5,720 |
| | Maize | 5,355 | 5,618 | 5,880 | 5,460 | 5,985 | 6,510 | 5,408 | 5,801 | 6,195 |
| | Barley & Others | 1,575 | 1,688 | 1,800 | 1,620 | 1,845 | 2,070 | 1,598 | 1,766 | 1,935 |
| | Total | 11,770 | 12,420 | 13,070 | 12,030 | 13,330 | 14,630 | 11,900 | 12,875 | 13,850 |
| Structure (%) | Wheat | 41.1 | 41.2 | 41.2 | 41.1 | 41.3 | 41.4 | 41.1 | 41.2 | 41.3 |
| | Maize | 45.5 | 45.2 | 45.0 | 45.4 | 44.9 | 44.5 | 45.4 | 45.1 | 44.7 |
| | Barley & Others | 13.4 | 13.6 | 13.8 | 13.5 | 13.8 | 14.1 | 13.4 | 13.7 | 14.0 |
| | Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source :The JICA Study Team

**Table 3.10.21 Revised Total Production of Grains in Hungary & Romania**

| | Crop | Scenario -1 (Low Growth Scenario) | | | Scenario –2 (High Growth Scenario) | | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Production (1,000tons) | Wheat | 12,660 | 13,255 | 13,790 | 12,770 | 14,080 | 15,290 | 12,715 | 13,668 | 14,540 |
| | Maize | 16,155 | 17,618 | 18,480 | 16,260 | 18,885 | 20,510 | 16,208 | 18,251 | 19,495 |
| | Barley & Others | 4,075 | 4,688 | 5,300 | 4,120 | 4,845 | 5,570 | 4,098 | 4,766 | 5,435 |
| | Total | 32,890 | 35,560 | 37,570 | 33,150 | 37,810 | 41,370 | 33,020 | 36,685 | 39,470 |
| Structure (%) | Wheat | 38.5 | 37.3 | 36.7 | 38.5 | 37.2 | 37.0 | 38.5 | 37.3 | 36.8 |
| | Maize | 49.1 | 49.5 | 49.2 | 49.0 | 49.9 | 49.6 | 49.1 | 49.8 | 49.4 |
| | Barley & Others | 12.4 | 13.2 | 14.1 | 12.4 | 12.8 | 13.5 | 12.4 | 13.0 | 13.8 |
| | Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source :The JICA Study Team
Note : The production of Romania was the same as of the World Bank

(c) Consumption

Recent statistical data with regard to grain consumption of Hungary is unavailable at this time. The 1999 consumption was about 9.5 million tons, which is more than any of the years 1995, 2000 and 2005. Actually the 1999 consumption increase could be rather exceptional as explained in the footnote of Table 3.10.23. Whereas we cannot judge from only one year of consumption, the consumption forecasts by the World Bank is pessimistic and should be lowered to level below the forecast traffic demand by the World Bank. Thus,

in this Study, the grain consumption of Hungary is basically based on the forecast result of the World Bank study. (See Table 3.10.22)

**Table 3.10.22 Grain Consumption in Hungary and Forecasts**

(Unit: 1,000 tons)

| | | 1995 | 1999 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| Human and Industrial Consumption | | 2,000 | | 2,000 | 2,000 | 2,000 |
| Animal Feed Consumption | Pigs | 1,710 | | 1,870 | 2,130 | 2,360 |
| | Cows | 860 | | 880 | 950 | 900 |
| | Sheep | 220 | | 250 | 300 | 280 |
| | Poultry | 1,130 | | 1,170 | 1,250 | 1,260 |
| | Milk | 1,460 | | 1,560 | 1,680 | 1,870 |
| | Eggs | 880 | | 940 | 980 | 980 |
| | Sub-Total | 6,260 | | 6,670 | 7,290 | 7,650 |
| Total | | 8,260 | 9,502 | 8,670 | 9,290 | 9,650 |

Source : 1."Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure or Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank
2. The figure of 1999 is based on Statistical Yearbook of Hungary,1999, Budapest 2000, Hungarian Statistical Office

(d) Export Potential

The general grain surplus balance of Hungary is derived by subtracting consumption from production. The forecast result in terms of consumption as done by the World Bank and the revised one by the JICA Feasibility Study, are shown in Table 3.10.23 and respectively 5.10.24.

**Table 3.10.23 General Balance for Grain in Hungary by the World Bank**

(Unit: 1,000 tons)

| Year | Scenario | Total Production | Total Consumption | Balance: Export (Theoretical) | Comments |
|---|---|---|---|---|---|
| 1995 | | 10,900 | 8,260 | 2,640 | Exports in Actual ; 2,300 |
| 1999 | | 11,376 | 9,502 | 1,874 | Exports in Actual ; 2,490 *1) |
| 2000 | 1 (Low) | 13,030 | 8,670 | 4,360 | Median Exports :4,500 |
| | 2(High) | 13,310 | | 4,640 | |
| 2005 | 1 (Low) | 13,730 | 9,290 | 4,440 | Median Exports :4,930 |
| | 2(High) | 14,710 | | 5,420 | |
| 2010 | 1 (Low) | 14,430 | 9,650 | 4,780 | Median Exports :5,620 |
| | 2(High) | 16,110 | | 6,460 | |

Source : 1."Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank
2. The figure of 1999 is based on Statistical Yearbook of Hungary,1999, Budapest 2000, Hungarian Statistical Office

Note: *1) Details of 2,490 tons as follows

| In | | Out | | Balance (Export) |
|---|---|---|---|---|
| Production | 11,375 | Domestic Use | 9,502 | 1,873 |
| Import | 70 | Loss | 117 | |
| From Stock | 664 | | | |
| Total | 12,109 | Total | 9,619 | 2,490 |

**Table 3.10.24 Revised General Balance for Grain in Hungary**

(Unit : 1,000 tons)

| Year | Scenario | Total Production | Total Consumption | Balance (Export) | Comments |
|---|---|---|---|---|---|
| 1995 | | 10,900 | 8,260 | 2,640 | Exports in Actual ; 2,300 |
| 1999 | | 11,376 | 9,502 | 1,874 | Exports in Actual ; 2,490 |
| 2000 | 1 (Low) | 11,770 | 8,670 | 3,100 | Median Exports :3,585 |
| | 2(High) | 12,030 | | 3,360 | |
| 2005 | 1 (Low) | 12,420 | 9,290 | 3,130 | Median Exports :3,940 |
| | 2(High) | 13,330 | | 4,040 | |
| 2010 | 1 (Low) | 13,070 | 9,650 | 3,420 | Median Exports :4,555 |
| | 2(High) | 14,630 | | 4,980 | |

Source: JICA Study Team

The general balance between production and consumption affects the export potential. For the purpose of forecasting traffic demand for transit cargoes, it is indispensable to estimate the export potentials of Romania, Hungary and F.R. Yugoslavia. Because part of the exports of these countries will be transported through the Port of Constantza, namely, exported cargoes for Romania and transiting cargoes from Hungary and F.R. Yugoslavia.

On the basis of forecast balances, the export potential is summarized as shown in Table 3.10.25 for the World Bank and Table 3.10.27 for the JICA Feasibility Study respectively. Tables 3.10.26 and 3.10.28 show the percentage structure of the export potentials. These percentages are applied to estimate export demand throughput in the Port of Constantza, assuming that the composing export cargo from these three countries which will make the throughput, are the same as the structure of export potential of these three countries.

**Table 3.10.25 Estimated Export Potential From Romania, Hungary, and F.R. Yugoslavia by the World Bank**

(Unit: Million Tonnage)

| Year | Romania | | | Hungary | | | F.R. Yugoslavia | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Average | Low | High | Average | Average | Low | High | Average |
| 2000 | 1.2 | 2.4 | 1.8 | 4.4 | 4.6 | 4.5 | 0.0 | 5.6 | 7.0 | 6.3 |
| 2005 | 2.3 | 3.2 | 2.8 | 4.4 | 5.4 | 4.9 | 0.4 | 7.1 | 9.0 | 8.1 |
| 2010 | 3.9 | 5.9 | 4.9 | 4.8 | 6.5 | 5.6 | 0.8 | 9.5 | 13.2 | 11.3 |

Source : 1."Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

**Table 3.10.26 Structure of Estimated Export Potential From Romania, Hungary, and F.R. Yugoslavia by the World Bank**

(Unit: %)

| Year | Romania | | | Hungary | | | F.R. Yugoslavia | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Average | Low | High | Average | Low | High | Average | Low | High | Average |
| 2000 | 21.6 | 34.1 | 28.6 | 78.4 | 65.9 | 71.4 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 |
| 2005 | 32.2 | 35.5 | 34.0 | 62.2 | 60.1 | 61.0 | 5.6 | 4.4 | 5.0 | 100.0 | 100.0 | 100.0 |
| 2010 | 41.1 | 44.8 | 43.3 | 50.4 | 49.1 | 49.6 | 8.4 | 6.1 | 7.1 | 100.0 | 100.0 | 100.0 |

**Table 3.10.27 Revised Export Potential From Romania, Hungary, and F.R. Yugoslavia**

(Unit: Million Tonnage)

| Year | Romania *1) | | | Hungary | | | F.R. Yugoslavia*1) | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Average | Low | High | Average | Average | Low | High | Average |
| 2000 | 1.2 | 2.4 | 1.8 | 3.1 | 3.4 | 3.2 | 0.0 | 4.3 | 5.8 | 5.0 |
| 2005 | 2.3 | 3.2 | 2.8 | 3.1 | 4.0 | 3.6 | 0.4 | 5.8 | 7.6 | 6.7 |
| 2010 | 3.9 | 5.9 | 4.9 | 3.4 | 5.0 | 4.2 | 0.8 | 8.1 | 11.7 | 9.9 |

Note: *1) The assumptions as of the World Bank were adopted.

**Table 3.10.28 Structure of Estimated Export Potential From Romania, Hungary, and F.R. Yugoslavia by the JICA Study Team**

(Unit: %)

| Year | Romania | | | Hungary | | | F.R. Yugoslavia | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Average | Low | High | Average | Low | High | Average | Low | High | Average |
| 2000 | 27.9 | 41.7 | 35.8 | 72.1 | 58.3 | 64.2 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 |
| 2005 | 39.5 | 41.9 | 40.8 | 53.7 | 52.9 | 53.2 | 6.9 | 5.2 | 5.9 | 100.0 | 100.0 | 100.0 |
| 2010 | 48.0 | 50.5 | 49.5 | 42.1 | 42.6 | 42.4 | 9.9 | 6.8 | 8.1 | 100.0 | 100.0 | 100.0 |

(e) Export Route

To estimate grain traffic demand through the Port of Constantza, it is necessary to study export cargo routes and the Port of Constantza. Table 3.10.29 shows the forecasts by the World Bank and the Table 3.10.30 shows the forecasts by the JICA Feasibility Study. When it comes to the average values, the World Bank Study has forecast that the traffic volume throughput of the Constantza Port would be as high as 7.8 million tons while the JICA Study assumes 6.4 million tons.

**Table 3.10.29 Grain Exports From Romania, Hungary and F.R. Yugoslavia by Estimated Future Export Routes by the World bank**

(Unit: Million Tonnage)

| Year | Agricultural Hypotheses | | Estimated Breakdown By Future Export Route | | | | |
|---|---|---|---|---|---|---|---|
| | Hypotheses | Traffic Forecast | Land Transport | Adriatic Ports | Ukrainian Ports | Galati and Braila | Constantza |
| 2000 | Low | 5.6 | 2.0 | 0.5 | 0.5 | 0.5 | 2.1 |
| | Average | 6.3 | 2.0 | 0.5 | 0.5 | 0.5 | 2.8 |
| | High | 7.0 | 2.0 | 0.5 | 0.5 | 0.5 | 3.5 |
| 2005 | Low | 7.1 | 1.4 | 0.8 | 0.5 | 0.8 | 3.6 |
| | Average | 8.1 | 1.4 | 0.8 | 0.5 | 0.8 | 4.6 |
| | High | 9.0 | 1.4 | 0.8 | 0.5 | 0.8 | 5.5 |
| 2010 | Low | 9.5 | 1.0 | 1.0 | 0.5 | 1.0 | 6.0 |
| | Average | 11.3 | 1.0 | 1.0 | 0.5 | 1.0 | 7.8 |
| | High | 13.2 | 1.0 | 1.0 | 0.5 | 1.0 | 9.7 |

Source : 1."Romania Grain Market and Export Project Preparation Study for Maritime and River Infrastructure for Maritime and River Infrastructure Component", Final Report Vol.1, 51 2304/Jan. 1998, World Bank

**Table 3.10.30 Revised Grain Exports From Romania, Hungary and F.R. Yugoslavia by Estimated Future Export Routes**

(Unit: Million Tonnage)

| Year | Agricultural Hypotheses | | Estimated Breakdown By Future Export Route *1) | | | | |
|---|---|---|---|---|---|---|---|
| | Hypotheses | Traffic Forecast | Land Transport | Adriatic Ports | Ukrainian Ports | Galati and Braila | Constantza |
| 2000 | Low | 4.3 | 2.0 | 0.5 | 0.5 | 0.5 | 0.8 |
| | Average | 5.0 | 2.0 | 0.5 | 0.5 | 0.5 | 1.5 |
| | High | 5.8 | 2.0 | 0.5 | 0.5 | 0.5 | 2.3 |
| 2005 | Low | 5.8 | 1.4 | 0.8 | 0.5 | 0.8 | 2.3 |
| | Average | 6.7 | 1.4 | 0.8 | 0.5 | 0.8 | 3.2 |
| | High | 7.6 | 1.4 | 0.8 | 0.5 | 0.8 | 4.1 |
| 2010 | Low | 8.1 | 1.0 | 1.0 | 0.5 | 1.0 | 4.6 |
| | Average | 9.9 | 1.0 | 1.0 | 0.5 | 1.0 | 6.4 |
| | High | 11.7 | 1.0 | 1.0 | 0.5 | 1.0 | 8.2 |

Note : *1) The same assumptions as of the World Bank were adopted.

(f) Transit Cargoes

The traffic demand throughput of Constantza Port mentioned above is divided into export cargoes from three countries based on the export potential structure (as already estimated in Tables 3.10.25 and 3.10.27) and the exports from Hungary and F.R. Yugoslavia categorized as transit cargoes. (See Tables 3.10.31 and 3.10.32). According to the JICA Study estimation, the export cargoes from Romania will be as high as 3.2 million tons and the transit cargoes will be 3.2 million in 2010, that is about 50% share for each respectively.

Finally net traffic demand (the median value of grain traffic demand, which is in the JICA Study) is derived by subtracting the annual fluctuation from the total traffic demand that would make the high growth scenario. (See Table 3.10.33) The result shows that the export trade of Romania in 2010 will be as high as 1.80 million tons, where the transit will be about 2.61 million tons and respectively the total net traffic demand will be about 4.41 million tons.

## Table 3.10.31 Estimates for Exports from Romania and Transit of Exports from Hungary and F.R. Yugoslavia Through Port of Constantza

**[Estimates on the Basis of the Forecast by the World Bank]**

| Year | Structure of Exports by Country (%) | | | | Traffic Volume (Million Tonnage) | | | |
|---|---|---|---|---|---|---|---|---|
| | Romania | Hungary | F.R.Yugoslavia | Total | Romania | Hungary | F.R.Yugoslavia | Total |
| | Average | Average | Average | Average | Average | Average | Average | Average |
| 2000 | 28.6 | 71.4 | 0.0 | 100.0 | 0.8 | 2.0 | 0.0 | 2.8 |
| 2005 | 34.0 | 61.0 | 5.0 | 100.0 | 1.6 | 2.8 | 0.2 | 4.6 |
| 2010 | 43.3 | 49.6 | 7.1 | 100.0 | 3.4 | 3.9 | 0.6 | 7.8 |

**[Estimates on the Basis of the Revised Forecast by JICA Feasibility Study]**

| Year | Structure of Exports by Country (%) | | | | Traffic Volume (Million Tonnage) | | | |
|---|---|---|---|---|---|---|---|---|
| | Romania | Hungary | F.R.Yugoslavia | Total | Romania | Hungary | F.R.Yugoslavia | Total |
| | Average | Average | Average | Average | Average | Average | Average | Average |
| 2000 | 35.8 | 64.2 | 0.0 | 100.0 | 0.5 | 1.0 | 0.0 | 1.5 |
| 2005 | 40.8 | 53.2 | 5.9 | 100.0 | 1.3 | 1.7 | 0.2 | 3.2 |
| 2010 | 49.5 | 42.4 | 8.1 | 100.0 | 3.2 | 2.7 | 0.5 | 6.4 |

## Table 3.10.32 Summary of Estimates for Exports from Romania and Transit of Exports from Hungary and F.R. Yugoslavia Through Port of Constantza

(Unit: Million Tons)

| Year | Estimates on the Basis of the Forecast by the World Bank | | | | | Estimates on the Basis of the Revised Forecast | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Exports from Romania | Transit | | | Total | Exports from Romania | Transit | | | Total |
| | | Exports from Hungary | Exports from F.R. Yugoslavia | Sub-Total | | | Exports from Hungary | Exports from F.R. Yugoslavia | Sub-Total | |
| | Average | Average | Average | Average | Average | Average | Average | Average | Average | Average |
| 2000 | 0.8 | 2.0 | 0.0 | 2.0 | 2.8 | 0.5 | 1.0 | 0.0 | 1.0 | 1.5 |
| 2005 | 1.6 | 2.8 | 0.2 | 3.0 | 4.6 | 1.3 | 1.7 | 0.2 | 1.9 | 3.2 |
| 2010 | 3.4 | 3.9 | 0.6 | 4.4 | 7.8 | 3.2 | 2.7 | 0.5 | 3.2 | 6.4 |

(g) Required Handling Facility Capacity

Based on the total demand forecast, including the annual fluctuation, the required handling capacity is determined. The total existing capacity of operators such as SILOTRANS, AGROEXPORT and others is about 2.5 million tons per year and may expand up to 3.7 million tons per year until 2003. The grain traffic demand will reach 5.72 million tons. Then the additional capacity of 2 million tons will need to be increased. (See Table 3.10.33 and Figure 3.10.4) Table 3.10.34 shows the result of forecast during the period from 2010 to 2020.

## Table 3.10.33
## Revised Estimation of Median Value of Grain Traffic Demand for Exports (Case1:High)

(Unit: Million Tons)

| Cargo Classification | | Median Value (Net Traffics) | Allowance to the annual fluctuation (Due to average change by climatic condition and etc,.) | Total (Required total facility capacity ) |
|---|---|---|---|---|
| **1. World Bank Study in 1997** | | | | |
| (1) Grain Traffics in 2010 | | | | |
| | Trade | 3.40 | | |
| | Transit | 4.30 | | |
| | Total | 7.70 | | |
| (2) Required Total Facility Capacity of Grain Terminal | | | | |
| | Trade | 3.40 | 0 | **3.40** |
| | Transit | 4.30 | 0 | **4.30** |
| | Total | 7.70 | 0 | **7.70** |
| (3) Net Traffic using Annual Fluctuation Allowance ( Estimated by JICA in 2001 * ) | | | | |
| | Trade | **3.40 – 1.37 = 2.03** | *1.37 | **3.40** |
| | Transit | **4.30 – 0.62 = 3.68** | *0.62 | **4.30** |
| | Total | **5.71** | *1.99 | **7.70** |
| **2. JICA Feasibility Study in 2001** | | | | |
| (1) Grain Traffics in 2010 (Estimated Median Value by JICA in 2001 *) | | | | |
| | Trade | ****1.80** | | |
| | Transit | ****2.61** | | |
| | Total | ****4.41** | | |
| (2) Designing Facility Capacity of Grain Terminal | | | | |
| | Trade | ****1.80** | *1.37 | **1.80 + 1.37 = 3.17** |
| | Transit | ****2.61** | *0.62 | **2.61 + 0.62 = 3.23** |
| | Total | ****4.41** | *1.99 | **6.40** |

## Table 3.10.34
## Grain Traffics and Required Handling Facility Capacity for Exports

(Unit : Million Tons)

| Year | Median Value (Net Traffic) | Allowance for Annual Fluctuation | Total | Required Capacity |
|---|---|---|---|---|
| 1999 | 1.76 | 1.99 | 3.75 | 2.5 |
| 2000 | 1.91 | 1.99 | 3.90 | 2.5 |
| 2001 | 2.08 | 1.99 | 4.07 | 2.5 |
| 2002 | 2.26 | 1.99 | 4.25 | 2.5 + 0.5 = 3.0 |
| 2003 | 2.46 | 1.99 | 4.45 | 3.0 + 0.7 = 3.7 |
| 2004 | 2.67 | 1.99 | 4.66 | 3.7 |
| 2005 | 2.90 | 1.99 | 4.89 | 3.7 |
| 2006 | 3.16 | 1.99 | 5.15 | 3.7 |
| 2007 | 3.43 | 1.99 | 5.42 | 3.7 |
| 2008 | 3.73 | 1.99 | 5.72 | 3.7 + 2.0 = 5.7 |
| 2009 | 4.06 | 1.99 | 6.05 | 5.7 |
| 2010 | 4.41 | 1.99 | 6.40 | 5.7 |
| 2011 | 4.60 | 1.99 | 6.59 | 5.7 |
| 2012 | 4.80 | 1.99 | 6.79 | 5.7 |
| 2013 | 5.01 | 1.99 | 7.00 | 5.7 + 2.0 = 7.7 |
| 2014 | 5.23 | 1.99 | 7.22 | 7.7 |
| 2015 | 5.46 | 1.99 | 7.45 | 7.7 |
| 2016 | 5.65 | 1.99 | 7.64 | 7.7 |
| 2017 | 5.84 | 1.99 | 7.83 | 7.7 |
| 2018 | 6.05 | 1.99 | 8.04 | 7.7 |
| 2019 | 6.26 | 1.99 | 8.25 | 7.7 |
| 2020 | 6.48 | 1.99 | 8.47 | 7.7 |
| Average Annual | | | | |
| 1999-2010 | 8.7 | 0.0 | 5.0 | 7.8 |
| 2010-2015 | 4.4 | 0.0 | 3.1 | 6.2 |
| 2015-2020 | 3.5 | 0.0 | 2.6 | 0.0 |
| 1999-2020 | 6.4 | 0.0 | 4.0 | 5.5 |

The average annual growth rate during the period from 2010 to 2020 is assumed to decrease gradually by five-year interval.

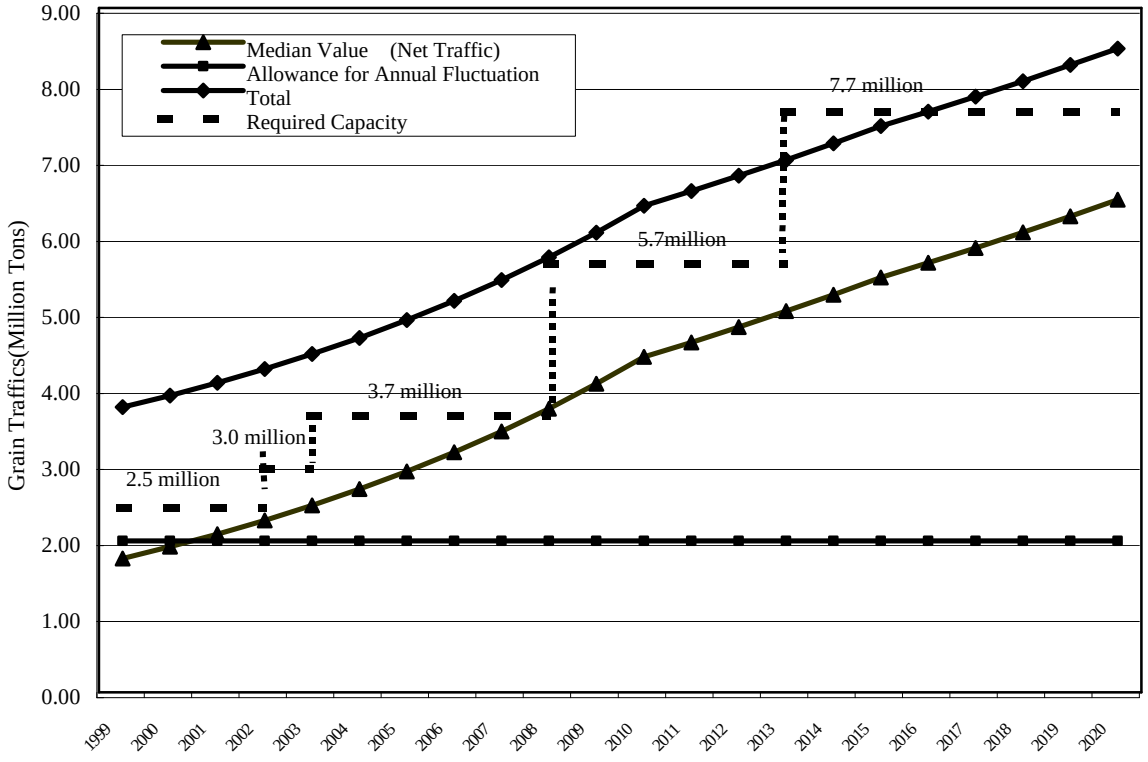



**Figure 3.10.4 Grain Traffics and Required Handling Facility Capacity for Exports**

## 3.11 Preliminary Passenger Traffic Demand Forecast

The passenger traffic demand by ship through the Port of Constantza has not yet been revealed completely because the facilities for handling passengers are insufficient in spite of the high potential traffic demand.

Available data is insufficient with regard to historical traffic demand of passengers by ship through the Port of Constantza. Thus, it is impossible to forecast the passenger traffic demand by detailed statistical an analysis. In this section, the traffic demand forecast is conducted to estimate the potential (or possible) passenger traffic demand regardless of the treatment capacity of berths at the Port of Constantza. Refer to Appendix IIB.

### 3.11.1 International Passenger

#### (1) International Tourists (Arrivals at Romania of Foreign Visitors) by Mode

1) Growth Scenario

The growth of international tourists has three scenarios: namely, "Low", "Medium" and "High". International tourists (arrivals at Romania of foreign visitors) have no close relationship with the GDP of main origin countries. (See Appendix Tables 3.11.1 and 3.11.3). But GDP is a basic indicator of influences on passenger traffic demand. Thus, the growth scenario based on the annual average growth rate of GDP of major originating countries is low 3%, medium 4% and high 6%.

2) Ratio of Visitors Destined to Constantza by Mode

The ratio of visitors destined to Constantza area was set up by mode and by growth scenario. (See Appendix Table 3.11.5)

3) Ratio of Visitors to Use Ship

It is necessary to estimate the number of passengers to make trips by ship through the Port of Constantza. The ratio of visitors to use ship was set up by mode and by growth scenario (See Appendix Table 3.11.6)

4) Result of Forecast

The results of forecast are shown in Tables 3.11.4 to 3.11.6. The number of passengers from foreign countries to use the Port of Constantza is forecast as 250,000 for low growth scenario and 963,000 for high growth scenario.

**(2) International Tourists (Departures of Romanians) by Mode**

1) Growth Scenario

The growth of international trips of Romanians abroad also has three scenarios: namely, "Low", "Medium" and "High". The international trips of Romanians abroad also have no close relationship with GDP at market prices in Romania. (See Appendix Tables 3.11.7, 3.11.9 and Figure 3.11.1). The low and high growth scenarios are set up on the basis of Case-1 and Case-2 in the Master Plan Study respectively. (See Appendix Table 3.11.10)

2) Diversion Ratio of Passengers Via the Port of Constantza by Mode

It is necessary to estimate the passenger traffic demand diverted to ship from modes of transport such as railway, road and airway. The ratio of diversion of passengers from other modes to ship to make trips via the Port of Constantza was set up. (See Appendix Table 3.11.12)

3) Ratio of Visitors to Use Ship

It is necessary to estimate the number of passengers to make trips by ship through the Port of Constantza. The ratio of visitors to use ship was set up by mode and by growth scenario (See Appendix Table 3.11.6)

4) Result of Forecast

The results of forecast are shown in Tables 3.11.11 and 3.11.12. The number of passengers travelling abroad from Romania to use the Port of Constantza is forecast as 450,000 for low growth scenario and 1,088,000 for high growth scenario.

**(3) International Business Passengers**

The forecast of international business passengers is made difficult because there is no available and historical data. However, business passengers to use ship through the Port of Constantza the smallest category of passenger.

### 3.11.2 Domestic Passengers

#### (1) Growth Scenario

The growth scenarios of Romanian domestic passengers are the same as of the international Romanian passengers going abroad. (See Appendix Table 3.11.10)

#### (2) Ratio of Visitors Destined to Constantza by Mode

The ratio of visitors destined to Constantza area was also set up by mode and by growth scenario. (See Appendix Table 3.11.17)

#### (3) Ratio of Visitors to Use Ship

It is necessary to estimate the number of passengers to make trips by ship through the Port of Constantza. Then the ratio of visitors to use ship was also set up by mode and by growth scenario (See Appendix Table 3.11.18)

#### (4) Result of Forecast

The results of forecast are shown in Tables 3.11.17 and 3.11.18 respectively. The number of passengers to make trips by ship through the Port of Constantza is forecast as 987,000 for low growth scenario and 4,877,000 for high growth scenario.

### 3.11.3 Cruiser Ship Passenger

#### (1) Conditions of Boosting Traffic Demand

The traffic demand of cruiser ship passengers has different characters from above passenger traffic demand. The key factors to accelerate the traffic demand for the cruiser ship passengers are (i) attractiveness of tourist resources, (ii) accommodations such as hotels and restaurants, (iii) the convenient linkage of inland transport between the Port of Constantza and inland scenic points and (iv) modernized and convenient passenger terminal facilities at the Port of Constantza.

#### (2) Resources for Tourism

The variety of landscape, the great number of historical and art monuments, the large number of health resorts and the possibilities of playing winter sports, have enabled Romania to develop domestic and international tourism.

The natural tourist assets include variety relief, especially mountains (alpine type massifs like Rodna, Bucegi, Fagarasi, Parang Retezat), natural reserve of Danube Delta and Black Sea coast.

The cultural assets include ethnographic and folklore elements (in the Apuseni Mountains, Tara Oasului, Tara Hategului, Tara Dornelor, Vrancea, etc), archaeological sites (the Roman mosaic in Constanta, the Histria and Sarmisegetusa fortified cities), monuments of the Middle Age (the monasteries of Neamt and Suceava counties, the fortresses and fortified cities of Transylvania and Moldavia), art museums, etc.

The Black Sea coast, one of the main tourist zones in Romania, offers special conditions for spending holidays. Along 70 km on the Black Sea coast there are famous resorts like Mamaia, Eforie Nord, Eforie Sud, Techirghiol, Costinesti, Olimp, Neptun, Jupiter, Cap Aurora, Venus, Saturn, Mangalia, with modern hotels and villas, minigolf and tennis courts, bowling halls, restaurants, casinos, bars, and nautical sports facilities. The estimated capacity of beaches is 1 million people per year.

The Danube Delta tourist area and the Razelm lagoon system offer exotic landscapes and fishing facilities. Northern Moldavia (Bucovina) with the main city of Suceava, Moldavia's capital in the 14th – 16th century, retains numerous feudal art monuments, among which are five monasteries with exterior frescoes listed by UNESCO among monuments of the world patrimony: Voronet (built in 1488), Arbore (built in 1503), Humor (built in 1530), Moldovita (built in 1532) and Sucevita (built in 1582-1601).

Central Moldavia, the area surrounding the Municipality Piatra Neamt, with the Bicaz and Bistrita river valleys, presents particular attractions on account of both the beautiful mountain landscapes and the historical vestiges of the Neamt Fortress, the monasteries Neamt, Agapia, Varatec, etc.
Prahova and Timis Valley, with the surrounding mountains Bucegi, Baicului, Piatra Mare, are situated only 120 – 150 km from Bucharest. The main resorts in this area (Sinaia, Busteni and Predeal) offer modern facilities for winter sports. Brasov and Poiana provide favorable conditions for rest, for winter sports, mountaineering, mountain climbing, hunting, etc. Northern Oltenia is one of the tourist areas with many balneological resorts: Baile Govora, Calimanesti, Caciulata, Baile Olanesti, etc. This area is famous for its folk architecture and historical monuments (monasteries Cozia, Tismana, Horezu, Polovraci).

Maramures tourist zone is a genuine ethnographic, folklore and folk art treasure, especially with regard to the wooden carved churches and gates, folk costumes and local songs and dancing. The Apuseni Mountains are famous for karstic phenomena in the areas of Cetatile Ponorului, Turda Gorges, Caves of Pojarul Politei, Meziad, Ursilor Scarisoara with a Quaternary Glacier and for their local ethnography and folklore.

The strategy of tourism development, launched in 1997, is based on the privatization of Romanian companies dealing with domestic and international tourism. The privatization process is based on the public offer of the assets and shares held by the State Ownership Fund in tourism companiesto domestic and international markets. Some other objectives of the strategy are the setting up of pilot tourism centers in various areas with financial support from the local administration and through foreign investment, and the development of agro-tourism centers.

### (3) General Trend of Cruiser Ship Transportation

Cruise navigation was very much developed in the last decades, as well in regards to ship-type diversification and itineraries. In the Europe, there are some well defined routes (crossing the English Channel, Spain-The Canaries and in the North Sea or routes connecting the countries in the Scandinavian area), as well as other cruising routes in the Mediterranean area, the Atlantic Ocean, etc. In Eastern Europe this activity is rather narrow since there are only a few routes along the Aegean Coast, in the Marmara and in the Black Sea. In Romania, excepting a short period (1965-1970), when there were some cruise (leisure) trips between Mamaia and Mangalia in the summer season, this activity may be considered as absent.

If a remarkable port infrastructure in Constantza would be constructed and when the relationships between countries gets closer, the Black Sea basin would generate interest to set up zonal passenger routes in the Black Sea basin, as well as attracting passengers from some of the cruise routes that are already established in the Mediterranean Sea, The Middle East, etc. The evolution of demand will greatly depend on the transport offered, so they have a big chance to develop in the future, on the inland waters and on the sea routes.

Based on the documentation obtained from specialized maritime sources for the present study, a few cruise ships and some RO-RO passenger ferries were selected for analysis. Based on the main construction and functional parameters, the following remarks are given:

- the dimension range is rather large, since the cruise ships length may vary between 120m - 270m, and the RO-RO ferries from 117-190m;
- the draft of this ship group may vary between 4.2 and 7.60m.
- the transport capacities are between 188 and 2744 passengers for the passenger ships and 378-1500 for the RO-RO passenger ferries.
- the number of vehicles that can be loaded on board and transported ranges between 50 - 70.

All ships have several decks, being also provided with a large range of cabins (for crew and also for passengers), as well as with all other cruising facilities: restaurants, bars, casinos, shops, pools, reading and video rooms, various telecommunication systems, etc.

The navigation equipment and systems are modern, reaching a maximum in regards to safety and comfort during trips, things that may be a decisive options for tourists.

In Romania, despite great building capacities installed in shipyards and a large number of shipyards, only a few passenger ships (mostly for the Danube) were built with a very narrow range of diversification.

In the future, companies (joint ventures) should be set up in order to be able to do something for this sector of activity.
Within these joint ventures, foreign partners would probably participate by providing specific technologies and appliances, whereas local participants will have to come up with the labor and materials needed for production, also taking into account that the Romanian shipyards have a 20% non-order covered working capacities.

Later, passenger transport with fast ships (30-40 knots speed) could be very well developed and enhanced. The European practice in naval passenger transport with fast ships leads to adopting a classification like the one in the table below.

| Type of the fast ship | Length | *Transport Capacity* | |
|---|---|---|---|
| | | Passenger | vehicles |
| Small | 50-90 | 250-500 | 10-120 |
| Medium | 75-105 | 500-900 | 140-210 |
| Big | 120-130 | 900-1500 | 240-375 |

Accordingly, it is supposed that in the future the passenger terminal in Constantza will be serviced with ships that would efficiently “cover” reach most of the ports in the Black Sea and the Eastern Mediterranean Basin, ports that are located within a 200 maritime miles range. The Constantza terminal size should be able to handle a design ship capacity of about 400-500 passengers.