6.4 Required Cargo Handling Equipment

6.4.1 Summary

(1) Introduction

This section deals with the required cargo handling equipment for the Master Plan development. Since the port is the sole gate port of Romania, it contains all of the port facilities from ship building docks for 200,000 DWT vessels and barge terminals for the long haul to up stream of canal. It handled 80 million tons of cargo at the peak period.

Since the changes of political system from the planned economy to the so-called market mechanism at the end of 1980s, cargo volume went down to less than half of the peak. Contents of the cargo have been changed also to meet with real demands.

Method of port operation has been transformed from the public owned and operated port to the public owned but private-sector operated port. This new situation keeps the fixed assets such as civil works in the public sector, however ownership of the cargo handling equipment moves to the private sector. Now the private operators can introduce new equipment at his expenses as required. The study team extend their appreciation to CPA and local consultants namely IPTANA for the data collection of present cargo handling equipment.

(2) Issues on the Planning of Cargo Handling Equipment

In order to plan the cargo handling equipment at the Master Plan stage, present conditions relating to the equipment planning have been analyzed including following aspects:

- a. Understanding of the existing cargo handling equipment
- b. Project type
- c. Participation of the private sector
- d. Relation to the concession contract

Descriptions on these aspects are as below:

a. Understanding of the Existing Cargo Handling Equipment

The study team collected and analyzed the data of existing cargo handling equipment of more than 180 units, from three ton capacity to 50 ton capacity.

b. Project Type

Study of type of the project of cargo handling equipment: either independent project or integrated project.

c. Participation of the Private Sectors (or Source of Finance)

Study of the source of finance: either private sector or public sector.

d. Relation to the Concession Contract

Study of the duty of private operators in relation to cargo handling equipment

(3) Issues on Existing Cargo Handling Equipment

a. At the North Port

The North Port, especially northern area of the North Port, has the following particulars:

- Shallow water depth, capable of vessels berthing up to medium size
- Narrow site area, low storage capacity, traffic congestion roads and railway lines
- Old-fashioned, low efficiency, aged equipment
- Adjacent to residential areas, city center, historical site, resort areas which require good environmental conditions.

Particularly, the following terminals have much worse conditions:

- i. Grain terminals
- ii. Containerized cargo terminals
- iii. General cargo terminals

The north most area of the North Port is not suitable for modernized usage because this area is the oldest part of the Port and the water depth in front of the berths from No. 13 to No. 21 is shallow. According to the Master Plan, berths of this area are to be closed in the near future. This will influence to the Grain Terminal (berths from No. 17 to No. 19) and Edible Oil Terminal (berths No. 20 and 21).

The Grain Terminal (AGROEXPORT) will construct new grain handling facilities at berths from No. 31 to No. 33 at the middle area of the North Port to improve the productivity.

The Edible Oil Terminal (FRIAL) has oil handling facilities of sufficient capacity and will be able to cope with the future cargo demand. However, relocation of the facilities may be required when considering the closing of this area in the future. Although the relocation and site selection should be decided by the terminal operator, it is necessary to study the required scale of the facilities.

b. At the South Port

Contrary to the above North Port, the South Port has the following particulars:

- Relatively deep water depth, capable of larger size vessels berthing
- Wide open space, suitable for future development of infrastructure, cargo handling terminals, storage area, etc.
- Relatively modern equipment

(4) Improvement Scenario

Improvement scenarios of the cargo handling equipment were studied in parallel to the terminal requirement study. The existing cargo handling equipment conditions are important input data for studying the cargo handling capacity of the terminals. In order to facilitate this study, the following aspects were taken into account:

- 1) Study on comprehensive port layout
- 2) Overall redevelopment of the Port, including the North Port and the South Port

In order to harmonizing with the Master Plan including planning concepts of other facilities, the following three-step approach was considered.

a. First Step

Cargo traffic demand and present port capacity was compared by commodity and type of cargo. The basic criteria to recommend a new terminal are shortage of present port capacity against traffic demand. In order to materialize this study following analyses were performed:

- 1) Cargo traffic by commodity
- 2) Estimation of present cargo handling capacity of equipment
- 3) Itemization of commodities having handling shortage
- 4) Possibility of relocation of the existing terminals from the old North Port to the new South Port
- 5) Terminal expansion at the South Port

b. Second Step

At the second step, following aspects was studied in detail:

- 1) Zoning of the total Port area, by commodity handled,
- 2) Zoning of the total Port area, by calling vessel size,
- 3) Zoning of the total Port area, by environmental considerations

And finally, construction of new terminals at the South Port were selected for implementation. The south port will have various advantages as shown below:

- 1) Deep water depth allowing calling of larger size vessels
- 2) Wide site area, modern infrastructure, less traffic congestion, well arranged roads, railway tracks, sufficient cargo storage areas
- 3) Latest technology, high efficiency, environment friendly, new modern equipment

c. Third Step

It is so important to redevelop the North Port areas. In order to implement this, following actions should be taken into account:

- 1) Redevelopment of the North Port, especially old northern area:
- 2) Demolishing and removal of aged, old fashioned, low efficiency equipment
- 3) Renovation of old historical buildings, facilities to memorial objects at the North Port
- 4) Introduction of new business, e.g. business center, shopping center, amusement center at the North Port

(5) Cargo Handling Equipment for the Master Plan

The required cargo handling equipment for the Master Plan is studied as described in the following sections.

6.4.2 Issues on Existing Cargo Handling Terminals and Improvement Scenarios

For the analysis of improvement scenarios, the following reference data was prepared for review:

Commodities are classified into 14 groups by type of cargo. Each cargo is assigned to one of four types of cargo categories: namely, general cargo, containerized, dry bulk and liquid bulk. Study year are 1999, 2010 for the short-term plan and 2020 for the Master Plan. Both cargo traffics case-1 and case-2 are taken into account.

Table 6.4.2-1 Cargo Volume Arrangement by Commodity and Type of Cargo (1999, 2010 and 2020) (Case 1, Case 2)

Balance between future traffic and existing cargo handling capacity was evaluated for both traffic forecasts Case-1 and Case-2. Estimated berth capacities of 19 operators are shown by the eight cargo type classification.

 Table 6.4.2-2-1 Balance between Future Traffic and Existing Cargo Handling Capacity (Case 1)

 Table 6.4.2-2-2 Balance between Future Traffic and Existing Cargo Handling Capacity (Case 2)

Forecast cargo volume is generally lower than the present total cargo handling capacity of the terminals, except for handling capacities of **containerized cargoes** and **dry bulk grain cargoes**.

Considering the tendency for cargo demand to increase, the following improvement scenario can be proposed:

(1) New Container Terminal at Pier S2 of the South Port

- a. 1st Phase Construction
- b. 2nd and 3rd Phase Construction
- (2) New Grain Terminal at Pier S3 of the South Port

(2)-1 In case of Case 1 Cargo Demand

a. 1st Phase Construction (2.0 million tons/year)

b. 2nd Phase Construction (2.0 million tons/year)

(2)-2 In case of Case 2 Cargo Demand

No additional terminal will be required.

Table 6.4.2-3 Issues on Existing Cargo Handling Terminals and Improvement Scenario

Table 6.4.2-3 indicates issues of existing terminals by commodity classification and improvement scenarios also provided.

2000		4	Contraction of the second	-		0		19	99	_	Cours 2		
Category	No	Type	Commodities	Total	General	Case 1 Container	Bulk	Liquid	Total	General	Case 2	Bulk	Liqui
	1	В	Cereals	1.01	-Counting	CONTRACTOR	1.01	Linguing	1.01	Contract of	C. CHERNEL	1.01	- Filter Lan
1	4	C	Foods, Beverage, Tobacco	0.14		0.14			0.14		0.14		
	6		Timber, Charcoal	.0.64	0.64				0.64	0,64			-
	7		Fertilizers(B:50%+G:50%)	0.68	0.34		0.34		0.68	0.34	-	0.34	-
	9		Iron Ore, Scrap Non-Ferrous Ore	0.62	0.02		0.00		0.02	0.02		0.00	
1	13		Solid Fuel(Coal, Coke, etc.)	0.10		-	0.10		0.10			0.10	
Export-Load	14	L.	Crude Oil	0.00		-		0.00	0.00	1			.0.
1. A	15		Oil & Gas Products	1.38				1.38	1.38	-			1.
	17		Chemical Products(L:50%+G:50%)	0.70	0.35		1.27	0.35	0.70	0.35		1.27	- 0,
	18 20		Cement, Construction Marls(B:70%+G:30%) Ferrous/NonFerrous Materials	1.81	0.54	-	1.27	-	1.81	0.54		1.41	-
	23	C	Various Manufactured Products	0.36	1.54	0.36			0.36	1.00	0.36	-	
	24	C	Other Cargoes	0.62		0.62	in a second		0.62	1	0.62		
			Total	9.41	3,82	1.12	2.74	1,73	9,41	3.82	1.12	2.74	 11
	1		Cereals(B:90%+G:10%)	0.04	0.00		0.04		0.04	0.00		0.04	-
	4	0	Foods, Beverage, Tobacco	0.47	0.00	0,47			0.47	0.00	0.47		-
	- 6		Timber, Charcoal Fertilizers(B:40%+1.60%)	0.00	0.00		0.15	0.22	0.00	0,00		0.15	0
	9		Iron Ore, Scrap	4.17	0.00	-	4.17	Maria	4.17	0.00		4.17	
	10		Non-Ferrous Ore	1.07	0.00		1.07		1.07			1.07	
	13	B	Solid Fuel(Coal, Coke, etc.)	1.73			1.73		1.73	1		1.73	
mport-Unload	14		Crude Oil	3.14	1			3.14	3.14				3.
02000000000000000000000000000000000000	15		Oil & Gas Products	0.83			-	0.83	0,83		-		0.
	17		Chemical Products(L:50%+G:50%)	0.03	0.02		0.01	0.02	0.03	0.02		0.01	: 0
	18		Chalk, Cement, Construction Materials Ferrous/NonFerrous Materials	0.01	0.05		0.01		0.01	0.05		0.04	-
	23	0	Various Manufactured Products	0.35	0.05	0.35	-		0.35	0.05	0.35		-
	24	C	Other Cargoes	0.09		0.09			0.09		0.09		
			Total	12.35	0.07	0.91	7.16	4.21	12.35	0,07	0.91	7.16	4.
	1	B	Cereals	0.68	13	1	0.68		0.68	-		0.68	-
	4	C	Foods, Beverage, Tobacco	0.03	0.00	0.03	-		0,03	0.00	0.03		-
	6	B	Timber, Charcoal Fertilizers(Natural, Chemical)	0.00	0,00	-	0.01		0.00	0.00		0.01	-
	9	BAC	Iron Ore, Scrap	0.01	0.08		0.00		0.08	0.08		0.00	-
	10	B	Non-Ferrous Ore	0.01	-		0.01		0.01			0.01	
	13		Solid Fuel(Coal, Coke, etc.)	0.00	-		0.00		0.00	-		0.00	
Transit-Load	14		Crude Oil	0.00			6	0.00	0,00				0
and the states of the second	15	L	Oil & Gas Products	0,00		-		0.00	0.00				0.
	17		Chemical Products(L:50%+G:50%)	0.00	0.00	-	0.00	0.00	0.00	0.00		0.00	0.
	18		Chalk, Cement, Construction Materials Ferrous/NonFerrous Materials	0.00	0.06	-	0.00	-	0.00	0.06		0.00	-
6	23	C	Various Manufactured Prisducts	0.00	10.1045	0.00	-		0.00	0.00	0.00		
	24	C	Other Cargoes	0.04		0.04			0.04		0.04	-	-
			Total	0.91	0.14	0,07	0.70	0,00	0.91	0.14	0.07	0.70	0.
	1	B/G	Cereals(B:90%+G:10%)	0.04	0.00	1	0.04		0.04	0.00		0.04	
	4	C	Foods, Beverage, Tobacco	0.00		0.00			0.00		0.00	10000	_
	6		Timber, Charconl	0.00	0.00	-	0.01		0.00	0.00		0.01	-
	9		Fertilizers(Natural, Chemical) Iron Ore, Scrap	0.01	0.00	-	0.01		0.01	0.00		0.01	-
	10		Non-Ferrous Ore	0.10		-	0.10	-	0.10	9,00		0.10	-
	13		Solid Fuel(Coal, Coke, etc.)	0.00			0.00		0.00			0.00	
Fransit-Unload	14	1	Crude Oil	0.07				0.07	0.07	1	-		0
North Contraction	15		Oil & Gas Products	0.00				0.00	0.00	1			.0
	17		Chemical Products(L:50%+G:50%)	0.01	0.01			0.01	0.01	0.01			
	_		Chalk, Cement, Construction Materials	0.00		-	0.00		0.00	0.00		0.00	-
	20	G	Ferrous/NonFerrous Materials	0.00	0.00	0.00			0.00	9.00	0.00		-
	24	C	Various Manufactured Products Other Cargoes	0.01	-	0.00			0.00		10.0		-
	-	-	Total	0.24	0.01	0.01	0,15	0.08	0.24	0.01	0.01	0,15	0.
	1	В	Cereals	1.77	0.01	0.00	1,76	0.00	1.77	0.01	0.00	1.76	- 0
	-4	C.	Foods, Beverage, Tohacco	0.64		0.64	0.00	0.00	0.64	0.00	0.64	0.00	0
	6	G	Timber, Charcoal	0.64		0.00	0.00	0.00	0.64	0.64	0.00	0.00	0
	7		Fertilizers(Natural, Chemical)	1.07	0.34	0,00	0.51	0.22	1.07	0.34	0.00	0.51	0
	9	B/G B	Iron Ore, Scrap Non-Ferrous Ore	4.87		0.00	4.17	0,00	4.87	0.00	0.00	4.17	0
	13	B	Solid Fuel(Coal, Coke, etc.)	1.20	0.00	0.00	1.83	0.00	1.83	0.00	0.00	1.83	0
Total	14	L	Crude Oil	3.21	0.00	0.00	0.00	3.21	3.21	0.00	0.00	0.00	3
	15	L	Oil & Gas Products	2.21	0.00	0.00	0.00	2.21	2.21	0.00	0.00	0.00	2
	17	1.0	Chemical Products	0.74		0.00	0.00	0.17	0.74	0.37	0.00	0.00	- 0
			Chalk, Cement, Construction Materials	1.82	0.54	0.00	1.28	0.00	1.82	0.54	0.00	1.28	0
	18							and the second se			and the second se	the second se	
	20	G	Ferrous/NonFerrous Materials	1.44	1.44	0.00	0.00	0,00	1.44	1,44	0.00	0,00	
	_	G C			1.44 0.00			0.00	1.44 0.71 0.76	1,44 0.00 0.00	0.00 0.71 0.76	0.00	0.

Table 6.4.2-1-1 Cargo Volume Arrangement by Commodity and Type of Cargo (1999)

Category	No.	Type	Commodities			P			010				_
Carellony	1967.			Total	General	Case I Container	Bulk	Liquid	Total	General	Case 2 Container	Bulk	Liqui
	1	B	Cereals	1.80			1.80	100	1.50			1.50	
	6		Foods, Beverage, Tobacco Timber, Charcoal	0.24	1.13.	0.24	-	-	0.19		0.19	-	-
	7	and the second	Fertilizers(B:50%+G:50%)	0.36	0.18		0.18	-	0,48	0.24		0.24	-
	9		Iron Ore, Scrap	0.85	0.85		0.00		0.85	0.115		0.24	-
	10	-	Non-Ferrous Ore	0.00	1		0.00		0.00			0.00	
Ermort 1 and	13		Solid Fuel(Coal, Coke, etc.)	0.00			0.00		0,00			0.00	
Export-Load	14	L	Crude Oil Oil & Gas Products	0.00	1		-	0.00	0.00				.0,
	17	_	Chemical Products(L:50% p+G:50% p)	2,39	0.34			2.39	2.82	0.35	-		2.
	18		Cement, Construction Mat'ls(B:70%+G:30%)	1.07	0.32		0.75	0.14	1.36	0.35		0.95	D.
	20	G	Ferrous/NonFerrous Materials	1.90	1.90		0.10		1.90	1.90		41,92	
	2.3	C	Various Manufactured Products	0.63		0.63			0.49		0.49		-
	24	C.	Other Cargoes	1.08		1.08		· · · · ·	0.84		0.84	_	
	1	B/G	Total Cereals(B:90%+G:10%)	12.12	4.72	1.95	2.73	2.73	12.26	4,88	1.52	2,69	3,
	4	_	Foods, Beverage, Tobacco	0,20	0.02	0.82	0.18	-	0.38	0.04	0.64	0.34	-
	6	_	Timber, Charcoal	0.00	0.00	1,04			0.00	0.00	.0.04		-
	7	B/L	Fertilizers(B:40%+L:60%)	0.69			0.28	0.41	0.52	0.000		0.21	0,3
	9		and the second se	6.90	0.00		6.90		6.90	0.00		6.90	
	10	B	Non-Ferrous Ore	1.68	-		1.68		1.39			1.39	
Import-Unload	13	B	Solid Fuel(Coal, Coke, etc.) Crude Oil	2.11			2.11	11.00	2.10			2.10	
	15	L	Oil & Gas Products	11.92			-	11.92	9.33	-			9.
	17	1/0		0.00	0.00			0.00	0.00	0.00			1.
	18	В	Chalk, Cement, Construction Materials	0.00			0.00	0,00	0.00	0.00	-	0.00	
	20	G	Ferrous/NonFerrous Materials	0.00	0.00				0.00	0.00			
	23	C	Various Manufactured Products	0.62		0.62	1		0.48		0.48		-
	24	C.	Other Cargoes	0.16		0.16			0.13		0.13		
	1	В	Total Cerenis	26.54	0,02	1,60	11.15	13,77	23,00	0,04	1.25	10,94	16,
	- 4	C	Foods, Beverage, Tobacco	2.65	-	0.03	2.65		0.50		0.02	0.50	
	6	G	Timber, Charcoal	0.00	0.00				0.00	0.00	0.03		-
	7	-	Fertilizers(Natural, Chemical)	0.00	0,00		0.00		0.00	0.00		0.00	-
	- 9		Iron Ore, Scrap	0.11	0.11		0.00		0.11	0.11		0.00	
	10	В	Non-Ferrous Ore	0.00			0.00		0.00			0.00	
Trends I and	13		Solid Fuel(Coal, Coke, etc.)	0.00			0.00	i3	0,00			0.00	2
Transit-Load	14	L	Crude Oil Oil & Gas Products	0.00				0.00	0.00				-0.0
	17		Chemical Products(L:50%+G:50%)	0.00	0.00		-	0.00	0,00	0.00		_	0.0
	18		Chalk, Cement, Construction Materials	0.00	10.000		0.00	0,00	0.00	0,00		0.00	0.0
	20		Ferrous/NonFerrous Materials	0.10	0.10		9.00		0.10	0.10		0.00	
	23	C	Various Manufactured Products	0.07		0.07		1	0.07	6	0.07		-
	24	C	Other Cargoes	0.13		0.13			0.13		0.13		
			Total	3.09	0.21	0.23	2.65	0,00	0,94	0,21	0.23	0.50	0,0
	1		Cereals(B:90%+G:10%) Foods, Beverage, Tobacco	0.05	0.01	0.09	0.05	_	0.13	10,0	0.00	0.12	_
	6		Timber, Charcoal	0.00	0.00	0.09		-	0.09	0.00	0.09		
	7		Fertilizers(Natural, Chemical)	0.00	10,00		0.00		0.00	0,00		0.00	
	- 9		Iron Ore, Scrap	0.83	0.00		0.83		0.83	0.00		0.83	
	10		Non-Ferrous Ore	0.27			0.27		0.22			0.22	
ransit-Unload	13		Solid Fuel(Coal, Coke, etc.)	0.00			0.00		0.00			0.00	
ransit-Chioad	14		Crude Oil Oil & Gas Products	0.39				0.39	0.19	-			0.3
	17		Chemical Products(L:50%+G:50%)	0.00	0.00			0.00	0.00	0.00			0.0
	18		Chalk, Cement, Construction Materials	0.00	0,04		0.00	0.00	0.00	0,00		0.00	0.0
	20		Ferrous/NonFerrous Materials	0.00	0.00		0,00	_	0.00	0.00		0.007	
	23	C	Various Manufactured Products	0.08		0.08			0.08		0.08		
	24		Other Cargoes	0.02		9.02			0.02		0.02		
	-	_	Total	1.73	0,01	0,19	1,15	0.39	1.76	0.01	0,19	1.17	0,3
	1		Cereals	4.70	0.03	0.00	4.68	0.00	2.51	0.05	0.00	2.46	0,0
	4		Foods, Beverage, Tohacco Timber, Charcoal	1,18	0.00	1.18	0.00	0.00	0.95	0.00	0.95	0.00	0.0
	7		Fertilizers(Natural, Chemical)	1.05	0.18	0.00	0.00	0.00	1.00	0.24	0.00	0.00	0.0
	9		Iron Ore, Scrap	8.69	0.96	0.00	7.73	0.00	8.69	0.96	0.00	7.73	0.0
	10	В	Non-Ferrous Ore	1.95	0.00	0.00	1.95	0.00	1.61	0.00	0.00	1.61	0.0
	13		Solid Fuel(Coal, Coke, etc.)	2.11	0.00	0.00	2.11	0.00	2.10	0.00	0.00	2.10	.0.0
Total	14		Crude Oil	12.31	0.00	0.00	0.00	12.31	0.72	0.00	0.00	0.00	9.7
	15		Oil & Gas Products	3,83	0.00	0.00	0.00	3.83	3.95	0.00	0.00	0.00	3,9
	17		Chemical Products	0.67	0.34	0.00	0.00	0.34	0.70	0.35	0.00	0.00	0.3
	18		Chalk, Cement, Construction Materials Ferrous/NonFerrous Materials	2.00	2.00	0.00	0.75	0.00	1.36	0.41	0.00	0.95	0.0
	23		Various Manufactured Products	1.40	0.00	0.00	0.00	0.00	2.00	2.00	0.00	0.00	0.0
	24	_	Other Cargoes	1.39	0.00	1.39	0.00	0.00	1.12	0.00	1.12	0.00	0.0
			Total	43,48	4.95	3.97	17.67	16.89	37.96	5.14	3.19	15.30	14,3

Table 6.4.2-1-2 Cargo Volume Arrangement by Commodity and Type of Cargo (2010)

				-		4.4		20	20		Pur A		
Category	No.	Type	Commodities	-		Case 1	0.0	Flourd	Total	Connell	Case 2	Bulk	Liquit
				Total	General	Container	Bulk 2.64	Liquid	Total 1.50	General	Container	1.50	Liqui
	1	B	Cereals Foods, Beverage, Tobacco	2.64	-	0.42	2.04		0.29	-	0.29	1.50	
	4	G	Timber, Charcoal	0.68	0.68	0.76			0.68	0.68			
-	7	B/G	Fertilizers(B:50%+G:50%+)	0.19	0.10		0.10		0.30	0.15		0.15	
	9	BAG	Iron Ore, Scrap	0.30	0.30		0.00		0.30	0.30		0.00	
1	10	В	Non-Ferrous Ore	0.00			0.00		0.00			0.00	8
	13	B	Solid Fuel(Coal, Coke, etc.)	0.00	1		0.00		0.00			0.00	
xport-Load	14	L	Crude Oil	0.00				0.00	0.00				- 0,1
	15	L	Oil & Gas Products	1.57				1.57	2.02				2.0
	17	L/G	Chemical Products(1:50%+G:50%)	0,36	0.18			0.18	0.51	0.26			0.3
	18	B/G	Cement, Construction Mat'ls(B:70%+G:30%	0.64	0.19		0.45		0.94	0.28		0.66	
	20	G	Ferrous/NonFerrous Materials	1.90	1.90	S			1.90	1.90			-
	23	C	Various Manufactured Products	1.07		1.07			0.73		0,73		-
	24	C.	Other Cargoes	1,85		1.85			1,26		1.26		
			Total	11.62	3,35	3.34	3.18	1.75	10.43	3.57	2.28	2.31	2.
	- 1	B/G	Cereals(B:90%+G:10*a)	0.20	-		0.18		0.38	0.04		0.34	-
	- 4	C	Foods, Beverage, Tobacco	1.41	-	1.41			0.96	-	0,96		_
	6	G	Timber, Charcoal	0.00	0.00				0.00	0.00			
	7	B/L	Fertilizers(B:40%+L:60%)	1.24	-		0.50	0.74	0.81			0.32	0,
	9	B/G	Iron Ore, Scrap	8.30	0.00		8,30		6.90	0,00	-	6.90	-
	10	В	Non-Ferrous Ore	1.01	-		1.01	-	0.84	-		0.84	-
	13	В	Solid Fuel(Coal, Coke, etc.)	2.55			2.55	10.00	2.10			2.10	1.0
nport-Unload			Crude Oil	16.40	-			16,40	10.64				10.
	15	L	Oil & Gas Products	2.47				2.47	1.68	10.000	-	-	1.
	17	L/G	Chemical Products(L.50%+G:50%)	0.00	-			0,00	0.00	0.00		0.00	. 9,
	18	В	Chalk, Cement, Construction Materials	0,00			0.00	-	0.00	0.00		0.00	-
	20	_	Ferrous/NonFerrous Materials	0.00	-	1.05			0.00	0,00	0.72		-
	2.3	C	Various Manufactured Products	1.05		1.05		-	0.72	-	0.12	-	-
	24	C	Other Cargoes	0.28	statement is successful to the second	0.28	12.64	19,61	0.19	0.04	1.87	10.51	12.
	-		Total	34.91	-	2.74	12.54	17,01	25,22	0,04	1.07	0.50	144
	1	B	Cereals	3.84		0.00	3.84	-	0.08	-	0.08	0.50	-
	4	C	Foods, Beverage, Tobacco	0.08	-	0.08	-		0.08	0.00	0.08		-
	6		Timber, Charcoal	0.00	a di seconda	-	0.00	-	0.00	0,00		0.00	-
	7	B	Fertilizers(Natural, Chemical)	0.00		-	0.00		0.00	0.04		0.00	-
	9		Iron Ore, Scrap	0.04	the second se	1	0.00	-	0.04	0.04		0.00	-
	10	-	Non-Ferrous Ore	0.00	_		0.00		0.00	-		0.00	-
Transit-Load	13	-	Solid Fuel(Coal, Coke, etc.)	0.00			12.00	0.00	0.00	-	-	0.00	- 0.
Transit-Load	14	_	Crude Oil	0.00			-	0.00	0.00				0.
	15	-	Oil & Gas Products Chemical Products(L.50%+G:50%)	0.00		-		0.00	0.00	0.00			0
	-		Chalk, Cement, Construction Materials	0.00	and successive states	-	0.00	10,00	0.00	- HINPP		0.00	-
	18	-	Ferrous/NonFerrous Materials	0.10	-	-	0.00		0.10	0.10		0.00	
	20		Various Manufactured Products	0.21	-	0.21			0.21		0.21		-
	23			0.36		0.36	-	-	0.36		0.36		-
	24	0	Other Cargoes Total	4.63	-	0.65	3.84	0,00	1.29	0.14	0.65	0.50	0.
		B/O		0.05	the second s	0.05	0.05	4,00	0.13	0.01		0.12	-
	4		Foods, Beverage, Tobacco	0.26		0.26	0.03		0,26	0.01	0.26		-
	6		Timber, Charcoal	0.00		.0.20			0.00	0.00			
	7	-	Fertilizers(Natural, Chemical)	0.00	the second se		0.00		0.00	0,00		0.00	-
	- 9		Iron Ore, Scrap	1.00			1.00		0.95	0.00		0.95	
	10		Non-Ferrous Ore	0.16	_		0,16		0.13			0.13	
	13		Solid Fuel(Coal, Coke, etc.)	0.00	_		0.00		0.00			0.00	
ransit-Unload	-	-	Crude Oil	0.46				0.46	0.46	0			.0
- many to devide	15		Oil & Gas Products	0.00	_	1		0.00	0.00				0
	17		Chemical Products(L:50%+G:50%)	0.00	-			0.00	0.00	0.00			0
	18	and the second division of the	Chalk, Cement, Construction Materials	0.00	and the second second		0.00		0.00			0.00	
	20	-	Ferrous/NonFerrous Materials	0.00					0.00	0.00			
	23		Various Manufactured Products	0.21		0.21			0.21		0.21		
	24		Other Cargoes	0.05	_	0.05			0.05		0.05	1	
	-	-	Total	2.19	_	0,52	1.21	0.46	2.19	0,01	0.52	1.20	0
	1	В	Cereals	6.73		-	6.71	0,00	2.51	0.05	0.00	2.46	-0
	4	-	Foods, Beverage, Tobacco	2.17		and the second se	0.00	0.00	1.59	0.00	1.59	0.00	
	6	-	Timber, Charcoal	0.68	and the second second second		0.00	0.00	0.68	0.68	0.00	0.00	- 0
	7		Fertilizers(Natural, Chemical)	1.43		-	0.59	0.74	1.11	0.15	0.00	0.47	0
	9	-	Iron Ore, Scrap	9.64		-	9.30	0.00	8.19	0.34	0.00	7.85	0
	10	diam'r.	Non-Ferrous Ore	1.17	and the owner of the party of	and the second se	1.17	0.00	0.97	0.00	0.00	0,97	. 0
	13		Solid Fuel(Coal, Coke, etc.)	2.55		-	2.55	0.00	2.10	0,00	,0.00	2.10	0
Total	14	-	Crude Oil	16.86	_	-	0.00	16.86	11.10	0.00	0.00	0.00	- Ú
	15	-	Oil & Gas Products	4.04		0.00	0.00	4.04	3.70	0.00	0.00	0.00	3
	17	-	Chemical Products	0.36	0.18	0.00	0.00	0.18	0.51	0.20	0.00	0.00	0
	18			0.64		-	0.45	0,00	0,94	0.28	0,00	0.66	- 0
	20	and the second second	and the second se	2.00	the second se	and the owner water of the owner of the	0.00	0.00	2.00	2.00	0.00	0.00	0
	21		Various Manufactured Products	2.54		-	0.00	0.00	1.87	0.00	1.87	0.00	
	24		Other Cargoes	2.54		-	0.00	0.00	1.86	0.00	1.86	0.00	0
		-	Total	53.35			20,76	21.82	39.13	-	5.32	14.51	15

Table 6.4.2-1-3 Cargo Volume Arrangement by Commodity and Type of Cargo (2020)

							Cat	go Handling	Cargo Handling Capacity (x 1,000 tons)	(snot 000,			
°N N	Operator	Berth No	Handing Commodities	Handline Operation	Break Bulk	Containerized cargo		Dry	Dry Bulk		Lequid Bulk	Bulk	
					General Cargo	Containers	Grain	Conl/Ore	Phosphate / Fertilizer	Cement	Crude Oil / Oil Products	Edible Oil	Total
10	KOTRAC	Berth RR4	General Cargoes (timber, etc.)	Loading, Unloading								1	4
65	DEZKOBUKEA	Bertin 0 - 5		Loading, Unloading	634								614
		Berth 6,7	General Cargoes (fnuits, etc.)	Loading, Unloading	101								101
		Berth 11,12	General Cargoes (timber, etc.)	Loading, Unloading	171						T		121
		Berth 13-16	General Cargoes (Kaolin, soda, timber, etc.)	Loading, Unloading	257							T	195
	10000001	Berth 20	General Cargoes (timber, etc.)	Loading, Unloading	101								101
3	AURUEAPORT	Berth 17,18 & 24	Bulk Cargoes (grains)	Londing									0
10	CDIAL	Berth 31-31	Gram (New Project)	Loading			1,000.1					t	1 000
	No. AL	Derth 19		Losding, Unloading							T	350	550
		Berth 21	General Cargoes (rice, etc.)	Loading, Unloading	66						T	2.00	10
	DECIDION	Berth 53	General Cargoes & Refrigerated Food	Loading, Unloading	152							T	142
3.	INCOMPANY INCOMPANY	Berth 23	General Cargoes (tumber, rice, etc.)	Loading, Unloading	203					Ī			203
_	BUDENTY	Berth 47-50	General Cargoes (timber, Steel scrap, cement, etc.)	Loading, Unloading	144						T		111
8	VINDAL	Derth B	General Cargoes (tumber)	Loading, Unloading							T		0
0 400	00058	Berth 22	General Cargoes (timber, rice, etc.)	Loading, Unloading									0
-	WOLLET.	Berli 33-37 & 41-43	General Cargoes (bulk soda, steel scrap, timber, etc.)	Loading, Unloading	1,227								1.227
-	14.62	2C'1C STRAD	Containerized Cargoes	Loading, Unloading		810							810
5	INLA	Berth KM4	General Cargoes (timber etc.)	Loading, Unloading	264								164
1		Derth 38-40	Otheral Cargoes (timber, Steel scrap, cement, etc.)	Loading, Unloading	610						T		610
101	MINNETAL	Derth 44	General & Containenued Cargoes	Loading, Unloading	152						ſ		152
	and a large a case.	Derth +2,40	Letteral Cargoes (steel products, tumber,)	Loading, Unloading	582								582
1		Bareh 85	Durk Cargors (Contr. ores)	Unloading				12,000					12,000
0	CHIMPEX	Reth 54.50	Ciences Contract (rimbar ato)	Loading	1000								0
		Blench (4)	Crime (Mew Protect)	LOBORD, UNDBORD	11/20								1,750
		Berth 61	Bulk Carmen	Londing			450						450
		Berth 62	Bulk Carunes (phosphate pres)	Thissection									0
		Berth 63	Bulk Cargoes (fertilizers)	Loading					582	1			743
11	SICIM	Berth 67	General Cargora	Loading Unloading					Chil	1	T		143
_	11 20101-0011-1	Berth 68	분	Londeng					T	105.2	T		102 6
	ULL TERMINAL	Berth 69-79	Liquid Bulk (crude oil, metanol, chemical liquids, etc.)	Loading, Unloading						10.010	36.000		1000 92
2 2	LUMYEA DOM/TE AND	Berlb 80-84	Bulk Cargoes (Coals, ores)	Loading, Unloading				12,000			a a a a a a a a a a a a a a a a a a a		12 000
-	SULDTRANS	Derth 10/+112 dt 112-118	General Cargoes (timber, ferrous/non-ferrous metal, etc.)	Loading, Unloading	652								652
-	FREE TRADE ADMINISTRATION	Blanch 112 00 114	Bulk Cargoes (grains)	Loading, Unloading			2,000						2,000
-	SNTFM	Reth 120	General Carolane	Loading, Unloading									0
18 C	CPA RO-RO TERMINAL	Barth 120	Centeral Caronae	Loading, Unioading									0
19 N	MAST (Floating Operator)	Berth 124-125	Bulk Carnes (coment over etc.)	I and a linearing									0
20 A	RTS	Berth 55	Grain (New Project)	Londine			120			1			0
	Total Cargo Handling Capacity			-	7.720	310	1700	24 000	1492	1 6/11	1000	-	002
B	largo Detrand Forcast (Case 1) - (2020)				3.540	2050	our's	NUV P	1,480	2,201	36,000	1	70,707
E U	Balance(A+B)				4,180	077.9-	1.770	10 980	800	1001	14 160	(IC)	061.00
	ew Container Terminal (S2) - Phase L					3.130	-	and find	0.00	1001	001*11	+	11017
eio	New Container Terminal (SZ) - Phase Z, 3					4,200		-	-	1			T
- 14	Very Grain Leminial S5) - Phase 2						2.000					+	
	New Grain Terminal(S3) - Phase 2 Edited Oct Territorial Defension						2,000		,	1			
1	UNITE OF A STITUTE DESCRIPTION			+							t	1924	T

Table 6.4.1-2-1 Balance between Future Traffic and Existing Cargo Handling Capacity (Case 1)

Table 6.4.1-2-2 Balance between Future Traffic and Existing Cargo Handling Capacity (Case 2)

						Car	guilbrand op	Cargo Handling Capacity (x 1,000 tons)	(000 1000)			
No. Operator	Berth No	Handline Commodities	Handline Oneration	Break Bulls	Containerized cargo		Dry	Dry Bulk		Liquid Bulk	Bulk	
			0	General Cargo	Containers	Grain	Coal/Ore	Phosphate / Fertilizer	Cerment	Crude Oil / Oil Products	Edible Oil	Total
01 ROTRAC	Berth RR1-RR5	General Cargoes (timber, etc.)	Loading, Unloading									
2 DEZROBIREA	Berth 0 - 5	General Cargoes (steel scrap, timber, etc.)	Loading, Unloading	634								-634
	Berth 6,7	General Cargoes (fruits, etc.)	Loading, Unloading	101								101
	Berth 11,12	General Cargoes (timber, etc.)	Loading, Unloading	121								1
	Berth 13-16	General Cargoes (Kaolin, soda, timber, etc.)	Loading, Unloading	257								257
	Berth 20	General Cargoes (timber, etc.)	Loading, Unloading	101								101
03 AGROEXPORT	Berth 17,18 & 24	Bulk Cargoes (grains)	Loading									
	Berth 31-33	Grant (New Project)	Loading			1,000						1,00
04 FRIAL	Berth 19	Edible Oil	Loading, Unloading								550	550
	Berth 21	General Cargoes (noe, etc.)	Loading, Unloading	66								66
_	Berth 53	General Curgoes & Refrigerated Food	Loading, Unloading	152								152
05 DECIROM	Berth 23	General Cargoes (timber, nce, etc.)	Loading, Unloading	203								203
	Berth 47-50	General Cargoes (timber, Steel scrap, cement, etc.)	Loading, Unloading	144								177
06 PHOENIX	Berth 8	[General Cargoes (timber)	Loading, Unloading									
	Berth 22	[General Cargoes (timber, rice, etc.)	Loading, Unloading									
07 SOCEP	Berth 35-37 & 41-43	General Cargoes (bulk soda, steel scrap, timber, etc.)	Loading, Unloading	1,227								1,227
_	Berth 51,52	Containenzed Cargoes	Loading, Unloading		810							810
08 UMEX	Berth RR4	General Cargoes (timber etc.)	Loading, Unloading	264								264
	Berth 38-40	General Cargoes (timber, Steel scrap, cement, etc.)	Loading, Unloading	610								610
	Berth 44	General & Containenzed Cargoes	Loading, Unloading	152								152
09 MINNETAL	Berth 45,46	General Cargoes (steel products, timber,)	Loading, Unloading	582								582
	Berth 64-56	Bulk Cargoes (Coals, ores)	Unloading				12,000					12,000
PERMISSION	Derth 85	Bulk Cargoes (Coals, ores)	Loading	1000								1
IN CHIMPEN	13erth 34-00	(General Cargoes (Inmber, etc.)	Loading, Unioading	1,750								1.1
	Deriti ou	Urain (New Project)	Loading			06+		Ī			T	ŕ
	Denti ol	DUIX Cargors	Loading					112				247
	Derth 0.2	Bulk Cargoes (phosphate ores)	Unioading					19.2				145
11 SICIM	Rech 6.7	Dust Cargoes (resumers)	Loading Thiladinu					(4)				
	Harth 6.K	Bulk Carnoss (Cement)	Loading Crosses						105 5			2.50
12 OIL TERMINAL	Berth 69-79	Louid Bulk (crude oil, metanol, chemical liduids, etc.)	Loadine. Unloading							36.000		36.000
13 COMVEX	Berth 80-84	Bulk Cargoes (Coals, ores)	Loading, Unloading				12,000					12,000
14 ROMTRANS	Berth 107-112 & 115-118	General Cargoes (timber, ferrous/non-ferrous metal, etc.)	Loading, Unloading	652								652
15 SILOTRANS	Berth 113 & 114	Bulk Cargoes (grains)	Loading. Unloading			2,000						2,000
16 FREE TRADE ADMINISTRATION:	Berth 119A-119B	General Cargoes (meat, eto)	Loading, Unloading									
SNTFM	Berth 120	General Cargoes	Loading, Unloading									
	Berth 120	General Cargoes	Loading, Unloading									
19 MAST (Floating Operator)	Berth 124-125	Bulk Cargoes (cement, ores,etc.)	Loading, Unloading,									
20 ARTS	Berth 55	Grain (New Project)	Loading			250						21
				7,720	810	3,700	24,000	1,486	2,501	36,000	550	76,767
-		*		3,760	5,120	3,500	10,920	470	660	15,540	230	362
C Balance(A-B)				3,960	011.1	200	13,080	1,016	1,841	20,460	300	40,55
New Containor Terminal (S2) - Phase 1					3,430		4	4				•
New Container Terminal (S2) - Phase 2					2,100		1					1
										-	•	1
The second secon												

B General Cargo Berni, North North Guay Shallsor(6 -10 Gu, ps 1 and/m it a yead) Important methylic and the state of t	No. Cargo Handling	Berth	Port	Facilities	Issues on Existing Terminals	Improvement Presente
10 Ory Bulk Cargo Gask Born Norms, four officient screep, in officient field of an officient field off						Improvement Scenario
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Interview Section						To demplish in due order from the oldest one
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Sink Ama Stanking						
Image: Problem of the system of the state of th			Soum			
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Interference Compo Existence Use Borh North Existence Use Borh North Existence Use Borh North Existence Use Borh North Existence Use Borh	ľ		1	Capacity		To prove 5 and 5
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10 Org Buck Cargo General Use Borth Note The Section of The Section	02 Containenzed Cargo	Exclusive Use Berth	North			
Mathematical and the second						In one - Constituting exection willing
Image: Second						
13 Ory Bulk Cargo Grain Berth North Grain Dev Glasses In case of continuing operation, apecific coupsness of participation of parteast of parthy participation of participation of partinic parthy						and an annum Babarton securities aderbatent sedance
13 Dry Buik Cargo In cite of Continuing operation, specific cogniture ray (Environment Net or particular Environment Net Objection Control on the second Environment Net Objection Control on the second Caractic Vision Control on the second Environment Net Objection Control on the second Caractic Vision Control on the second Caract		General Use Berth	North		Relatively shallow(11.9m), slightly difficult for large vessel	
Image: Conjective Last capacity against process argo volume In stage of constimuting operation, specific capity must regise function of the system 00 Dry Buik, Cargo Genia Benh North Quay Shallous (1, 7h), up to nuclium aix exsed 10 Dry Buik, Cargo Genia Benh North Quay Shallous (1, 7h), up to nuclium aix exsed 11 Assamplic Construction Financi, how filtered and present caps volume In case of continuing operation, equipment regiserator 12 Assamplic Construction South Quay South In case of continuing operation, equipment regiserator 13 Assamplic Construction South Quay South In case of continuing operation, equipment regiserator 14 Quay Construction North Quay Construction To prolong bits status to adaptor continue maintenance 15 Area Eventrice To prolong bits status to adaptor continue maintenance To prolong bits status to adaptor continue maintenance 16 North Quay Astatus to adaptor continue maintenance To prolong bits status to adaptor continue maintenance 16 Quay As						
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13 Dry Balk Carges Grain Benk North Quay Shallperic Train, up to endiane are stread Inclusion North Quay Shallperic Train, up to endiane are stread In case of continuing openilos. exceptionent replacement Engineeric In case of continuing openilos. Environment protection Start Start Scattery start In case of continuing openilos. Environment protection Bink Area Scattery start Start Start In case of continuing openilos. Environment protection Intens Ore Borth North Quay Scattery start Intension To protong tile gamp to adquate processing the start processing Intens Ore Borth North Quay Open start(? Onto 152-18.2m), stoper size vasate benthing Intension Tens Ore Borth North Quay Redinity non- Capacity Staffacter processing To protong tile gata by adquate processinter maintenane Capacity Non-7e Ore Borth North Quay Redinity non- Start Area Scattery challenge of processing To improve environment protection Case. Case. North Quay Redinity non- Start Area Scatters challocontrenane Capacity To protong tile gata by						In case of continuing operation, specific equipment required
Image: Second	13 Dry Bulk Cargo	Grain Benti	North			
Image: Provide the second se		1		Site Area		
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Table 6.4.2-3 Issues on Existing Terminals and Improvement Scenario

6.4.3 Required Cargo Handling Equipment by Each Terminal

(1) Container Terminal

For the analysis of required cargo handling equipment, following reference data was prepared for review:

Figure 6.4.3-1-1, 2, 3 & 4 Cargo Flow Chart - Container Terminal

Table 6.4.3-1-1 Project Scale - Container Terminal

Table 6.4.3-1-2 Cargo Handling Equipment - Container Terminal

- Table 6.4.3-1-3 Design Data taken from S2 Container Terminal
 - (1) Estimated Cost of Equipment
 - (2) Required Number of Quay Gantry Crane at S2 Container Terminal
 - (3) Required Number of Rubber Tired Gantry (RTG) Type Yard Cranes
 - (4) Required Number of Gantry (RMG) Type Railway Station Cranes

Table 6.4.3-1-4 Required Major Facilities and Construction Schedule of Container Terminal

- (1) Container Ground Slot and Gantry Crane Calculation Sheet, Case 1
- (2) Container Ground Slot and Gantry Crane Calculation Sheet, Case 2
- (3) Container Terminal Construction Schedule

Figure 6.4.3-1 Cargo Flow Charts indicate the estimated cargo movement flow by volume and direction. Data cover the flows for Case 1 and Case 2 together with those at the target years, 2010 and 2020. Main input data are the traffic forecast data and estimated modal split by commodity. This is basic data to design the cargo handling equipment and yard arrangement. Based on the cargo volume forecast, container cargo flow and cargo handling equipment are studied.

Table 6.4.3-1-1 Project Scale indicates cargo volume in TEUs and number and type of cargo handling equipment.

Table 6.4.3-1-2 Cargo Handling Equipment shows the contents of major cargo handling equipment of new container terminal.

Table 6.4.3-1-3 (1) Estimated Cost of Equipment indicates the procurement schedule and cost data taken from the design data of S2 Container Terminal.

Table 6.4.3-1-4 (1) indicates the required ground slots and quay gantry cranes for the Case 1. Table 6.4.3-1-4 (2) indicates the same for the Case 2.

Table 6.4.3-1-4 (3) shows the possible construction of civil facilities and equipment procurement schedule for Case 1 and Case 2.

Based on these data, required cargo handling equipment for the container terminal is estimated. According to these data, total seven (in case of "Case 1") or total six (in case of "Case 2") quay gantry cranes, "Post-PANAMAX" type, will be required up to the year of 2020.

Considering competitive operation by plural terminal operators, provision of at least two (2) independent terminals is recommendable.

For implementing these works, two alternative plan were developed for selection.

Plan A: To meet with Case 1 requirement

- i. On-going "S2 West Container Terminal": 4 quay gantry cranes (future stage maximum : 6 cranes)
- ii. Additional new "S2 East Container Terminal": 3 quay gantry cranes (future stage maximum : 6 cranes)

Plan B: To meet with Case 2 requirement

- i. On-going "S2 West Container Terminal": 3 quay gantry cranes (future stage maximum: 6 cranes)
- ii. Additional new "S2 East Container Terminal": 3 quay gantry cranes (future stage maximum: 6 cranes)

For implementing these works, a layout of two terminals, S2-West and S2-East is proposed.

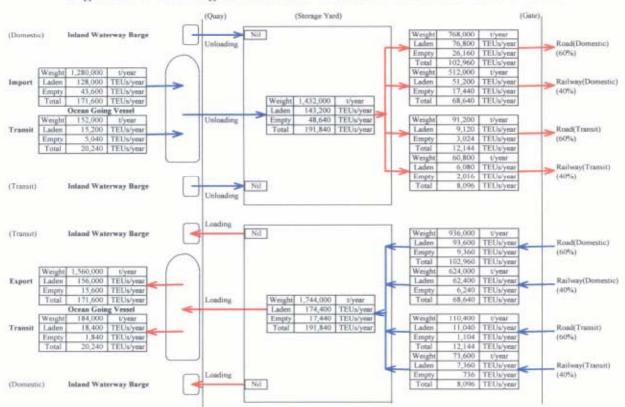
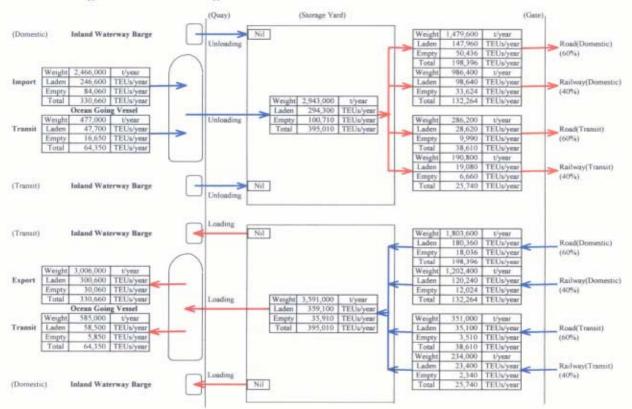


Figure 6.4.3-1-1 Cargo Flow Chart - Container Terminal - Case 1 - 2010

Figure 6.4.3-1-2 Cargo Flow Chart - Container Terminal - Case 1 - 2020



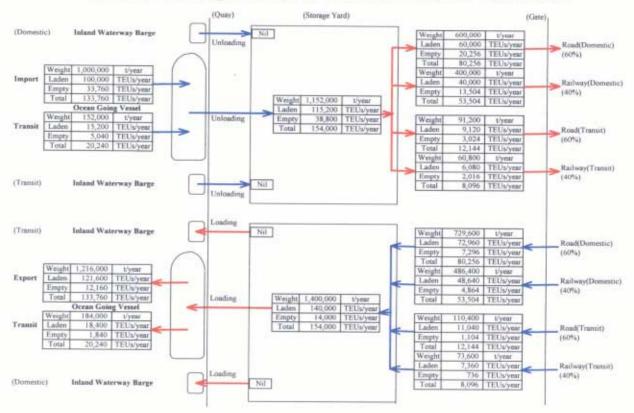
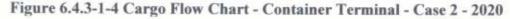


Figure 6.4.3-1-3 Cargo Flow Chart - Container Terminal - Case 2 - 2010



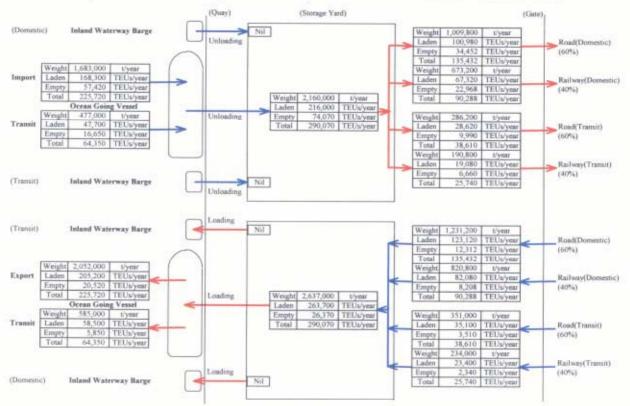


Table 6.4.3-1-1 Project Scale - Container Terminal

Cargo Volume to be Handled:

			Ca	se I			Cas	ie 2	
Operation	Category	2(010	20	20	20	10	20	20
·		Volume	unit	Volume	unit	Volume	unit	Volume	unit
	Trade	171,600	TEUs/year	330,660	TEUs/year	133,760	TEUs/year	225,720	TEUs/year
Loading	Transit	20,240	TEUs/year	64,350	TEUs/year	20,240	TEUs/year	64,350	TEUs/year
Ţ	Total	191,840	TEUs/year	395,010	TEUs/year	154,000	TEUs/year	290,070	TEUs/year
	Trade	171,600	TEUs/year	330,660	TEUs/year	133,760	TEUs/year	225,720	TEUs/year
Unloading	Transit	20,240	TEUs/year	64,350	TEUs/year	20,240	TEUs/year	64,350	TEUs/year
Ĵ	Total	191,840	TEUs/year	395,010	TEUs/year	154,000	TEUs/year	290,070	TEUs/year
Total	TEU	383,680	TEUs/year	790,020	TEUs/year	308,000	TEUs/year	580,140	TEUs/year

Required Number of Quay Gantry Crane:

Phase	Year		Ca	se 1			Cas	se 2	
	1	Volume	N	umber of Cran	e	Volume	N	umber of Cran	e
	1	TEUs/year	S2-West	S2-East	Total	TEUs/year	S2-West	S2-East	Total
Phase 1	2004-20010	383,680	4(*3)	0	4(*3)	308,000	3	0	3
Phase 2	2011-2015	559,100	4	2	6	409,500	3	2	5
Phase 3	2016-2020	790,020	4	3	7	580,140	3	3	6

(*3): Up to 2008

Table 6.4.3-1-2 Cargo Handling Equipment - Container Terminal

			2	Factions	No. of Computer	Remarks	Ca	e i	· Cas	se 2
Phase	Year	No.	System	Equipment	No. x Capacity	Kemarks		S2-East	S2-West	S2-East
	2005 -	01	Quay Container Handling	Quay Gantry Crane	3 x (41t x 30,5m)	Post PANAMAX Type	4(*3)	0	3	0
	2010	02	Stacking Yard Container Handling	Rubber Tired Gantry Crane	8 x (41t x 23,5m)	(6+1) Rows x (4+1) Tier:	8	0	8	0
		03	Railway Terminal Container Handling	Rail Mounted Gantry Crane	2 x (41 t x 32m)	(2+1) Tiers	2	0	2.	0
			Transportation	Trailer (Tractor Head + Chassis	18 x (2 x 20ft/1 x 40ft)		34	0	34	0
		05	Container Freight Station (CFS) Serv	Fork Lift Truck	5 x (lt x 0.5m)	Electric Driven	5	0	5	0
	·				2 x (3t x 0.5m)	Diesel Driven	2	0	2	0
		07	General Service	Reach Stacker	1 x (31t x 4m x 4 high)		1	0	1	0
		08	Empty Container Handling	Side Spreader Lift Truck	2 x (4.5t x 5 high)		2	0	2	0
2	2011 -			Quay Gantry Crane	3 x (41t x 30,5m)	Post PANAMAX Type	4	2	3	2
-	2015	02	Stacking Yard Container Handling	Rubber Tired Gantry Crane	8 x (41t x 23,5m)	(6+1) Rows x (4+1) Tier	10	6	8	6
;	2013	03	Railway Terminal Container Handling	Rail Mounted Gantry Crane	2 x (41t x 32m)	(2+1) Tiers	2	2	2	2
			Transportation	Trailer (Tractor Head + Chassis	18 x (2 x 20ft/1 x 40ft)		45	12	34	12
		05	Container Freight Station (CFS) Serv	Fork Lift Truck	5 x (1t x 0.5m)	Electric Driven	5	3	5	3
		06	Maintenance Service	Fork Lift Truck	2 x (3t x 0.5m)	Diesel Driven	2	1	2	; I
		07	General Service	Reach Stacker	1 x (31t x 4m x 4 high)		l	1	1	
		08	Empty Container Handling	Side Spreader Lift Truck	2 x (4.5t x 5 high)		2	1	2	
3	2016 -			Quay Gantry Crane	3 x (41t x 30.5m)	Post PANAMAX Type	4	3	3	3
-	2020		Stacking Yard Container Handling	Rubber Tired Gantry Crane	8 x (41t x 23.5m)	(6+1) Rows x (4+1) Tier	10	8	8	8
		03	Railway Terminal Container Handling	Rail Mounted Gantry Crane	2 x (41 t x 32m)	(2+1) Tiers	2	2	2	2
		04	Transportation	Trailer (Tractor Head + Chassis	18 x (2 x 20ft/1 x 40ft)		45	18	34	18
		05	Container Freight Station (CFS) Serv	Fork Lift Truck	5 x (lt x 0.5m)	Electric Driven	5	5	5	5_
		06	Maintenance Service	Fork Lift Truck	2 x (3t x 0.5m)	Diesel Driven	2	2	2	2
		07	General Service	Reach Stacker	1 x (3 lt x 4m x 4 high)			1		1
				Side Spreader Lift Truck	2 x (4.5t x 5 high)		2	2	2	2

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B. Quay Mobile Crane 401x 16m 1,200 55 3,240 15 0	Þ	Quay	Gantry Crane	41t x 30.5in, P'max	5,400	270	810		20	3		9440	4	1 64	180	5	1 648					-	6480
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	<u>ا</u> ت		Mobile Crane	40t x 16m	1,700	85	255	2,040											-	2040		-	2040
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RTG Crane(Replace) 11x 32m, (2+1)migh 2.700 1320 60 1320 6 1320 72 12 0 <	Stacking D/I	RVE S.Y.	RTG Crane	41t x 23.5m	1,200	60	180	1,440	15	8		1520	0			2						7	2880
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			RTG Crane(Replace)	41t x 23.5m	1,200	60	180	1,440	15	0	0	0	0	0	0	0						8	11520
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		S	RMG Crane	41t x 32m, (2+1)high	2,700	55	405	3,240	2	7		480	77		╡	-	1 324			3240		5	
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30 2 5 36 5 0 0 0 5 180 0 7 252 0 2 72 0 7 450 23 68 540 10 1 540 1 0 0 1 0 0 2 1 540 2 0 450 23 68 540 10 0				2 x 200/1 x 40A	30	2	5	36	5	5	5	180	7	2	72	8	1 3		1	36		1	36
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200 10 30 240 10 2 480 2 0 3 1 240 3 0 200 10 30 240 10 0			Reach Stacker(Replace)	311 x 4m x 4 high	450	23	68	540	101	0	0	0	0	0	0	0						0	0
200 10 30 240 10 <			SSLT	4.5t x 5 high	200	10	30	240	10	2	2	480	2	0	0	2			1	240		0	0
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1. All costs are of approximate(Yearly price changes are not included). - - 43692 - 12420 - 21588 - 9900 - - 1. All costs are of approximate(Yearly price changes are not included). Legends: A.: Apron V: Vessels 2. Spare parts prices are assumed as 5% of CIF price. S.Y.: Stacking Yard B: Barges 3. Taxes, charges, etc. are assumed as 15% of CIF price. R.S.: Railway Station D: Dry Containe.			_	3t x 0.5m	20	-	C	24	2	0	0	0	0	-	0					0		0	0
1. All costs are of approximate(Yearly price changes are not included). - - 43692 - - 12420 - - 21588 - - 9900 - - 2. Spare parts prices are assumed as 5% of CIF price. V: Vessels 3. Taxes, charges, etc. are assumed as 15% of CIF price. D: Dry Containe. 4. Annual maintenance costs can be estimated as behavier R.S.: Railway Station D: Dry Containe.											_		-		_		_						-
 All costs are of approximate(Yearly price changes are not included). Spare parts prices are assumed as 5% of CIF price. Taxes, charges, etc. are assumed as 15% of CIF price. A number number and a station. 										,	- 43	1692		-	20	-	2158		·	9900		-	28104
 2. Spare parts prices are assumed as 5% of CIF price. 3. Taxes, charges, etc. are assumed as 15% of CIF price. 4. Annual maintenance costs can be estimated as helow. 		All cos	its are of annroximate(Yearly price changes	are not	inchuc	led)			-	evenc			Apron						V: V	essels		
R.S.: Railway Station RTG: Rubber Tired Gantry Tyne Crane		Snare r	harts prices are assume	ad as 5% of CIF nrice			-			1	0		Y.: SI	ackin	y Yard	•				B: Ba	arges		
RTG. Ruhher Tired Gantry Tyne Crane	i m	Taxes.	charges, etc. are assum	ned as 15% of CIF p	rice.							Ľ	S.: R	ailway	Static	E					Zo Co Lo	Itainer	ş
	; -	Annual	I maintenance costs ca	n he estimated as hel								2	LQ: R	uhher	Tired	Gan	TVD	e Cra	ne	R. R.	efer (ontai	ners

Table 6.4.3-1-3 (1) Estimate Cost of Equipment (Preliminary) (Design Data taken from S2 Container Terminal)

6-62

3% of equipment CIF price for Gantry Cranes, RTG Cranes and RMG Cranes. 5% of equipment CIF price for Common Equipment.

RMG: Rail Mounted Gantry type Crane E: Empty Containers SSLT: Side-lift Spreader Lift Truck

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Table 6.4.3-1-3 (2)

Required Number of Quay Gantry Crane at S2 Container Terminal - 1/2

(Design Data taken from S2 Container Terminal)

Annual container handling capacity of the Gantry Type Quay Cranes is calculated by adopting the following formula:

Qb = Nq x Pq x Hw x Dw x Rb x Rw x Rh x Re

The results of the calculation are shown on the table below:

S2 - West Side (Continuous 2 Berths)

Marks	Descriptions	Units	Case 1-1	Case 1-2	Case 1-3	Remarks
Ng	Number of quay cranes	sets	2	3	4	
Nb	Number of berth	-	2	2	2	
Pqt	Theoret'l ave. productivity of crane	boxes/hour	32	32	32	For Post-PANAMAX size container vesse
Hw	Working hours per day	hours/day	22	22	22	
Dw	Working days per year	days/year	355	355		Subtracted holidays
Rb	Berth occupancy ratio	-	0.5	0.5		Nb=1:0.4, Nb=2:0.5,Nb=3:0.55
Rw	Crane working hour ratio	-	0.90	0.90		working hour/berthing hour
	Cargo handling hour ratio	-	0.70	0.70		handling hour/working hour
Pqn	Nominal ave, productivity of crane	boxes/hour	20	20		Pqn = Pqt x Rw x Rh
	Crane effectiveness factor	-	1	0.9	0.9	Nc/Nb=1:1,Nc/Nb=2:0.9, Nc/Nb=3:0.8
Qb	Annual container handling capacity	boxes/year	157,450	212,557	294,746	
Note	Year		-	2008	2011	
	Cargo movement forecast	boxes/year	-	206,100	272,100	

S2 - East Side

Marks	Descriptions	Units	Case 3-1	Case 3-2	Case 3-3	Remarks
Ng	Number of quay cranes	sets	2	3	4	
Nb	Number of berth		1	2	2	•
Pqt	Theoret'l ave, productivity of crane	boxes/hour	32	32	32	For Post-PANAMAX size container vessel
Hw	Working hours per day	hours/day	22	22	22	•
Dw	Working days per year	days/year	355	355		Subtracted holidays
Rb	Berth occupancy ratio	-	0.4	0.5		Nb=1:0.4, Nb=2:0.5,Nb=3:0.55
Rw	Crane working hour ratio	-	0.90	0.90		working hour/berthing hour
Rh	Cargo handling hour ratio	-	0.70	0.70		handling hour/working hour
Pgn	Nominal ave. productivity of crane	boxes/hour	20	20		Pan = Pat x Rw x Rh
	Crane effectiveness factor	-	1.0	0.9	0.9	Nc/Nb=1:1,Nc/Nb=2:0.9, Nc/Nb=3:0.8
Qb	Annual container handling capacity	boxes/year	125,960	212,557	294,746	
Note	Уеаг		- 1	-	-	
	Cargo movement forecast	boxes/year	-	-	-	

Table 6.4.3-1-3 (2)

Required Number of Quay Gantry Crane at S2 Container Terminal - 2/2

(Design Data taken from S2 Container Terminal)

No.	Descriptions	Units	S2-West	S2-East	Total		Cae I			Case 2	
-	Target Year	Year				'04-'10	'11-'15	'16-'20	'04-'10	'11-'15	'16-'20
-	Cargo Movement	TEUs/year				383,680	559,100	790,020	308,000	409,500	580,140
	Number of quay crane	sets	3	0	3						
1	Annual container	boxes/year	212,557	0	212,557						
	handling capacity	TEUs/year			340.091	(X)			x		
	Number of quay crane	sets	3	2	5				·		
2	Annual container	boxes/year	212,557	125,960	338.517].	ŧ.				
	handling capacity	TEUs/year			541.627]				Х	L
	Number of quay cran		3	3	6						
3	Annual container	boxes/year	212,557	212,557	425,114]			1		
	handling capacity	TEUs/year			680,182						<u> </u>
	Number of quay crane		4	0	4						
4	Annual container	boxes/year	294,746	0	294,746						
	handling capacity	TEUs/year			471,594	X					
	Number of quay crane	sets	4	2	6	'					
5	Annual container	boxes/year	294,746	125,960	420,706						
	handling capacity	TEUs/year			673,130		X		ļ		
	Number of quay crane		4	3	7	1				1	
6	Annual container	boxes/year		212,557	507,303	1					
	handling capacity	TEUs/year			811.685			X	1		

(X): Up to 2008

Table 6.4.3-1-3 (3)

Required Number of Rubber Tired Gantry (RTG) Type Yard Cranes - 1/4

((6+1)Rows x (4+1)Tier Type)

(Design Data taken from S2 Container Terminal)

1. Category of the Crane Operation:

There are two(2) major categories of container handling operation at the laden container stacking yard: (1) Sea-side Operation: To/from apron

(2) Land-side Operation: To/from the railway station and outside of the terminal through the terminal gate.

2. Required Number of the Cranes - 1/4:

Required number of the Yard Cranes is calculated by adopting the following formula:

(1) Sea-side Operation: To/from apron (To be adequate for the Quay Crane Productivity)

Nys = (Pq x Nq) / Py

The results of the calculation are shown on the table below:

Case-1	(2 Berths)	
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Marks	Descriptions	Units	Case 1-1	Case 1-2	Case 1-3	Remarks
Pya	Theoret'l ave. Y crane productivity	boxes/hour	30	30	30	
Pqa	Theoret'l ave. Q crane productivity	boxes/hour	32	32	32	Average cycle path of quay crane*
Nq	Number of Q crane	sets	2	3	4	
Nysa	Total number of Y crane(for Pqa)	sets	2.1	3.2	4.3	
	say	sets	2	3	4	At average cycle path of quay crane*
Pym	Theoret'l min. Y crane productivity	boxes/hour	22	22		Longest cycle path of yard crane
Pqm	Theoret'l max. Q crane productivity	boxes/hour	45	45	45	Shortest cycle path of quay crane*
Nq	Number of Q crane	sets	2	3	4	
Nysm	Total number of Y crane(for Pqm)	sets	4.1	61	8.2	
	say	sets	4	6	8	At shortest cycle path of quay crane*

Note* For Post-PANAMAX size container vessel

Case-2 (3 Berths)

Marks	Descriptions	Units	Case 2-1	Case 2-2	Case 2-3	Remarks
Pya	Theoret'l ave. Y crane productivity	boxes/hour	30	30	30	
Pqa	Theoret'l ave. Q crane productivity	boxes/hour	32	32	32	Average cycle path of quay crane*
Nq	Number of Q crane	sets	5	6	7	
Nysa	Total number of Y crane(for Pqa)	sets	5.3	6.4		
	say	sets	5	6	7	At average cycle path of quay crane*
Pym	Theoret'l min. Y crane productivity	boxes/hour	22	22		Longest cycle path of yard crane
Pqm	Theoret'l max. Q crane productivity	boxes/hour	45	45	45	Shortest cycle path of quay crane*
Nq	Number of Q crane	sets	5	6	7	
Nysm	Total number of Y crane(for Pqm)	sets	10.2	12.3	14.3	
	say	sets	10	12	14	At shortest cycle path of quay crane*

Note* For Post-PANAMAX size container vessel

Table 6.4.3-1-3 (3)Required Number of Rubber Tired Gantry (RTG) Type Yard Cranes - 2/4

((6+1)Rows x (4+1)Tier Type)

(Design Data taken from S2 Container Terminal)

2. Required Number of the Cranes - 2/4:

Required number of the Yard Cranes is calculated by adopting the following formula:

(2) Land-side Operation: To/from the railway station and outside of the terminal through the terminal gate. - 1/2

Nyl = (Qy x Rp x Th) / (Py x Ra x Dw x Hw x Rw x Rh)

The results of the calculation are shown on the table below:

Case-1 (2 Berths)

Marks	Descriptions	Units		2008	2011	Remarks
	Import dry container quantity	boxes/year		79,600	101,400	
	Import reefer container quantity	boxes/year		1,500	1,900	
	Import empty container quantity	boxes/year	-	11.000	14,100	
Oit	Import transit container quantity	boxes/year	-	4,400	7,400	
Ois	Import tranship container quantity	boxes/year	-	4,500	7,600	
Qiy	Total import container quantity	boxes/year	-	101,000	132,400	
Rp	Peak ratio	-	-	1.25	1.25	
Thi	Average handling times	-	-	1.8	1.8	Including container rehandling*
Pya	Yard crane productivity(average)	boxes/hour	•	32	32	
Ra	Crane availability ratio	- }		1	1	
Dw	Working days per year	days/year	-	345		Subtracted holidays, maintenance, etc.
Hw	Working hours per days	hours/day	-	22	22	
Rw	Crane working hour ratio	-	-	0.90	0.91	
Rh	Cargo handling hour ratio	-	-	0.70	0.72	
Nyli	Number of yard crane for import	units	-	1.5	1.9	
Qed	Export dry container quantity	boxes/year	-	65,900	84,000	· · · · · · · · · · · · · · · · · · ·
Qer	Export reefer container quantity	boxes/year	-	400	500	
Qee	Export empty container quantity	boxes/year	-	25,800	32,900	
Qet	Export transit container quantity	boxes/year		4,400	7,400	
Oes	Export tranship container quantity	boxes/year	-	4,500	7,600	
Qey	Total export container quantity	boxes/year	-	101,000	132,400	
Rp	Peak ratio	-	-	1.25	1.25	
The	Average handling times	-	-	1		Including container rehandling**
Pya	Yard crane productivity(average)	boxes/hour	-	32	32	
Ra	Crane availability ratio	-	-	1	1	
Dw	Working days per year	days/year	-	345	345	Subtracted holidays, maintenance, etc.
Hw	Working hours per days	hours/day	-	22	22	
Rw	Crane working hour ratio	-	-	0.90		
Rh	Cargo handling hour ratio	-	-	0.70	0.72	
Nyle	Number of yard crane for export	units	-	0.8		
Ňyl	Total number of yard crane	units	-	2.3		Including cranes for import & export
ļ	say	units	-	3	3	l

Note*: Container stacking height(average): 2.5, first come first serve service

**: Container stacking height(average): 3.0, as per vessel loading plan