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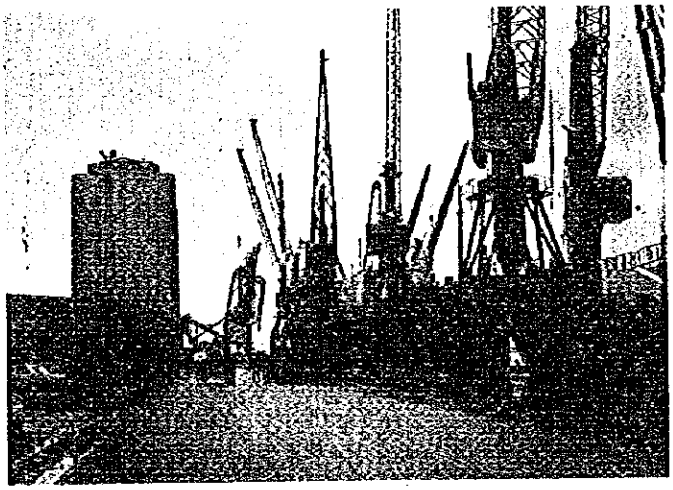
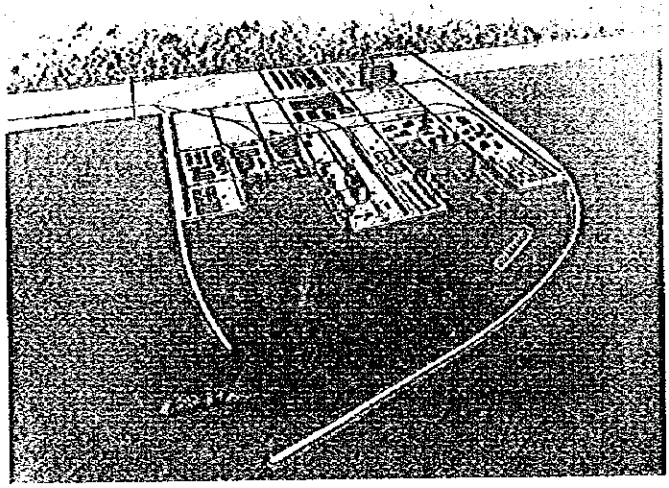
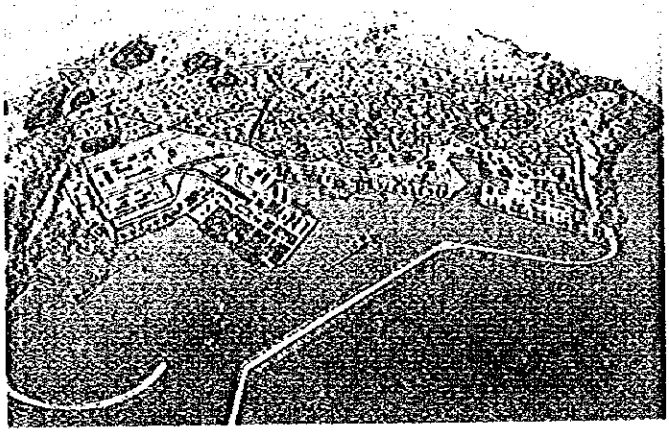
FINAL REPORT

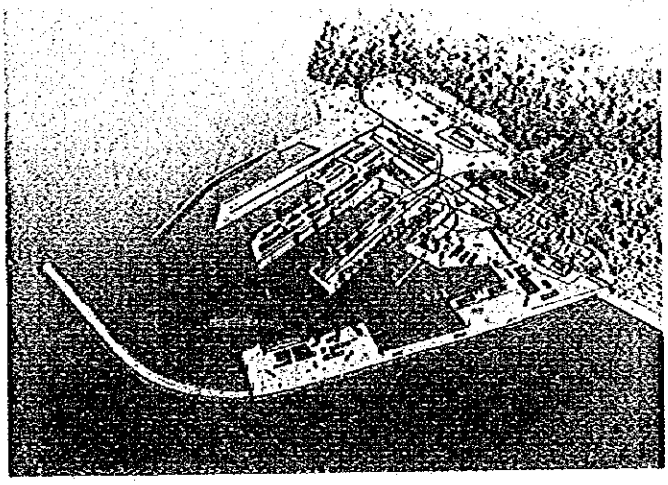
THE STUDY ON THE PORT DEVELOPMENT PLAN IN THE SYRIAN ARAB REPUBLIC

Vol.2









AUGUST 1996

The Overseas Coastal Area Development Institute of Japan (OCDI)
NIPPON KOEI CO.,LTD.(NK)

The following foreign exchange rate is applied in this study:
US$1.00 = 42 Syrian Pound (as October 1995) = ¥100

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ABBREVIATIONS

B/L	Bill of lading
CAMP	Coastal Area Management Plan
CBR	Cost Benefit Ratio
CFC	Conversion Factor for Consumption
CFL	Conversion Factor for Labor
CFS	Container Freight Station
CIF	Cost Insurance and Freight
COD	Chemical Oxygen Demand
CPU	Central Processing Unit
CY	Container Yard
dB	Decibel
DG	Dangerous Goods
DMC	Developing Member Countries
DO	Dissolved Oxygen
DWT	Dead Weight Tonnage
ECU	European Currency Unit
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EPZ	Exporting Processing Zone
ETA	Estimated Time of Arrival
EDA	Estimated Time of Departure
FCL	Full Container Load
FEU	Forty-foot Equivalent Unit
FIRR	Financial Internal Rate of Return
FOB	Free on Board
FTZ	Free Trade Zone
GDP	Gross Domestic Product
GL	Ground Level
GNP	Gross National Product
GRT	Gross Registered Tonnage
HP	Horse Power
hr	hour
IALA	International Association of Lighthouse Authorities
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IMO	International Maritime Organization
JICA	Japan International Cooperation Agency
LCL	Less than Container Load
LOA	Length Over All
MLWL	Mean Low Water Level
MOT	the Ministry of Transport
MT	Metric Ton
NRT	Net Registered Tonnage

OD-Survey	Origin and Destination Survey
OECF	The Overseas Economic Cooperation Fund
OS	Operation System
PH/ph	Potential of Hydrogen
Ro-Ro	Roll-on Roll-off
SCF	Standard Conversion Factor
SDR	Special Drawing Rights
SHIPCO	Shipping Agencies Company
SP	Syrian Pound
SPC	State Planning Committee
SS	Suspended Substance
SW	Scope of Work
TEU	Twenty-foot Equivalent Unit
UAE	United Arab Emirates
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
US$	US Dollar
WHO	World Health Organization

Contents of the Final Report

VOL. 1

PART I PRESENT CONDITIONS

PART III SHORT-TERM PLAN

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

PART II

MASTER PLAN

PART II

MASTER PLAN

Chapter 9 Socio-economic Framework

The socio-economic framework drafted herein by the study team will be solely used as the preconditions of the projection of cargo traffic through the study ports in the future, but is not aimed to allude to the entire socio-economic aspects of Syria which are viewed by the authorities concerned of the Syrian Government.

9.1 Long-term Framework (In 2010)

9.1.1 Population

As of 1994, the Syrian population is estimated at around 13,884,000. The average growth rate per annum in the past ten years (1984-1994) is 3.4%. As to the population forecast, the following figures are estimated by the authorities concerned of the Government of Syria and the international institutes:

a. The Central Bureau of Statistics (The Government of Syria)

2005:Medium	case	19,205,000	(1994-2005:3.0%)
High	case	19,949,000	
2010:Medium	case	22,216,000	(1994-2010:3.0%)
High	case	23,414,000	

b. Statistical Abstract (1984)(The Government of Syria)

2000: 17,085,000

c. Population Prospects (1992)(The United Nations)

2005:Low	case	18,787,000	
Medium	case	20,586,000	(1994-2005:3.7%)
High	case	21,641,000	
2010:Low	case	20,849,000	
Medium	case	23,646,000	(1994-2010:3.4%)
High	case	25,423,000	

d. World Population Projections (1994-1995)(The World Bank)

2005:	19,948,000	(1994-2005:3.4%)
2010:	23,331,000	(1994-2010:3.3%)

From the above, the estimated average population growth rates per annum towards the year 2010 are in the range of 3.0%-3.4% in the respective medium cases. In the meantime, through the interviews with the authorities concerned of the Government of Syria, it is recognized that the government intends to promote employment of women through encouragement of education .In this way, it is hoped that the

present population growth rate of 3.4%, which is somewhat high, will gradually decrease. From this view, the population growth rate in Syria is expected not to exceed 3% in the long-range prospects, though a figure under 2% is unthinkable.

Taking account of the forecast figures by the authorities concerned and the intention of the government mentioned above, the average population growth rate of 3% per annum towards the year 2010 is adopted as the precondition of the projection of cargo traffic through the study ports. The resulting estimated population in 2010 is 22,216,000, the same as the fegure estimated by the Central Bureau of Statistics (see Table 9.1.1-1)

Table 9.1.1-1 Trend and Future Forecast of Total Population of Syria

(Unit: thousand, %)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Population	7140	7380	7627	7883	8148	8421	8704	9046	9298	9611	9934
Growth Rate		3.4	3.3	3.4	3.4	3.4	3.4	3.9	2.8	3.4	3.4

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	2010
Population	10267	10612	10969	11338	11719	12116	12529	12958	13393	13844	22216
Growth Rate	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.0

Data: Total Population ; STATISTICAL ABSTRACT

Note: Growth rate in each column is percentage for the previous year until 1994 and in the column of 2010 is an average growth rate from 1994 to 2010.

9.1.2 Gross Domestic Product (GDP)

A long-term program of gradual economic liberalization has been under way since the late 1980's according to the government's economic policy. In addition to the program, in 1991, the Law No 10 for Encouragement of Productive Investment was enacted which offers investors privileges to attract private funds back into the country, along with direct foreign investment.

Owing to a series of economic liberalization policies mentioned above, the Syrian economy has achieved stable growth since the late 1980's. The annual growth rate of the Gross Domestic Product (GDP)from 1987 to 1993 was 5.3%. Since 1991 when the Law No 10 was enacted, the annual growth rate of GDP amounts to 7.2%.

As to the prospects of the growth rate of GDP in the future, through the interview with the authorities concerned of the Government of Syria, it is recognized that the target growth rate of GDP towards the near future covering the coming 8th Five-Year Plan (1996-2000) is in the range of 6-7% per annum.

Considering the actual upward trend of GDP which was recorded in recent years and the government policy for economic liberalization to back up stable economic growth, the above target of GDP growth seems likely to be achieved.

Taking account of the above, the average GDP growth rate of 6% per annum towards the year 2010 is adopted as the precondition of the projection of cargo traffic through the study ports. The resulting estimated GDP in 2010 is 300 billion S.P. at 1985 constant price (see Table 9.1.2-1).

Table 9.1.2-1 Trend and Future Forecast of Syrian GDP at 1985 constant price

(Unit: million SP, %)

	1975	1977	1978	1979	1980	1981	1982	1983	1984	1985
GDP	52145	57124	62109	64365	72078	78931	80606	81758	78429	83225
Growth Rate			8.7	3.6	12.0	9.5	2.1	1.4	-4.1	6.1

	1986	1987	1988	1989	1990	1991	1992	1993	2010
GDP	79109	80618	91313	83133	89485	95883	105997	110151	300000
Growth Rate	-4.9	1.9	13.3	-9.0	7.6	7.1	10.5	3.9	6.0

Data: GDP; STATISTICAL ABSTRACT

Note: Growth rate in each column is percentage for the previous year until 1993 and in the column of 2010 is an average growth rate from 1993 to 2010.

9.2 Short-term Framework (In 2003)

9.2.1 Population

As previously mentioned the average population growth rate per annum in the period from 1994-2010 is estimated to be 3%. It is natural that the population growth rate during this period will decrease year by year from the top level of 3.4% in 1994. Taking this into account, in the former term of this period (1994-2003), on the assumption that this period can be divided into nearly two equal terms by the year 2003 (1994-2003, 2003-2010), the average population growth rate per annum should be a little more than 3%, and in the latter term a little less than 3%. Based on the mentioned above, the average population growth rate per annum in the former term is fixed to be 3.2%, in the same way in the latter term 2.8%. Consequently the population of Syria in 2003 is estimated to be 18,435,000.

9.2.2 GDP

As previously stated the average GDP growth rate per annum towards the year 2010 is 6%.
The same rate of 6% is adopted also in the period of 1993-2003.
The GDP in the year 2003 results in 200 billion S.P. at 1985 constant price.

Chapter 10 Demand Forecast and Function Allotment (Long, Short-term)

10.1 Demand Forecast (Nation-wide)

10.1.1 Cargo Volume Forecast

(1) Methodology

In this section, the total future cargo volume handled in all Syrian ports is forecasted and in the section 10.3, future cargo volume in each port is determined after considering the function and role of each port, future container cargo volume is forecasted.

Generally speaking, two methods are used to forecast the cargo volume handled at the port. One is a macro forecast which is a method to estimate the cargo volume as a group including various commodities, regardless of the volume of each commodity. The other is a micro forecast which is a method to estimate the cargo volume of each commodity individually.

Judging from the cargoes handled in Syrian ports, the handling cargoes are classified into 3 categories, that is, "major cargoes" (phosphate rock, iron and steel products, cement and clinker, grain), "other cargoes" and "transit cargoes".

In this demand forecast, a macro forecast is used only for "other cargoes" because future cargo volume of "major cargoes" seems to be controlled greatly by the future production plans in Syria and future cargo volume of "transit cargoes" should be judged from the future trading circumstances by countries.

Histrical trend of handling cargo volume through Syrian ports by commodities is shwown in Table 10.1.1-1.

Table 10.1.1-1 Trend of Handling Cargoes by Commodities through Syrian Ports

[EXPORT]

(Unit: thousand ton)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Phosphate	857	887	1265	1534	1824	1634	1257	1103	926	607	777
Cement	0	0	0	0	71	56	90	21	0	0	0
Clinker	0	0	0	0	0	534	679	392	357	115	0
Grain	70	2	15	1	24	172	25	20	21	52	170
Coal	0	233	17	0	0	0	8	6	2	0	0
Petroleum Residues	0	36	2	0	2	0	0	0	0	0	0
Cotton	200	117	118	78	52	74	101	107	123	167	223
Foodstuff	13	29	67	4	42	16	14	27	25	77	13
Others	85	67	46	56	45	68	88	94	72	111	117
Export Total	1225	1371	1530	1673	2060	2553	2263	1770	1525	1128	1300
Empty Containers & Tracks	101	134	79	59	47	49	52	76	94	107	116
Export Total	1326	1505	1609	1732	2107	2602	2315	1846	1619	1235	1416

Data: General Company of Latakia Port, General Company of Tartous Port

[IMPORT]

(Unit: thousand ton)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Grain	1452	762	745	960	883	1237	1278	1491	662	734	582
Iron & Steel	745	721	465	284	320	306	341	550	528	1015	1112
Rice	2	105	101	98	2	25	48	83	131	135	122
Sugar	280	338	306	311	288	329	351	491	345	383	471
Foodstuff	784	584	230	188	187	313	856	414	569	621	674
Wood & Wooden Products	270	193	185	68	74	129	112	122	209	270	279
Fiber & Textiles	129	54	40	36	158	146	46	71	70	117	111
fertilizer & Chemicals	110	369	237	481	661	474	478	682	872	970	757
Cement	10	3	5	3	16	6	6	10	10	9	11
Machine & Equipments	271	310	233	189	159	156	183	185	224	368	491
Others	498	550	332	317	246	298	285	414	509	461	474
Import Total	4551	3989	2879	2935	2994	3419	3984	4513	4129	5083	5084

Data: General Company of Latakia Port, General Company of Tartous Port

(2) Major Cargoes Volume Forecast

1) Phosphate Rock

[Long-term Forecast]

A great part of the phosphate rock produced in Syria has been exported. The production of phosphate rock peaked in 1989, reaching to around 2.3 million tons. The volume of exported phosphate rock peaked in the previous year, recording about 1.9 million tons, of which major portion was shipped from Tartous Port. Since then to 1993, both production and exports of phosphate rock in Syria showed a continuous downward trend under the worldwide setback of phosphate rock trade, presumably affected by the political and economic chaos in Eastern Europe and Russia triggered by a collapse of the Soviet Union.

As to the long-range prospects of international market of phosphate rock, however, it is expected that the demand for phosphate rock will steadily increase along with the population growth and consequent increase in demand for food production using fertilizer, especially in developing countries. Additionally, it is also expected that political and economic stabilization in Eastern Europe and former Soviet Union will be accomplished in the near future, resulting in the recovery of international phosphate market.

In the meantime, quality of phosphate rock produced in Syria is planned to be upgraded by installing processing plants at the phosphate mines, thus strengthening international competitiveness of Syrian products.

Considering the situation mentioned above, and on the assumption that the international phosphate rock market will recover to its previous peak level in several years, in 1998 the exports of phosphate rock from Syria through its ports will regain its peak level of 1,763,000 tons in 1988, and then it will steadily increase annually by 4.8% until the year 2010 (annual growth rate of GDP in the developing countries towards 2004 estimated by the World Bank). Thus, the resulting figure of phosphate rock to be exported from the Syrian port is 3.1 million tons in the year 2010 (see Table 10.1.1-2).

[Short-term Forecast]

On the same premise which is adopted in the case of long-term forecast above, the volume of phosphate rock to be exported from the Syrian ports is 2.2 million tons in 2003, using a figure 4.8% as the average increase rate per annum in the period of 1998-2003.

Table 10.1.1-2 Trend and Future Forecast on Production and Exports of Phosphate Rock in Syria

(Unit: thousand ton)

	1984	1985	1986	1987	1988	1989
Production	1,515	1,224	1,600	1,985	2,186	2,250
Exports through ports	932	904	1,302	1,603	1,763	1,643

	1990	1991	1992	1993	1994	2010
Production	1,633	1,469	1,265	931	1,202	
Exports through ports	1,272	1,147	941	620	801	3,100

Data: General Company of Phosphate and Mine

2) Iron, Steel Products and Raw and Processed Materials for Making Them

In the projection of the volume of iron, steel products and raw and processed materials for making them which will be imported into Syria, the following preconditions are adopted (see Table 10.1.1-3):

i) The volume of iron and steel products consumed in Syria in 2010 is estimated by using the two methods below:

a. The gap in the consumption volume per capita between Syria (66 Kg) and the world (130 Kg) in the year 1993 will be narrowed gradually by half towards the year 2010.

b. The following formula which shows the correlation between GDP and the total consumption volume in a country is used:

The total consumption volume of iron and steel (Kg)
= 0.03 x GDP (US$ at 1985 constant price)

The above two methods, "a" and "b" give the figures of 2.2 million and 2.3 million tons in the year 2010 in Syria, respectively. There being no decisive difference, the latter figure is adopted for the projection.

ii) The volume of iron and steel products to be produced in the Syrian steel making factories in 2010 is estimated to be 0.9 million tons considering the project for establishing the new steel making factory at Al-Zara (700,000 tons per annum) and the production increase program of the existing factory in Hama (200,000 tons).

From the above "i)" and "ii)", the volume of iron and steel products to be imported into Syria in the year 2010 is estimated to be 1.4 million tons by subtracting the domestic production volume (0.9 million tons) from the domestic consumption volume (2.3 million tons).

Additionally, the total volume of 1.6 million tons of raw and processed materials including pellets, scraps, ferro-alloys and bricks for furnaces will be imported for the domestic production in 2010.

Table 10.1.1-3 Trend and Future Forecast on Production and Imports of Iron and Steel

(Unit: thousand ton)

		1984	1985	1986	1987	1988	1989
Production	Steel Bar	84	89	90	32	35	31
	Pipe		11,280	3,000	-	-	3,000
Imports		701	608	427	269	317	343

		1990	1991	1992	1993	1994	2010
Production	Steel Bar	82	81	95	83	35	
	Pipe	5	4	5	15	17	
Imports		397	622	543	836		1,400

Data: STATISTICAL ABSTRACT, General Corporation of Steel

Note: 1) Unit of Pipe volume from 1985 to 1989 is km.

2) Imports include part of billet needed a production of iron bar and all hot coil needed a production of pipe.

[Short-term Forecast]

As mentioned previously the iron and steel consumption in Syria is estimated to be 2.3 million tons in 2010, and resulting average consumption increase rate per annum is 5.7% from 1993-2010. Adopting this figure 5.7% also as the average rate in the period from 1993-2003, the consumption in 2003 is estimated to be 1.6 million tons.

In the meantime the domestic production of iron and steel in the same year can be determined as 900,000 tons on the assumption that the total capacity of two steel making factories (the existing and the projected) in 2003 is just equal to that in 2010.

From the above the volume of iron and steel to be imported into Syria in 2003 is estimated to be 700,000 tons by subtracting the domestic production (900,000 tons) from the consumption (1.6 million tons).

Additionally, the total volume of 1.6 million tons of raw and processed materials should be imported in the same year in order to make iron and steel in the country.

3) Cement and Clinker

In the projection of the volume of cement and clinker which will be exported from Syria, the following preconditions are adopted (see Table 10.1.1-4):

[Long-term Forecast]

i) The volume of cement to be consumed in Syria in 2010 is estimated by the following formula which shows the correlation between the value of gross fixed capital formation and the total volume of consumed cement in Syria:

The total consumption of cement (tons)
=0.22 x value of gross fixed capital formation
('000 S.P. at 1985 constant price)
=9.9 million tons (the year 2010)
(value of gross fixed capital formation in 2010 is estimated to be 45 billion S.P. on the assumption that its ratio to the total GDP accounts for 15%)

ii) The volume of cement to be produced in the Syrian cement making mills in 2010 is estimated to be 10.9 million tons considering four projects for establishing new cement making mills around Hama, etc. (one million tons per annum x 3 projects + 3 million tons per annum x one project = 6 million tons per annum) and the production capacity of the existing 9 mills (4.9 million tons per annum).

From the above "i)" and "ii)", the volume of cement to be exported from Syria in the year 2010 is estimated to be one million tons by subtracting the domestic consumption (9.9 million tons) from the domestic production (10.9 million tons).

[Short-term Forecast]

The cement consumption in Syria is estimated to be 9.9 million tons in 2010 as stated previously, and resulting average consumption increase rate per annum is 6.3% from 1993-2010. Adopting this figure 6.3% also as the average rate in the period from 1993-2003, the consumption in 2003 is estimated to be 6.5 million tons.

In the meanwhile the domestic production of cement in the same year can be decided to be 7.9 million tons from the following suppositions;

a. The total capacity of existing 9 cement making mills remains its present level of 4.9 million tons in the year 2003.

b. The total capacity of new mills which are to be in operation in the same year will be 3 million tons considering three new mills each of which has a capacity of one million tons.

From the above the volume of cement to be exported from Syria in 2003 is estimated to be 1.4 million tons by subtracting the consumption (6.5 million tons) from the domestic production (7.9 million tons). Out of this volume, 1.1 million tons is estimated to be exported through the Syrian ports considering that the exports through ports accounts for around 80% of the total exports now.

Table 10.1.1-4 Trend and Future Forecast on Production and Exports of Cement and Clinker

(Unit: thousand ton)

		1984	1985	1986	1987	1988	1989
Production of Cement		4,279	4,357	4,316	3,870	3,330	3,442
Exports	Cement	63	93	33	61	118	163
	Clinker	-	-	-	-	31	534
Consumption in Syria		4,062	4,296	4,203	3,388	2,865	2,900

		1990	1991	1992	1993	1994	2010
Production of Cement		3,049	2,843	3,246	3,667	4,009	10,900
Exports	Cement	295	66	58	1		1,000
	Clinker	679	410	406	158		
Consumption in Syria		2,789	2,688	3,159	3,501		9,900

Data: STATISTICAL ABSTRACT, General Establishment of Cement

4) Sulphur

Sulphur is needed to produce a phosphatic fertilizer at the factory of Homs and Palmyra. Therfore, considering the consumption and the domestic production, the future handling volume is estimated.

[Consumption]

According to an interview with authorities concerned, domestic consumption of sulphur in Syria is estimated as follows.

(Unit: thousand ton)

Year	2003	2010
Consumption Volume	380	380

[Production]

Sulphur in Syria is produced at several facilities related to petroleum. The production plan in the future is undecided now. The production volume is estimated to increase because the consumption volume of petroleum products in Syria will increase steadily and the elimination of sulphur in petroleum products will be more necessary to prevent air pollution.

(Unit: %, thousand ton)

Year	1994	2003	2010
Production Volume	33	50	150

[Import]

Sulphur is assumed to be imported from Iraq in the future because the cost of land transportation from Iraq is cheaper than that of sea transportation from European countries.

Table 10.1.1-5 Sulphur Volume in the Future

(Unit: thousand ton)

Year	2003	2010
Total import volume	330	230
: through the ports (0%)	0	0
: by land transportation(100%)	330	230

5) Oil Cokes

[Production]

Oil cokes are produced in Homs Refinery. In line with the expansion of facilities, the production volume will be 330,000 ton until 2003. The production plan in the future is undecided now. The production volume is estimated to increase because the consumption volume of petroleum products in Syria will increase steadily.

(Unit: %, thousand ton)

Year	1994	2003	2010
Production Volume	166	330	660

[Export]

As oil cokes produced in Homs Refinery contain much sulphur and air pollution arises from burning oil cokes, the demand is small. Sixty-five percent of oil cokes produced in 1994 is not consumed and stocked in Homs refinery. The consumption is assumed to increase in the future owing to the improvement in quality.

Table 10.1.1-6 Oil Cokes Volume in the Future

(Unit: thousand ton)

Year	2003	2010
Domestic consumption (40%)	130	260
Total exports	200	400
: through the ports (30%)	100	200
: by land transportation (30%)	100	200

6) Wheat

[Long-term Forecast]

According to the opinion of authorities concerned, domestic consumption of wheat in Syria will amount to 3-3.5 million tons in the future period from 2000-2005 (see Table 10.1.1-7). From this the consumption of wheat in 2003 can be estimated to be 3.3 million tons, adopting a middle value between the maximum and the minimum.

Taking this figure of 3.3 million tons into consideration, the average increase rate of wheat consumption per annum is calculated at 2.6% from 1993-2003, 0.6% less than the population growth rate (3.2%) in the same period. Similarly, the increase rate from 2003-2010 can be fixed at 2.2% allowing for a gap of 0.6% between the wheat consumption increase rate and the population growth rate (the population growth rate per annum in this period is 2.8% as previously stated).
As a result, wheat consumption in Syria will be 3.8 million tons in 2010.

In the meanwhile, consumption of wheat in Syria is composed of three parts; wheat domestically produced, wheat imported from foreign countries and flour from abroad. In Syria consumption of flour from abroad accounts for 20% of total wheat consumption (in 1993). Thinking this situation over, real wheat consumption in Syria, not including that of flour from abroad, is calculated at 3 million tons in 2010.

Production of wheat in Syria is estimated to be 5.5 million tons in 2010 based on the data of authorities concerned. The average increase rate of wheat production per annum is calculated at 2.2% from 1994-2010.

From the above, the volume of wheat to be exported from Syria in the year 2010 is calculated at 2.5 million tons by subtracting the consumption (3 million tons) from the production (5.5 million tons). About 80% of this volume is assumed to be exported through the Syrian ports (2.0 million tons).

[Short-term Forecast]

Wheat consumption in Syria is estimated to be 3.3 million tons in 2003 as stated previously. But 20% of this volume must be the consumption of flour from abroad, and resulting real wheat consumption is estimated to be 2.6 million tons.

In the meantime domestic wheat production in 2003 is estimated to be 5.0 million tons.

From the mentioned above, the volume of wheat to be exported from Syria in the year 2003 is calculated at 2.4 million tons by subtracting the consumption (2.6 million tons) from the production (5.0 million tons). About 80% of this volume is assumed to be exported through the Syrian ports (2.0 million tons)

Table 10.1.1-7 Trend and Future Forecast on Production and Imports of Wheat

(Unit: thousand ton)

	1984	1985	1986	1987	1988	1989
Production	1,068	1,714	1,969	1,656	2,067	1,020
Imports	1,279	525	576	551	600	1,002

	1990	1991	1992	1993	1994	2010
Production	2,070	2,350	3,046	3,627		4,800
Imports	945	752	89	79		

Data: STATISTICAL ABSTRACT, Ministry of Agriculture and Agrarian Reform

7) Barley

In the projection of the volume of barley which will be imported into Syria, the following preconditions are adopted (see Table 10.1.1-8):

[Long-term Forecast]

i) The possibility of steady increase in the domestic production of barley in future is small because barley is produced mainly on wastelands without the benefits of irrigation projects. Hence, the volume of domestic production of barley is assumed to remain at its present production level of 1.2 million tons (the average from 1991-1993) even in the year 2010.

ii) All of barley is used for feed, especially for sheep and cattle. It is assumed that the domestic consumption of barley will increase with an annual growth rate of 3% from the present level along with population growth towards the year 2010. The resulting domestic consumption of barley in 2010 is 1.8 million tons.

From the above "i)" and "ii)", the volume of barley to be imported into Syria in the year 2010 is estimated to be 600,000 tons by subtracting the domestic production (1.2 million tons) from the domestic consumption (1.8 million tons). All of the above 600,000 tons is assumed to be shipped from the Syrian ports.

Table 10.1.1-8 Trend and Future Forecast on Production and Imports of Barley

(Unit: thousand ton)

	1984	1985	1986	1987	1988	1989
Production	304	740	1,116	576	2,836	271
Imports	399	144	-	30	5	-

	1990	1991	1992	1993	2010
Production	846	917	1,091	1,553	1,200
Imports	106	199	82	-	600

Data: STATISTICAL ABSTRACT

[Short-term Forecast]

From the above statement domestic barley production in Syria is estimated to be 1.2 million tons also in 2003, remaining at its present production level.

In the meanwhile, it is considered that barley consumption in Syria will increase along with population growth, annual growth rate of which is estimated to be 3.2% from 1994-2003 as mentioned before. As a result the barley consumption in 2003 is estimated to be 1.5 million tons (consumption in 1994 is estimated to be 1.14 million tons).

From the above the volume of barley to be imported into Syria in 2003 is estimated to be 300,000 tons by subtracting the production (1.2 million tons) from the consumption (1.5 million tons).

8) Maize

[Long-term Forecast]

Over 95% of maize is used for feed for fowl in Syria. A part of chickens and eggs produced in the country have been exported to neighboring countries such as Lebanon, and its volume has shown a steady increase recently.

It is assumed that in Syria the domestic consumption of maize will increase with the annual growth rate of 5% from the present level towards the year 2010 based on the prospects by the authorities concerned (see Table 10.1.1-9). The resulting domestic consumption of maize in 2010 is one million tons. It is also assumed that half of this volume is provided domestically.

From the above, the volume of maize to be imported into Syria in the year 2010 is estimated to be 500,000 tons.

Table 10.1.1-9 Trend and Future Forecast on Production and Imports of Maize

(Unit: thousand ton)

	1984	1985	1986	1987	1988	1989
Production	60	79	74	57	90	109
Imports	249	210	106	145	81	126

	1990	1991	1992	1993	1994	2010
Production	180	225	215	200		500
Imports	250	262	104	348		500

Data: STATISTICAL ABSTRACT

[Short-term Forecast]

According to the view expressed above domestic maize consumption in Syria is assumed to increase annually by 5% towards the future. As a result the maize consumption in 2003 is estimated to be 700,000 tons (consumption in 1994 is estimated to be around 450,000 tons). Half of this volume is assumed to be provided domestically.

Therefore the other half, 350,000 tons, is to be imported into Syria in 2003.

(3) "Other Cargoes" Volume Forecast

In this case, the "Other Cargoes" volume is forecasted by two methods, that is, macro forecast and micro forecast.

1) Macro Forecast

In this case, the "Other Cargoes" volume is forecasted by two methods, that is, time series analysis and correlation analysis with economic indices.

i) Time Series Analysis

The cargo volume is expressed as the following liner equation.

[Exports]

$Y = 41.976 X - 83248.3$ (r=0.890)

where, Y : Export "Other Cargoes" volume (thousand tons)
X : Year

[Imports]

Y = 272.166 X - 539274 (r=0.962)
where, Y : Import "Other Cargoes" volume (thousand tons)
X : Year

ii) Correlation Analysis with Economic Indices

In general, the cargo volume has a close relation with the social and economic indices of the country. Therefore, the method of the correlation analysis between the volume of port cargoes and GDP is adopted.

[Exports]

Y = 0.00708 X - 382.4 (r=0.705)
where, Y : Export "Other Cargoes" volume (thousand tons)
X : GDP at 1985 constant price (million S.P.)

[Imports]

Y = 0.05123 X - 2452.4 (r=0.895)
where, Y : import "Other Cargo" volume (thousand tons)
X : GDP at 1985 constant price (million S.P.)

iii) Results of Forecast

The results of forecast using the above equations are shown in Table 10.1.1-10.

Table 10.1.1-10 Results of Macro Forecast of "Other Cargoes"

(Unit: thousand ton)

Year	2003	2010
Export: Time Series	830	1,120
Correlation	1,000	1,700
Import: Time Series	5,900	7,800
Correlation	7,800	13,000

2) Micro Forecast of Export Cargoes

i) Cotton

According to the interview with Ministry of Agriculture, production volume of cotton is estimated to increase with the expansion of irrigated area. Based on the

data of Ministry of Agriculture and Ministry of Irrigation, the future cargo volume is estimated as follows.

Table 10.1.1-11 Cotton Cargo Volume in the Future

Year	2003	2010
Planted Area(thousand ha)	290	380
Yield(ton/ha)	3.3	3.3
Production Volume(thousand ton)	957	1,254
Percentage of Ginned Cotton(%)	35	35
Production Volume of Ginned Cotton(thousand ton)	335	439
Domestic Consumption(thousandton)	75	88
Export Volume through Ports (thousand ton)	260	345

ii) "Other Cargoes"

As for the forecast of "Other cargoes", the method of correlation analysis between the volume of cargo and GDP is adopted because it is a group of small volume cargoes and it is difficult to estimate the volume of each cargo using the relation between the demand and the supply.

- Correlation equation between port cargo volume and GDP

$Y = 0.0041\ X - 269$ $(r = 0.945)$

where, Y : port cargo volume (thousand ton)
X : GDP (million S.P.)

Table 10.1.1-12 "Other Cargoes" Volume in the Future

Year	2003	2010
Cargo Volume(thousand ton)	530	930

3) Micro Forecast of Import Cargoes

i) Rice

The future handling volume is forecasted using consumption per capita and a Syrian population. Consumption volume per capita is based on interviews with

authorities concerned. Imports of rice in 1993 amounted to 144,000 tons and all of which was through ports. In the future it is assumed that the transportation mode will not change.

Table 10.1.1-13 Rice Volume in the Future

Year	2003	2010
Increase Rate of Consumption per Capita	1.18(1.7%)	1.33(1.7%)
Increase Rate of Population	1.37(3.2%)	1.65(3.0%)
Import Volume(thousand ton)	230	320

ii) Sugar

There are two kinds of imported sugar, that is, refined sugar and raw sugar. On the other hand, refined sugar is made of imported raw sugar and homemade beet in Syria. Hence, considering the consumption and the production of sugar, the future handling volume is estimated.

[consumption]

The consumption volume is estimated as follows using the increase rate of population and consumption per capita. Consumption volume per capita is based on interviews with authorities concerned.

Year	1993	2003	2010
Increase Rate of Consumption per Capita(%)		0.5	0.5
Increase Rate of Population(%)		3.2	3.0
Consumption Volume(thousand ton)	430	620	770

[Production]

Based on the data of Ministry of Agriculture and Ministry of Irrigation, the production volume of beet is estimated as follows.

Year	1995	2003	2010
Planted Area (thousand ha)	45.0	61.6	81.0
Yield(ton/ha)		36	36
Production Volume (thousand ton)		2,400	3,200

The capacity of refining factories is assumed to be raised with the increase of beet production. Being enough to spare for the production, the capacity of refining factories for imported raw sugar is assumed to be the same as at present they have.

Year	1994	2003	2010
Capacity for Beet (thousand ton)	120	180	240
-	-	-	-
Capacity for Raw Sugar (thousand ton)	130	130	130
Total	250	310	370

[Imports]

According to the above results, imports of sugar are estimated as follows.

Table 10.1.1-14 Sugar Volume in the Future

(Unit: thousand ton)

Year	2003	2010
Refined Sugar	310	400
Raw Sugar	150	150
Total	460	550

iii) Foodstuff

[Foodstuff -except for flour-]

There are two kinds of imported foodstuff, that is, flour and other foodstuff. Using the method of correlation analysis between imports of cargo and GDP, each

future handling volume is estimated. The volume of foodstuff is calculated subtracting flour volume from total foodstuff volume.

- Correlation equation between total foodstuff volume and GDP

Y = 0.0129 X - 809.4 (r = 0.969)
where, Y : Total foodstuff volume (thousand ton)
- Ports statistics -
X : GDP (million S.P.)

- Correlation equation between flour volume and GDP

Y = 0.008 X - 534.2 (r = 0.854)
where, Y : Flour volume (thousand ton)
- Trade statistics -
X : GDP (million S.P.)

Table 10.1.1-15 Foodstuff Volume in the Future

Year	2003	2010
Foodsruff(thousand ton)	560	985

iv) Flour

Consumption volume of wheat in Syria and percentage of imported flour in its total volume is mentioned in Section 10.1.1(2)-4). Hence, imports of flour are estimated as follows.

Table 10.1.1-16 Flour Volume in the Future

Year	2003	2010
Flour (thousand ton)	515	625

v) Woods

Using the method of correlation analysis between imports of cargo and GDP, future handling volume is estimated.

- Correlation equation between woods volume and GDP

Y = 0.0058 X - 407 (r = 0.771)

where, Y : Woods volume (thousand ton)
- Ports statistics -
X : GDP (million S.P.)

Table 10.1.1-17 Woods Volume in the Future

Year	2003	2010
Woods (thousand ton)	750	1330

vi) Fiber & Textiles

Using the method of correlation analysis between imports of cargo and GDP, future handling volume is estimated.

- Correlation equation between Fiber & Textiles volume and GDP

Y = 0.0023X - 166 (r = 0.824)
where, Y : Fiber & Textiles volume (thousand ton)
- Trade statistics -
X : GDP (million S.P.)

Table 10.1.1-18 Fiber & Textiles Volume in the Future

Year	2003	2010
Fiber & Textiles (thousand ton)	290	520

vii) Chemicals (except for fertilizer)

There are two kinds of imported chemicals, that is, fertilizer and other chemicals. As for the other chemicals, using the method of correlation analysis between imports of cargo which is calculated subtracting fertilizer volume in trade statistics from total chemicals volume in ports statistics and GDP, the future handling volume is estimated.

- Correlation equation between other chemicals volume and GDP

Y = 0.01038 X - 590 (r = 0.837)
where, Y : Other chemicals volume (thousand ton)
X : GDP (million S.P.)

Table 10.1.1-19 Chemicals Volume in the Future

Year	2003	2010
Chemicals (thousand ton)	1490	2525

viii) Fertilizer

Considering the consumption and the production of fertilizer, the future handling volume is estimated.

[consumption]

According to the authorities concerned, the combined share of fertilizer consumed by wheat and cotton in the total is about 60 % - 70 %. Moreover, the volume of fertilizer given to crops is not enough now. It is necessary that the increase rate of consumption will be more than that of the irrigated area for a while. Based on interviews with authorities, the future consumption of fertilizer is estimated as follows. In this case, potassic fertilizer is not considered because its consumption is assumed to be not so large in the future, the same as at present.

(Unit: %, thousand ton)

Year	1993	2003	2010
Increase Rate of Consumption			
P: Phosphatic Fertilizer		6.0	1.2
N: Nitrogenous Fertilizer		5.0	1.0
Total Consumption Volume	890	1,500	1,620
P: Phosphatic Fertilizer	321	575	625
N: Nitrogenous Fertilizer	569	925	995

[Production]

Based on the interview with the authorities, the future production of fertilizer is estimated as follows.

(Unit: thousand ton)

Year	1995 (capacity)	2003	2010
Total Production Volume	770	1,810	1,810
P: Phosphatic Fertilizer	400	780	780
N: Nitrogenous Fertilizer	370	1,030	1,030

Note: 1. Operation ratio of existing factory is assumed to be 70%.
2. Construction plan of new factory
Phosphatic Fertilizer: Capacity 500,000 ton/year in Palmyra
Nitrogenous nertilizer: Capacity 775,000 ton/year in Raqqa, Indien-Syrian joint undertaking (Investment ratio 50% : 50%), 50% of products will be exported to India.

[Export and Import]

According to the above results, the exports of fertilizer are estimated as follows.

Table 10.1.1-20 Fertilizer Volume in the future

(Unit: thousand ton)

Year	2003	2010
Total export volume	590	540
: through the ports (P:60%, N:100%)	510	480
: by land transportation (P:40%, N:0%)	80	60
Total import volume	280	350
: through the ports (N:60%)	170	210
: by land transportation (N:40%)	110	140

ix) Machine & Equipment

Using the method of correlation analysis between imports of cargo and GDP, the future handling volume is estimated.

- Correlation equation between machine & equipment volume and GDP

$Y = 0.008 X - 563.3$ ($r = 0.798$)
where, Y : Machine & equipment volume (thousand ton)
X : GDP (million S.P.)

Table 10.1.1-21 Machine & Equipment Volume in the Future

(Unit: thousand ton)

Year	2003	2010
Machine & Equipment	1040	1840

x) Other Cargoes

Using the method of correlation analysis between imports of cargo and GDP, the future handling volume is estimated.

- Correlation equation between other cargoes volume and GDP

$Y = 0.00544\ X - 137.35\ (r = 0.769)$

where, Y : Other cargo volume (thousand ton)

X : GDP (million S.P.)

Table 10.1.1-22 Other Cargoes Volume in the Future

(Unit: thousand ton)

Year	2003	2010
Other Cargoes	950	1500

4) Cross Check for the "Other Cargoes" with the Results of Macro Forecast

Table 10.1.1-21 shows a comparison of "Other Cargoes" volume obtained by the macro and micro forecast methods mentioned in Section 10.1.1(3) 1)-3).
The results of the micro forecast except for the estimation of fertilizer almost correspond with those of the macro forecast. Herein, the "Other Cargoes" volumes handled in the Syrian ports for the target years are forecasted as those obtained by the micro forecast method.

Table 10.1.1-23 Forecast of "Other Cargoes" Volume in Target Year

(Unit: thousand ton)

Year	2003	2010
Export: Macro	830 - 1,000	1,120 - 1,700
Micro	1,300	1,755
Import: Macro	5,900 - 7,800	7,800 - 13,000
Micro	6,450	10,395

(4) Transit Cargo Volume Forecast

Historical trend of the transit cargo volume handled in Syrian ports is shown in Table 10.1.1-24.
Considering the historical trend of the transit cargo volume, several countries were selected as objects of projects.

Table 10.1.1-24 Transit Cargo Volume by Main Countries handled in Syrian ports

(Unit: thousand ton)

Countries	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
UAE & Other Gulf Countries								624	442	281
Iraq								343	509	202
Jordan								84	139	140
Lebanon								9	10	6
Saudi Arabia								5	1	2
Kuwait								2	2	1
Iran								0	2	3
Others								0	363	93
Total	(69)	(118)	(225)	(396)	(208)	(362)	(917)	1067	1468	728

Countries	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
UAE & Other Gulf Countries	84	18	23	5	1	1	3	1	1	0
Iraq	0	0	0	0	0	0	0	0	0	0
Jordan	74	50	64	70	57	94	139	127	117	118
Lebanon	1	0	0	0	2	1	0	0	1	1
Saudi Arabia	4	0	1	1	1	0	0	3	2	2
Kuwait	1	0	0	0	0	0	0	0	0	0
Iran	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
Total	164	68	88	76	61	96	142	131	121	121

Data: General Company of Latakia Port, General Company of Tartous Port
Note: 1)Cargo volume in the column of total from 1973 to 1979 excludes the volume of Latakia Port.
Note: 2)Cargo volume of Latakia Port in the column of 1980 is estimated based on the data for eight months.

Distances between major ports and Amman and Baghdad are shown in Table 10.1.1-25. Moreover, a comparative table of transportation costs are shown in Table 10.1.1-26. As for the transit cargo from Europe destined for Iraq, these data show that Syrian Ports are the most conveniently located among ports in the Mediterranean Sea side and the Persian Gulf.

Table 10.1.1-25 Distances between major Ports and Amman and Baghdad

(Unit: km)

Port City	Baghdad(Iraq)	Amman(Jordan)
Syria/Tartous	880	470
Latakia: via Tartous	970	560
: via Deir-ez-Zor	1065	-
Jordan/Aqaba	1280	340
Israel/Haifa	1170	230
Ashdod	1100	160
Iraq/Basra	520	-
Umm Qasr	570	-

Table 10.1.1-26 Comparative Index Number for Total Transportation Cost of Transit Cargo Destined for Baghdad

1) Container(per TEU)

Origin	through Latakia Port(Syria)	through Umm Casr Port(Iraq)
Constanza	100	152
Marseilles	100	146
Rotterdam	100	137
New York	100	129

Note: 1)Ship size: 35,000DWT(2,000TEU)
2)Land transportation: Truck

2) Dry Bulk(per ton)

Origin	through Latakia Port(Syria)	through Umm Casr Port(Iraq)
Constanza	100	153
Marseilles	100	149
Rotterdam	100	135
New Orleans	100	126

Note: 1)Ship size: 40,000DWT
2)Land transportation: Railway

1) Jordan

The transit cargo volume destined for Jordan passing through Syrian ports has increased in the last decade. There is a correlation between the import cargo for domestic consumption in Aqaba Port and transit cargo destined for Jordan through Syrian Ports. The percentage of transit cargo to import cargo of Aqaba Port is

about 3%. The transit cargo volume is estimated using the percentage and the handling volume of Aqaba Port in the future.

Table 10.1.1-27 Transit Cargo Volume through Syrian Ports Destined for Jordan

(Unit: thousand ton, %)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	2003	2010
Aqaba Port (A) Import	2362	2690	2802	2213	2531	2934	4023	3928	3977	7800	9700
Syrian Ports (B) Transit to Jordan	74	50	64	70	57	94	139	127	117	230	290
Percentage of Syrian Ports (B/A)	3.1	1.9	2.3	3.2	2.3	3.2	3.5	3.2	2.9	3.0	3.0

Data: JICA study for Aqaba Port

2) Iraq

i) Exports

[Phosphate Rock]

Phosphate mine in Iraq is located in Akashat 150 km to the southwest of Al Qaim and the capacity of production is 3.4 million tons per year. All products have been consumed within the country in order to produce the fertilizer in the last decade. Maximum production volume in the past was two million tons in 1985 and it is estimated that production volume will continue to fall short of the capacity. Therefore, the export volume through Syrian ports is estimated to be one million tons by subtracting the domestic consumption from the capacity.

Table 10.1.1-28 Production and Export Volume of Phosphate Rock in Iraq

(Unit: thousand ton)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Production	363	1199	1000	2000	1100	1100	1273	1142	600	0	100
Export	0	0	0	0	0	0	0	0	0	0	0

Data: "Commodity Yearbook" UNCTAD

[Sulphur]

Sulphur in Iraq is produced in a mine and oil refinery. Mine and its refinery is located in Mosul and the capacity of production is about 1.3 million tons per year. Moreover, major oil refineries are located in Baiji and Basra but production capacities are unknown. Part of sulphur is used in order to produce the fertilizer and rest is exported. Maximum production volume in the past was 1.3 million tons in 1989 and it is estimated that production volume will not reach the capacity. Therefore, the export volume through Syrian ports is estimated to be about same as in the past export: 500,000 tons.

Table 10.1.1-29 Production and Export Volume of Sulphur in Iraq

(Unit: thousand ton)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Production	340	340	570	570	800	957	1185	1330	1180	300	570
Export	35	40	146	239	500	600	700	530	621	-	-

Data: "Commodity Yearbook" UNCTAD

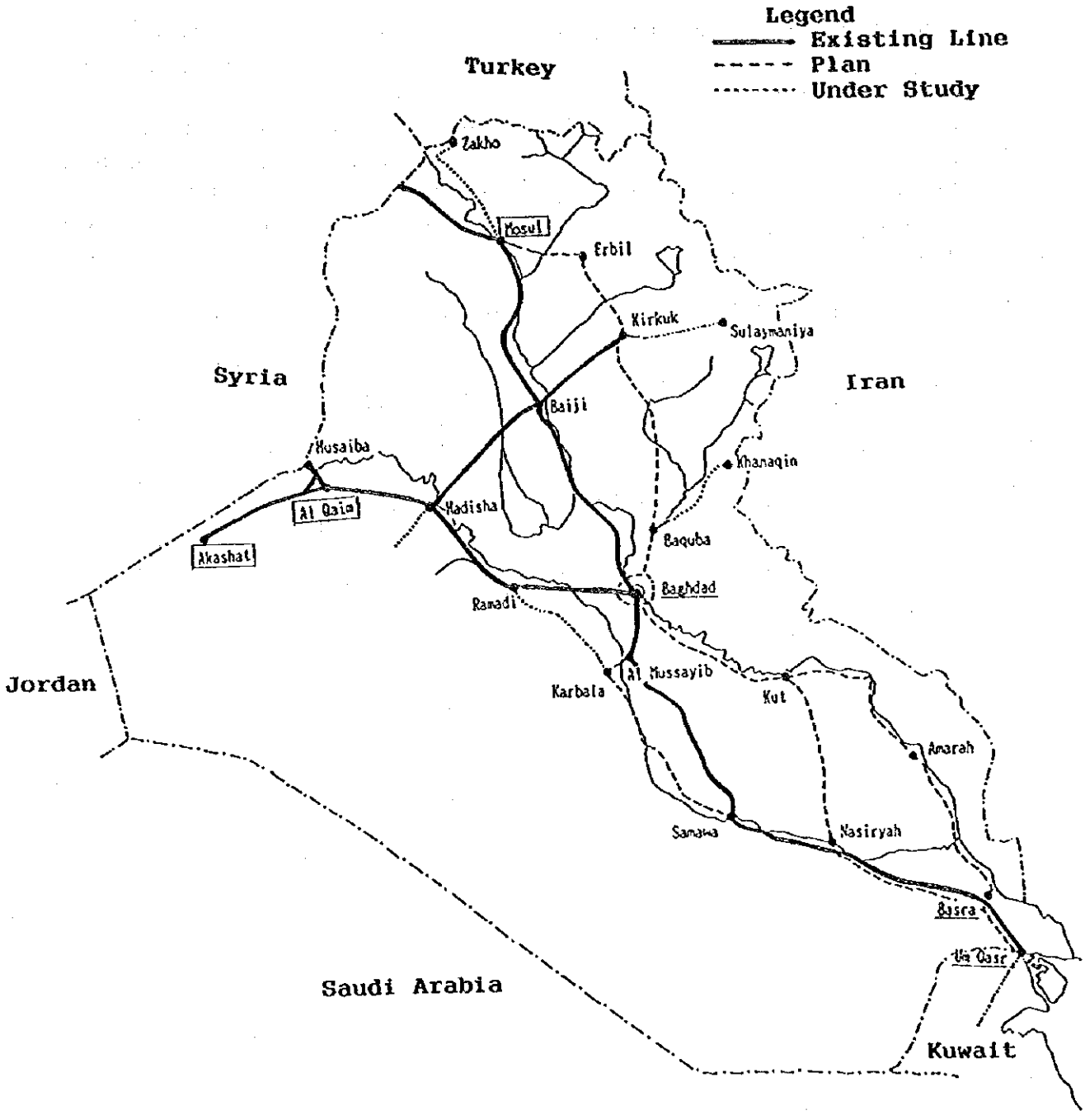

Figure 10.1.1-1 Construction Plan of Railway in Iraq

ii) Imports

Historical trends of cargo volume destined for Iraq through ports are estimated as Table 10.1.1-30.

Table 10.1.1-30 Transit Cargo Volume through Ports Destined for Iraq

(Unit: thousand ton)

Year		Handling Volume in Iraqi ports	Transit Volume through Jordan	Transit Volume through Syria	Transit Volume through Turkey	Transit Volume Total	Cargo Total	Population ('000)
1980	Volume	8,569	889	343	*700	1,932	*10,500	13,238
	Percentage(%)	81.6	8.4	3.3	6.7	18.4	100.0	
1986	Volume	-	4,434	0	2,913	7,347	-	16,110
	Percentage(%)							
1987	Volume	-	5,882	0	2,187	8,069	-	16,335
	Percentage(%)							
1988	Volume	-	6,853	0	2,064	8,917	-	16,882
	Percentage(%)							
1991	Volume	-	1,440	0	200	1,640	-	19,580
	Percentage(%)							
2003	Volume	8,500	-	400	-	2,000	10,500	26,800
	Percentage(%)	81.0		3.8		19.0	100.0	
2010	Volume	11,000	-	2,000	-	5,000	16,000	32,500
	Percentage(%)	68.7		12.5		31.3	100.0	

Data: "Statistics Yearbook" United Nation
"Port Statistics" of Aqaba Port, Mersin Port, Iskenderun Port in reports by JICA and other organizations
Note: Data of * marks are estimated and - marks are unknown.

In the latter half of the 1970s, transit cargoes, especially through Turkish ports, were forecast to decrease due to the enlargement of ports and the progress of industrial development in Basra and Al-Zubair of Iraq.
In the first half of the 1980s, however transit cargoes increased rapidly due to the Iran-Iraq conflict. Transit cargoes through Syrian ports have virtually disappeared since 1981 and most transit cargoes are estimated to be handled in Turkish and Jordan ports with the share of about 50% respectively.
In the latter half of the 1980s, transit cargoes through Turkish ports were forecast to decrease and those through Jordan ports to increase. Transit cargoes have indeed decreased due to the ceasefire in 1988.

Considering the above historical trend of transit cargoes, the demand forecast of transit cargoes through Syrian ports is estimated as follows.

[Short-term Forecast]

As income of Iraq from exports of crude petroleum is assumed to rapidly recover to the level before the Persian Gulf conflict after economic sanctions are removed,

the import volume of Iraq is estimated to recover the level of 1980, about 10.5 million tons. The handling share of Syrian ports in the transit cargoes is estimated to be the level of 1980, about 20% because Syria has not traded with Iraq since 1981. Therefore, the transit cargo volume through Syrian ports is estimated to be about 400,000 tons.

[long-term Forecast]

Considering the past records of average annual increase rate of import value, the import volume of Iraq in 2010 is estimated to be 16 million tons. Considering that Syrian route holds a dominant position in the transportation route and the progress of industrial development in the northern area of Iraq, the share of transit cargo in the total import volume is estimated to reach about 30% and equal to 40% of the import volume originated from Europe in the future. Moreover, the share of Syrian ports in the total transit cargo volume is estimated to be about 40%. Therefore, the transit cargo volume through Syrian ports is estimated to be about 2 million tons.

3) UAE (United Arab Emirates) and Gulf countries

The transit cargo volume destined for UAE has decreased sharply since the conflict between Iran and Iraq occurred and at present the flow has virtually stopped. Since that conflict, UAE has constructed two ports, namely Khor Fakkan and Fujairah, which are located in the Indian Ocean side of the Horms Channel in order to evade being influenced by the conflicts between Persian Gulf countries. As a result, UAE which also has Dubai, has become the largest hub of the Middle East in the international maritime transportation. Hence, the transit cargo volume destined for the Gulf countries is estimated to remain at a low level.

Table 10.1.1-31 Number of Containers handled at Major Ports in Middle East

(Unit: thousand TEU)

Country	Port	Area	1982	1987	1992
UAE			411	954	2506
	Dubai	A	324	596	1482
	Fujairah	A	-	188	527
	Khor Fakkan	A	-	70	359
	Mina Zayed	A	30	30	101
Saudi Arabia			1049	830	1154
	Jeddah	R	688	597	847
	Dammam	A	344	223	303
Israel			305	374	610
	Haifa	M	151	194	386
	Ashdod	M	120	136	182
	Eilat	R	33	33	34
Kuwait			286	200	187
	Shuaiba	A	58	89	158
	Shuwaikh	A	228	111	28
Oman: Mina Qaboos		A	44	139	115
Jordan: Aqaba		R	105	99	100
Syria: Latakia		M	57	54	93
Bahrain: Mina Sulman		A	112	79	90
Lebanon: Beirut		M	27	7	81

Data: Containerization International Year Book
Note: Area - A: Arabian Gulf, R: Red Sea
M: Mediterranean Sea

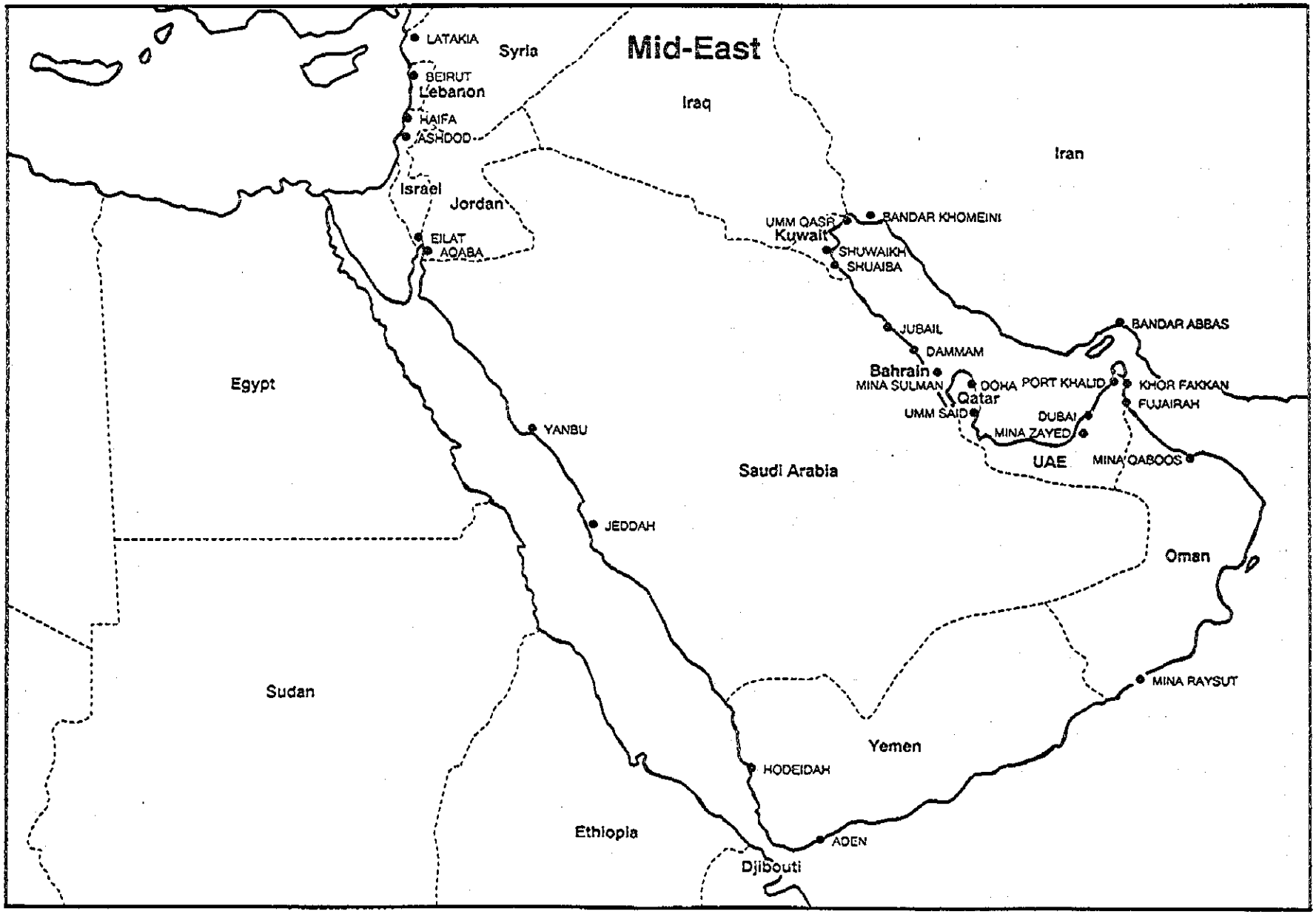

Figure 10.1.1-2 Location Map of Major Ports in Middle East

4) Results of Transit Cargo Forecast

According to the above forecast, the results are shown in Table 10.1.1-32.

Table 10.1.1-32 Results of Forecast on Transit Cargo

[Exports]

(Unit: thousand ton)

Commodity	2003			2010		
	Jordan	Others	Total	Jordan	Others	Total
Phosphate Rock	0	1,000	1,000	0	1,000	1,000
Sulphur	0	500	500	0	500	500
Total	0	1,500	1,500	0	1,500	1,500

[Imports]

(Unit: thousand ton)

Commodity	2003			2010		
	Jordan	Others	Total	Jordan	Others	Total
Grain	0	0	0	0	0	0
Metal Products	85	80	165	110	420	530
Sugar	0	0	0	0	0	0
Foods	55	65	120	65	320	385
Wood	55	50	105	65	260	325
Chemical Materials	0	85	85	0	400	400
Tools & Equipment	15	45	60	20	220	240
Others	20	75	95	30	380	410
Total	230	400	630	290	2,000	2,290

5) Summary of Results of Demand Forecast

The summary of the results of demand forecast mentioned in section 10.1.1 (2)-(4) is shown in Table 10.1.1-33.

Table 10.1.1-33 Summary of Demand Forecast on Handling Cargo Volume through Syrian Ports

[Total] (Unit: thousand ton)

	2003			2010		
	Domestic	Transit	Total	Domestic	Transit	Total
Total	16,180	2,130	18,310	22,665	3,790	26,455
Export	6,700	1,500	8,200	8,055	1,500	9,555
Import	9,480	630	10,110	14,610	2,290	16,900

Note: Cargo volume excludes empty container.

[Export] (Unit: thousand ton)

	2003			2010		
	Domestic	Transit	Total	Domestic	Transit	Total
Phosphate Rock	2,200	1000	3,200	3,100	1000	4,100
Cement Clinker	1,100	0	1,100	1,000	0	1,000
Sulphur	0	500	500	0	500	500
Oil Cokes	100	0	100	200	0	200
Fertilizer	510	0	510	480	0	480
Grain: Wheat	2,000	0	2,000	2,000	0	2,000
Cotton	260	0	260	345	0	345
Others	530	0	530	930	0	930
Export Total	6,700	1,500	8,200	8,055	1,500	9,555
Empty Containers	375	0	375	845	0	845
Export Total	7,075	1,500	8,575	8,900	1,500	10,400

[Import] (Unit: thousand ton)

	2003			2010		
	Domestic	Transit	Total	Domestic	Transit	Total
Grain	650	0	650	1,100	0	1,100
Wheat	0	0	0	0	0	0
Barley	300	0	300	600	0	600
Maize	350	0	350	500	0	500
Metal Products	2,380	165	2,545	3,115	530	3,645
Iron & Steel	700	145	845	1,400	455	1,855
Material for Iron	1,600	0	1,600	1,600	0	1,600
Other Metal Products	80	20	100	115	75	190
Rice	230	0	230	320	0	320
Sugar; Refined	310	0	310	400	0	400
Raw	150	0	150	150	0	150
Flour	510	25	535	615	65	680
Foodstuff	560	95	655	985	320	1,305
Wood & Wooden Products	750	105	855	1,330	325	1,655
Fiber & Textiles	290	0	290	520	0	520
Fertilizer	170	0	170	210	0	210
Chemicals	1,490	85	1,575	2,525	400	2,925
Machine & Equipments	1,040	60	1,100	1,840	240	2,080
Others	950	95	1,045	1,500	410	1,910
Import Total	9,480	630	10,110	14,610	2,290	16,900

10.2 Functions and Roles of the Study Ports

10.2.1 Hinterlands of the Ports of Latakia and Tartous

The major hinterlands of the ports of Latakia and Tartous are the northern and the southern parts of Syria respectively, though there is overlap, especially in the Damascus area which is a major hinterland of Latakia Port as well as of Tartous. Aleppo, Latakia, Idleb, Al-Hassakeh and Al-Raqqa are principal local cities in the northern part. On the other hand, Homs, Hama, Dar'a, Tartous and Palmyra are principal local cities in the southern part.

As to exports, phosphate rock, cotton and other agricultural products such as barley are major export commodities. Phosphate rock produced mainly in and around the Palmyra district is exported through Tartous Port. Fertile farm lands are predominantly located in the districts of Aleppo, Al-Hassakeh and Al-Raqqa in the northern part of Syria, and crops produced there including cotton are exported mainly through Latakia Port.

On the other hand, the ports of Latakia and Tartous are used to discharge imports mainly composed of general cargo. In many cargo items, there is not much difference in the shares of cargo volume between the two ports, therefore equal priority should be given both ports. Exceptionally, a great portion of containers passes through Latakia Port which has the only dedicated container terminal in the Syrian ports and a major portion of steel products passes through Tartous Port including intermediate products such as billets which are delivered to the iron and steel making factory in Hama.

As to transit cargo, the Arabic countries neighboring Syria are the hinterlands of the ports of Latakia and Tartous. Iraq is considered to be the potential hinterland in the future as it was until 1981.

10.2.2 Functional Allotment between the Ports of Latakia and Tartous

As mentioned in Section 10.2.1, the existing two ports, Latakia and Tartous are supporting the economic activities in their respective hinterlands by serving port services. To meet an increasing demand for the ports of Latakia and Tartous along with the anticipated economic growth in their hinterlands for the future, it is necessary to expand their respective cargo-receiving capacities through required investment and the introduction of efficient cargo-handling systems. Equal emphasis must be given to the two ports.

10.2.3 Necessity and Expected Role of the New Port

Tartous Port can expand its cargo-receiving capacity by the renovation of the existing port facilities and the introduction of efficient cargo-handling systems within the existing port areas enclosed by the breakwaters so as to meet the

forecast port demand up to the year 2002. Both the northern and southern coasts of Tartous Port are not usable for the port expansion areas: the northern coast is occupied by the military zone and the southern coast is used for resort beach adjacent to densely-populated urbane areas.

Hence, beyond the year 2002, it is necessary to create a new port to receive cargoes overflowing from the existing Tartous Port. Taking account that Tartous Port is adjacent to densely-populated residential areas, bulk cargoes risking dust emissions harmful to humans which will originate from or be destined for its hinterland need to be diverted to the new port; phosphate rock, cement clinker, iron pellet and scraps, sulfur, fertilizer in bulk, and petroleum coke are identified as those bulk cargoes. As mentioned in Section 13.7, the site located south of Hamidieh and around 30 km south of Tartous Port is selected as the optimum site for the new port.

The new port is expected to resolve the current dust emission problem in Tartous Port and back up the promotion of manufacturing and mining industries in its potential hinterland, namely the southern part of Syria. Considering that the hinterlands of Tartous Port and the new port are overlapped and the respective functions are quite different, Tartous Port and the new port are expected to support the economic activities in the southern part of Syria by complementing one another; Tartous Port is mainly expected to serve general cargo and the new port is expected to serve bulk cargo. Additionally, the new port is expected to receive transit bulk cargo from/to the Arabic countries neighboring Syria. Among them, Iraq is considered to be the great potential hinterland of the new port in the future.

10.3 Demand Forecast (Each Port)

10.3.1 Methodology

Considering functions and roles of the study ports mentioned in chapter 10.2, total cargo volume is allotted to each port based on the following way of thinking.

(1) Bulk Cargoes related to Manufacturing Industry and Mining

All bulk cargoes related to manufacturing industry and mining, namely phosphate rock, cement & clinker and materials for ironworks are handled in New Port.

(2) Grain

Production volume on major agricultural products by hinterland of ports is shown in Table 10.3.1-1.

Table 10.3.1-1 Production Volume by Mohafazat on Major Agricultural Products in 1993

(Unit:1000MT)

Material	Wheat	Maize	Sheep	Cow	Chicken	Cotton	Sugar Beet
Damascus	86	2	647	148	4,889	7	0
Dar'a	92	1	246	31	595	0	0
Sweida	36	0	144	12	526	0	0
Quneitra	9	0	73	12	140	0	0
Homs	166	8	1,436	87	2,167	5	304
Hama	411	13	1,042	64	1,007	66	385
Tartous	67	0	14	53	491	0	0
Hinterland of Tartous Port	867	24	3,602	407	9,816	78	689
Latakia	24	0	5	49	566	0	0
Idleb	170	0	446	24	777	9	65
Aleppo	486	29	1,621	34	2,612	68	235
Hassakeh	1,627	8	1,495	67	2,439	296	13
Rakka	261	83	1,113	6	385	100	140
Deir-ez-Zor	191	56	1,865	120	508	88	95
Hinterland of Latakia Port	2,759	176	6,545	300	7,287	561	548
Total	3,626	200	10,147	707	17,103	639	1,237

Data: Ministry of Agriculture
Note: Production volume of barley by mohafazat is unknown but main production area is northern part of Syria.

1) Wheat in exports

The share of hinterland of Latakia port in the total production volume is about 76 % in 1993. Considering the production volume in the hinterland and the handling capacity of each port, the share of handling volume of Latakia Port is assumed to be 70 % in 2003, 60 % in 2010.

2) Maize and Barley in imports

Maize is mainly feed for fowl, especially chicken, and barley is feed for cattle, especially cow. Hence, considering the share of cow and chicken of hinterland of Tartous Port in the total number, the handling volume of Tartous Port is assumed to be about 60 %.

(3) Other Cargoes

As for other cargoes excluding the above commodities, considering the share of each port in the total cargo, the handling volume by commodities is determined. The historical trend of share of each port is shown in Table 10.3.1-2.

Table 10.3.1-2 Share of each port in handling cargo volume by commodities

(1) Export

(Unit: %)

		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Grain	Latakia	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	66.5
	Tartous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.5
Cotton & Others	Latakia	82.6	64.6	56.3	71.9	49.3	84.3	82.8	78.6	86.4	74.4	87.6
	Tartous	17.4	35.4	43.7	28.1	50.7	15.7	17.2	21.4	13.6	25.6	12.4

(2) Import

(Unit: %)

		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Grain	Latakia	7.5	20.9	11.9	31.2	31.8	15.9	10.6	17.8	45.9	36.9	49.5
	Tartous	92.5	79.1	88.1	68.8	68.2	84.1	89.4	82.2	54.1	63.1	50.5
Rice	Latakia	0.0	12.3	4.0	4.0	66.7	100.0	61.2	80.7	74.0	83.1	73.6
	Tartous	100.0	87.7	96.0	96.0	33.3	0.0	38.8	19.3	26.0	16.9	26.4
Metal Products	Latakia	27.2	19.8	28.0	22.2	22.8	24.5	35.5	39.1	43.7	36.8	29.5
	Tartous	72.8	80.2	72.0	77.8	77.2	75.5	64.5	60.9	56.3	63.2	70.5
Woods	Latakia	38.5	46.9	37.0	20.6	16.2	41.1	37.8	32.8	42.1	42.6	49.5
	Tartous	61.5	53.1	63.0	79.4	83.8	58.9	62.2	67.2	57.9	57.4	50.5
Refined Sugar	Latakia	41.3	50.2	47.9	41.2	28.1	43.4	61.4	75.9	63.8	59.3	100.0
	Tartous	58.7	49.8	52.1	58.8	71.9	56.6	38.6	24.1	36.2	40.7	0.0
Foodstuff	Latakia	46.1	43.2	76.1	68.1	48.7	34.5	61.1	79.7	31.1	33.5	42.9
	Tartous	53.9	56.8	23.9	31.9	51.3	65.5	38.9	20.3	68.9	66.5	57.1
Fiber & Textiles	Latakia	32.6	96.3	100.0	100.0	22.9	37.0	100.0	100.0	100.0	100.0	100.0
	Tartous	67.4	3.7	0.0	0.0	77.1	63.0	0.0	0.0	0.0	0.0	0.0
Fertilizer & Chemicals	Latakia	1.8	57.7	56.3	44.9	52.3	51.6	35.4	34.5	38.2	47.8	58.8
	Tartous	98.2	42.3	43.7	55.1	47.7	48.4	64.6	65.5	61.8	52.2	41.2
Machine & Equipment	Latakia	39.9	50.7	58.1	51.7	66.7	77.6	79.0	74.6	66.9	65.7	57.3
	Tartous	60.1	49.3	41.9	48.3	33.3	22.4	21.0	25.4	33.1	34.3	42.7
Others	Latakia	46.1	68.9	72.4	77.9	53.1	65.3	81.8	81.3	72.5	80.1	76.3
	Tartous	53.9	31.1	27.6	22.1	46.9	34.7	18.2	18.7	27.5	19.9	23.7
Total Cargo	Latakia	28.3	40.9	40.8	42.4	39.7	36.7	41.7	45.6	49.6	49.7	52.4
	Tartous	71.7	59.1	59.2	57.6	60.3	63.3	58.3	54.4	50.4	50.3	47.6

10.3.2 Forecast of Container Cargo Volume

The volume of container cargoes in the target years can be obtained by multiplying the volume of containerizable cargoes by the percentage of containerization. The containerizable cargoes were estimated by their suitability for containerization from the statistics data and the analysis of the manifest. The percentage of containerization is estimated as follows.

(1) Export

The percentage of containerization in both ports is shown in Table 10.3.2-1, Figure 10.3.2-1.

Table 10.3.2-1 Percentage of Containerization in Exports

[LATAKIA PORT] (Unit: thousand ton)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Cotton	197	115	113	72	46	66	97	102	119	156	205
Others	50	22	18	28	23	68	71	78	72	109	105
Sub-total	247	137	131	100	69	134	168	180	191	265	310
Container	115	122	118	95	68	105	133	166	173	231	286
Share of Container (%)	46.6	89.1	90.1	95.0	98.6	78.4	79.2	92.2	90.6	87.2	92.3

[TARTOUS PORT] (Unit: thousand ton)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Cotton & Textiles	4	2	5	6	7	8	4	5	5	11	18
Others	48	73	96	33	64	17	31	44	25	80	26
Sub-total	52	75	101	39	71	25	35	49	30	91	44
Container	5	9	3	6	9	7	8	9	10	19	23
Share of Container (%)	9.6	12.0	3.0	15.4	12.7	28.0	22.9	18.4	33.3	20.9	52.3

[TWO PORTS TOTAL] (Unit: thousand ton)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Cotton & Textiles	201	117	118	78	53	74	101	107	124	167	223
Others	98	95	114	61	87	85	102	122	97	189	131
Sub-total	299	212	232	139	140	159	203	229	221	356	354
Container	120	131	121	101	77	112	141	175	183	250	309
Share of Container (%)	40.1	61.8	52.2	72.7	55.0	70.4	69.5	76.4	82.8	70.2	87.3

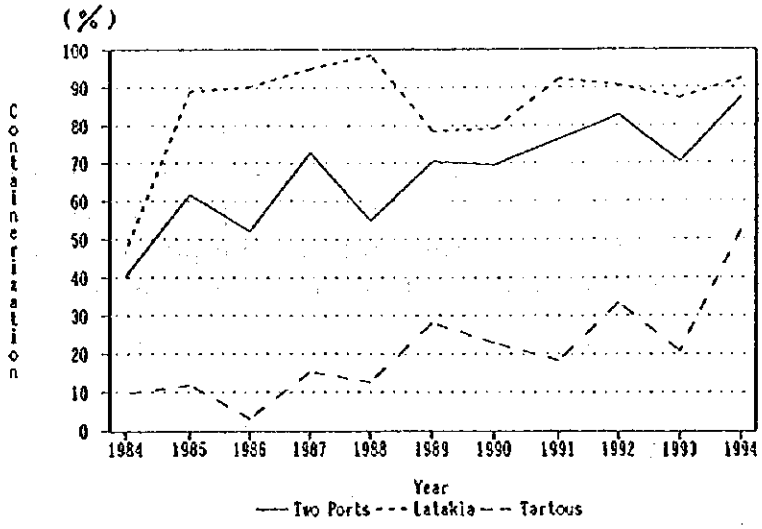

Figure 10.3.2-1 Percentage of Containerization of Export Cargoes

1) Latakia Port

The percentage of containerization has not risen from the rate of 90 % since 1991. Considering the regular line of container ship and transit time, the transportation by conventional cargo ship in the North Africa route and others is assumed to be maintained. Hence, the percentage of containerization in 2003 is estimated to be 92 % and in 2010 95 %, which is the about same as at present.

2) Tartous Port

The percentage of containerization in the target years is estimated by using the following logistic curve. As the transportation by conventional cargo ship in Tartous Port is assumed follow the same pattern as that of Latakia Port, the percentage of containerization of Tartous Port in 2010 will not be over that of Latakia Port.

- Logistic Curve of Percentage of Containerization in export cargo

$$P(\%) = 1 / \{ 1 + C^{(t - to)} \}$$

where, t: Christian year

P(%): Percentage of containerization in t year

C = 0.8054: Parameter prescribed for change rate of curve

To = 1996: Christian year in which percentage of containerization reached 50 %

Table 10.3.2-2 Percentage of Containerization in the Target Year

(Unit: %)

Port	2003	2010
Latakia Port	92	95
Tartous Port	80	95

(2) Import

The percentage of containerization is forecasted using the cargo data through all ports based on both the trade statistics and the port statistics shown in Table 10.3.2-3. The percentage of containerization of each port in 1993 is estimated to be about 78 % in Latakia Port and about 18 % in Tartous Port.

Table 10.3.2-2 Percentage of Containerization in Imports - All Ports -

(Unit: thousand ton)

Commodity	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total	4552	3989	2881	3132	2994	3418	3986	4513	4131	5085	
Barley											
Maize	1452	762	745	960	883	1237	1278	1491	662	734	582
Rice	2	105	101	98	2	25	49	83	131	136	121
Flour	178	23	113	384	188	200	491	302	427	404	
Raw Sugar	96	97	26	73	0	62	111	147	88	83	
Wood & Wooden Products	270	193	185	68	74	129	111	122	209	270	279
Iron & Steel											
Materials for Iron	705	678	432	271	280	263	313	518	491	974	
Fertilizer	23	102	43	178	302	142	227	408	433	348	
Feed for Animal	94	148	49	29	70	66	98	126	163	183	
Non-Containerizable Cargo Total	2820	2108	1694	2061	1799	2124	2678	3197	2604	3132	
Refined & Other Sugar	184	241	280	238	288	267	241	344	257	300	
Foodstuff	606	561	117	0	0	113	365	112	142	217	
Fiber & Textiles	129	54	40	36	158	146	46	71	70	117	111
Other Metal Products	40	43	33	13	40	43	28	32	38	41	
Vehicles & Tractor	35	28	40	18	18	16	22	38	71	83	
Machine & Equipments	272	308	208	189	143	140	165	155	192	323	
Other Chemical Products	97	270	201	306	375	337	257	284	450	631	
Paper	54	99	45	43	48	56	63	91	99	113	
Others	315	277	223	228	125	176	121	189	208	128	
Containerazable Cargo	1732	1881	1187	1071	1195	1294	1308	1316	1527	1953	
Container Cargo	413	658	464	395	331	422	546	683	805	1034	
Percentage of Container	23.8	35.0	39.1	36.9	27.7	32.6	41.7	51.9	52.7	52.9	

1) Latakia Port

The percentage of containerization in the target years is estimated by using the following logistic curve. As a result, that in 2003 is estimated to be about 92 % and in 2010 about 96 %. But the actual percentage of containerization of Latakia Port has not risen rapidly since 1992 because it is assumed that containerizable cargoes include non-containerizable cargoes, namely feed for animal, banana and others. Hence, considering the increase rate in recent years, the percentage of containerization in 2003 and 2010 is estimated to be 85 % and 88 % respectively.

- Logistic Curve of Percentage of Containerization in import cargo

$$P(\%) = 1 / \{ 1 + C^{(t - to)} \}$$

where, t: Christian year

P(%): Percentage of containerization in t year

C = 0.8856: Parameter prescribed for change rate of curve

To = 1992: Christian year in which percentage of containerization reached 50 %

2) Tartous port

As the percentage of containerization of Tartous port is low, it is difficult to forecast exactly the progress of containerization in the future. Hence, in this case the container cargo volume is estimated using the correlation between the container cargo volume and GDP, and it is expressed by the following equation. As a result, the container cargo volume of Tartous Port in 2003 and 2010 is estimated to be 520,000 tons and 1,400,000 tons respectively.

- Correlation equation between container cargo volume and GDP

$Y = 0.0066 X - 582.1$ ($r = 0.996$)
where, Y: container cargo volume (thousand ton)
X: GDP (million S.P.)

10.3.3 Results of Demand Forecast in Each Port

Considering the results mentioned in section 10.3.1 and 10.3.2, the handling cargo volume of each port in the target year is shown in Table 10.3.3-1, 10.3.3-2 and 10.3.3-3 each.

(1) Latakia Port

Table 10.3.3-1 Results of Demand Forecast in Latakia Port

[Total] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Latakia Port	6,340	255	6,595	3,250	3,345	9,590	1,220	10,810	6,290	4,520
Export	2,070	0	2,070	615	1,455	2,285	0	2,285	1,030	1,255
Import	4,270	255	4,525	2,635	1,890	7,305	1,220	8,525	5,260	3,265

Note: Cargo volume excludes empty container.

[Export] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Phosphate	0	0	0	0	0	0	0	0	0	0
Cement			0		0					0
Clinker	0	0	0	0	0	0	0	0	0	0
Grain: Wheat	1,400	0	1,400	0	1,400	1,200	0	1,200	0	1,200
Cotton	239	0	239	220	19	317	0	317	300	17
Others	431	0	431	395	36	768	0	768	730	38
Export Total	2,070	0	2,070	615	1,455	2,285	0	2,285	1,030	1,255
Empty Containers	305	0	305	305	0	640	0	640	640	0
Export Total	2,375	0	2,375	920	1,455	2,925	0	2,925	1,670	1,255

[Import] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Grain	260	0	260	0	260	440	0	440	0	440
Wheat	0	0	0	0	0	0	0	0	0	0
Barley	120	0	120	0	120	240	0	240	0	240
Maize	140	0	140	0	140	200	0	200	0	200
Metal Products	280	35	315	37	278	610	180	790	74	716
Iron & Steel	245	30	275	0	275	560	155	715	0	715
Material for Iron	0	0	0	0	0	0	0	0	0	0
Other Metal Products	35	5	40	37	3	50	25	75	74	1
Rice	170	0	170	0	170	240	0	240	0	240
Sugar; Refined	170	0	170	128	42	220	0	220	171	49
Raw	0	0	0	0	0	0	0	0	0	0
Flour	305	5	310	0	310	370	0	370	0	370
Foodstuff	225	20	245	230	15	405	120	525	505	20
Wood & Wooden Products	400	10	410	0	410	715	60	775	0	775
Fiber & Textiles	290	0	290	270	20	520	0	520	510	10
Fertilizer	0	0	0	0	0	0	0	0	0	0
Chemicals	820	75	895	805	90	1,440	360	1,800	1,615	185
Machine & Equipments	630	40	670	535	135	1,145	185	1,330	1,115	215
Others	720	70	790	630	160	1,200	315	1,515	1,270	245
Import Total	4,270	255	4,525	2,635	1,890	7,305	1,220	8,525	5,260	3,265

(2) Tartous Port

Table 10.3.3-2 Results of Demand Forecast in Tartous Port

[Total] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Tartous Port	4,160	375	4,535	660	3,875	6,485	1,070	7,555	1,710	5,845
Export	720	0	720	95	625	990	0	990	180	810
Import	3,440	375	3,815	565	3,250	5,495	1,070	6,565	1,530	5,035

Note: Cargo volume excludes empty container.

[Export] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Phosphate	0	0	0	0	0	0	0	0	0	0
Cement Clinker	0	0	0	0	0	0	0	0	0	0
Grain: Wheat	600	0	600	0	600	800	0	800	0	800
Cotton	21	0	21	17	4	28	0	28	27	1
Others	99	0	99	78	21	162	0	162	153	9
Export Total	720	0	720	95	625	990	0	990	180	810
Empty Containers	70	0	70	70	0	205	0	205	205	0
Export Total	790	0	790	165	625	1,195	0	1,195	385	810

[Import] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Grain	390	0	390	0	390	660	0	660	0	660
Wheat	0	0	0	0	0	0	0	0	0	0
Barley	180	0	180	0	180	360	0	360	0	360
Maize	210	0	210	0	210	300	0	300	0	300
Metal Products	500	130	630	25	605	905	350	1,255	80	1,175
Iron & Steel	455	115	570	0	570	840	300	1,140	0	1,140
Material for Iron	0	0	0	0	0	0	0	0	0	0
Other Metal Products	45	15	60	25	35	65	50	115	80	35
Rice	60	0	60	0	60	80	0	80	0	80
Sugar; Refined	140	0	140	20	120	180	0	180	55	125
Raw	150	0	150	0	150	150	0	150	0	150
Flour	205	20	225	0	225	245	65	310	0	310
Foodstuff	335	75	410	175	235	580	200	780	450	330
Wood & Wooden Products	350	95	445	0	445	615	265	880	0	880
Fiber & Textiles	0	0	0	0	0	0	0	0	0	0
Fertilizer	0	0	0	0	0	0	0	0	0	0
Chemicals	670	10	680	195	485	1,085	40	1,125	515	610
Machine & Equipments	410	20	430	80	350	695	55	750	250	500
Others	230	25	255	70	185	300	95	395	180	215
Import Total	3,440	375	3,815	565	3,250	5,495	1,070	6,565	1,530	5,035

(3) New Port

Table 10.3.3-3 Results of Demand Forecast in New Port

[Total] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
New Port	5,680	1,500	7,180	0	7,180	6,590	1,500	8,090	0	8,090
Export	3,910	1,500	5,410	0	5,410	4,780	1,500	6,280	0	6,280
Import	1,770	0	1,770	0	1,770	1,810	0	1,810	0	1,810

Note: Cargo volume excludes empty container.

[Export] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Phosphate Rock	2,200	1000	3,200	0	3,200	3,100	1000	4,100	0	4,100
Cement Clinker	1,100	0	1,100	0	1,100	1,000	0	1,000	0	1,000
Sulphur	0	500	500	0	500	0	500	500	0	500
Oil Cokes	100	0	100	0	100	200	0	200	0	200
Fertilizer	510	0	510	0	510	480	0	480	0	480
Grain: Wheat	0	0	0	0	0	0	0	0	0	0
Cotton	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
Export Total	3,910	1,500	5,410	0	5,410	4,780	1,500	6,280	0	6,280
Empty Containers	0	0	0	0	0	0	0	0	0	0
Export Total	3,910	1,500	5,410	0	5,410	4,780	1,500	6,280	0	6,280

[Import] (Unit: thousand ton)

	2003					2010				
	Domestic	Transit	Total	Con	Other	Domestic	Transit	Total	Con	Other
Grain	0	0	0	0	0	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	0	0
Barley	0	0	0	0	0	0	0	0	0	0
Maize	0	0	0	0	0	0	0	0	0	0
Metal Products	1,600	0	1,600	0	1,600	1,600	0	1,600	0	1,600
Iron & Steel	0	0	0	0	0	0	0	0	0	0
Material for Iron	1,600	0	1,600	0	1,600	1,600	0	1,600	0	1,600
Other Metal Products	0	0	0	0	0	0	0	0	0	0
Rice	0	0	0	0	0	0	0	0	0	0
Sugar: Refined	0	0	0	0	0	0	0	0	0	0
Raw	0	0	0	0	0	0	0	0	0	0
Flour	0	0	0	0	0	0	0	0	0	0
Foodstuff	0	0	0	0	0	0	0	0	0	0
Wood & Wooden Products	0	0	0	0	0	0	0	0	0	0
Fiber & Textiles	0	0	0	0	0	0	0	0	0	0
Fertilizer	170	0	170	0	170	210	0	210	0	210
Chemicals	0	0	0	0	0	0	0	0	0	0
Machine & Equipments	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
Import Total	1,770	0	1,770	0	1,770	1,810	0	1,810	0	1,810

Chapter 11 Master Plan of Latakia Port

11.1 The Basic Concept of the Port Development

The purpose of the Master Plan (target year 2010) is to serve as a target and guideline for phase plans including the Short-Term Plan (target year 2003). The Master Plan shall be an integrated plan covering the layout plans for new facilities, modernization plans for existing facilities and effective management and operation systems. In making the Master Plan for Latakia Port, the following various aspects concerning the port development are recognized:

(1) Non-existence of a full-scale container terminal

Although, in 1994, the number of containers which passed through the port amounted to around 134,000 TEUs with a high increase rate of 13.9% from the preceding year, quay-side and rail-mounted container gantry cranes have not yet been installed at the container terminal in the new port. Containers are mainly discharged/loaded from/onto container vessels by using ship cranes/derricks with a container-handling productivity much lower compared with that of a quay-side crane, resulting in longer berthing times of costly container vessels. Average gross container-handling productivity in 1994 is estimated to be 10.0 boxes/hr/vessel.

Within the container marshaling yard behind the quays Nos 13-15, straddle carriers are used and they can not receive/hand container boxes directly from/to ship cranes/derricks due to the insufficient reach lengths, and hence, forklift trucks are used to hand over the boxes between ship cranes and straddle carriers. Container boxes are also lifted directly onto/from tractor-trailer units by ship cranes, then/before being hauled to/from stacking places within the marshaling yard. Those complicated or inefficient container-handling yard operations are also contributing to longer berthing times of container vessels.

Presently, in the port, there are only two toplifters which are suitable to lift on/off container boxes. The advantage of toplifters is that there is little fear of causing damage compared with a forklift truck, especially when handling a 40ft container box most of which have no forklift pockets. With the exception of the toplifters, forklift trucks with the capacity of 10-32 tons are mainly used at the terminal, sometimes resulting in damage to container boxes.

(2) Non-existence of grain unloaders connected with silos and shortage of existing silo capacity

In 1994, grains (excluding rice) of 328,000 tons and 113,000 tons were

imported and exported through Latakia Port, and most of them were bulk cargoes. Notwithstanding that grains in bulk are both imported and exported through the port at present, the port has only shiploaders (two units of nominal capacity of 150 tons/hr each) connected with silos of 35,000 ton storage capacity. Hence, imported grains in bulk are directly unloaded onto trucks through portable pneumatic unloaders of 100 tons/hr capacity each, hauled to the silos and then stored, resulting in long berthing times of grain carriers and costly dock-side operations. An average gross maize-handling productivity in 1994 is estimated to be 62.3 tons/hr/vessel.

Even in case of exports, loading capacity of the existing shiploaders is very small and obsolete, and moreover a water depth of 8.5 m (MSL) along the existing grain dolphin is very shallow, which can only barely receive a grain carrier of 10,000 DWT in full loaded condition. These facilities were designed and constructed in 1956 when vessels were smaller.

The capacity of silos at present is 35,000 tons. Since approximately one third of the storage space must be reserved for emergency grain supply, only 23,000 tons is available for transit storage. Therefore the capacity of grain silos is insufficient even in the present demand level.

(3) Obsolete and insufficient cargo-handling machines

Various kinds of cargoes differently packed such as bags of sugar, rice, fertilizer and feed, bundles/coils/sheets of steel products, bundled wood, wooden cases/palletized cartons of general cargo are discharged/loaded from/onto general cargo vessels mainly at the quays Nos 1-4 and the passenger quay of the old port zone, and the quays Nos 7-12 of the new port zone.

In stevedoring and longshore operations at the quays Nos 7-12 of the new port and the passenger quay of the old port, rail-mounted quay-side cranes of 22 units of 6.3 ton capacity each and one unit of 16 ton capacity which were built in 1980-1990 are well used and maintained. In contrast, the ten quay-side cranes of 3 ton capacity each installed on the quays Nos 1-4 are already obsolete, since they were built in 1957. Two of them are out of order. The Latakia Port Company intends to renew them.

In yard operations including longshore operations, forklift trucks or the combination of trucks and forklifts/mobile cranes are used to haul port cargo between quay-side and open storage yards/transit sheds. In the above operations, 15 middle-sized forklift trucks of 10 ton capacity each are used to lift comparatively heavy cargo such as bundles, coils and sheets of steel products. Considering the forklift trucks of the above size are also used to lift empty container boxes, the number of the middle-sized forklift trucks is

insufficient. Moreover, various attachments of forklift trucks and slings suitable to lift cargoes safely without damages also are short.

(4) Future demand for use of the port

According to the demand forecast mentioned in Chapter 10, the volume of cargoes to be handled at Latakia Port in 2010 is estimated as 10.8 million tons 3.8 times as much as the volume in 1994. The volume of imports is estimated as 8.5 million tons, accounting for 79.6% of the total. In imports, the volume of container cargo takes the largest share (61.7% of the total), followed by general cargo in break-bulk (15.6%), wood (9.1%), iron and steel products (8.4%) and grains in bulk (5.2%). On the other hand, the volume of exports is estimated as 2.3 million tons. In exports, the volume of grains in bulk takes the largest share (52.5%), followed by container cargo (45.1%) and general cargo in break-bulk (2.4%).

(5) Effective utilization of the existing facilities

In the first step of making the Master Plan, the effective utilization of the existing facilities to meet the forecast demand needs to be examined so as to save investment cost for a new project as much as possible along with improvement of management and operation systems of the port including institutional matters aiming at efficient cargo-handling.

(6) Economic transportation

In making the port investment plan, it is necessary to put emphasis on economic transportation, considering both the investment cost for port facilities and ship transportation cost from the standpoint of the national economy.

(7) Safe operations

In making the port plan, safe operations need to be considered both on waters and land. Basins need to be protected from violent waves by breakwaters, especially in the winter season, though construction cost for the breakwaters is costly. On the other hand, in order to ensure safe operations on land, it is necessary to prepare sufficient yard areas with required facilities adequately laid out, since congestion risks accidents in port operations.

(8) Environmental impact on areas around the port induced by the port development

In selecting sites for the port development, environmental impact on the area both during the periods under construction and after the start of operations must be considered.

Based on the above, the following concept of the development of Latakia Port is proposed for the purpose of achieving safe, efficient and reliable operations for the customers:

(1) Establishment of a full-scale new container terminal

The number of containers to be handled at the port in 2010 is estimated as 712,000 TEUs. To receive the forecast container traffic, a full-scale new container terminal will be required by the year 2010 together with an increase in container-handling capacity of the existing container terminal.

(2) Modernization of the existing container terminal

To receive the forecast number of container traffic with the least capital investment for the above new terminal, it is necessary to increase the present container-handling capacity of the existing container terminal as much as possible by modernization through the preparation of required container-handling machines including dock-side container gantry cranes and the relocation of the yard facilities including ground slots, terminal gate, and a terminal control office.

(3) Introduction of a closed terminal system in the container terminals

It is advisable to introduce a closed container terminal system controlled by a terminal operator that takes the responsibility of receipt, storage and delivery of containers at the terminal by conducting yard planning and inventory control of containers which is indispensable for a modernized container terminal.

(4) Modernization of the current grain-handling operation

To resolve the current inefficient and dusty operations of grain-unloading without direct connection with silos and to meet increasing demand for grain-handling for the future, it is proposed to install unloaders connected with silos through belt conveyors.

(5) Preparation of additional general cargo berths

Despite the anticipated progress of containerization, it is forecast that considerable volume of general cargo in break-bulk still needs to be received in the stage of the Master Plan. To make the most of the existing conventional berths, a half of berths with spacious open yards behind in the new port zone needs to be allocated for long and/or heavy cargoes mainly comprising iron/steel and wood products on priority basis. Hence, existing conventional berths usable to general cargo in break-bulk in the stage are limited to berths in the old port zone and the remaining half of the new port zone. Thus, to

meet the forecast demand in the stage, it is necessary to prepare additional general cargo berths as well as the preparation of a new container terminal.

(6) Preparation of required cargo-handling machines

It is proposed to prepare required cargo-handling machines giving emphasis on the improvement of handling long and heavy products such as iron and steel.

11.2 Usage Plan for the Existing Port Facilities

Vessels calling at Latakia Port at present are divided into four types; general cargo vessel, Ro/Ro vessel, cereal carrier and full-cellular container vessel. These four types of vessels are further divided into the following ten categories.

- General cargo vessel laden with various kinds of cargoes
- General cargo vessel laden with one kind of commodity
  - Foodstuffs or agricultural products
  - Steel products
  - Wood
  - Car, machine and equipment
  - Chemical products
- Ro/Ro vessel
- Grain carrier(Import)
- Grain carrier(Export)
- Container vessel

The volume of cargoes estimated in the demand forecast(see Chapter 10) is distributed to vessels categorized above. The usage plan for the existing port facilities by vessel type is proposed as follows.

(1) General Cargo Vessel(Various Kinds of Cargoes)

The total volume of cargoes to be transported by the vessel of this type through Latakia Port is estimated as 1.16 million tons in 2010, an increase of nearly 800,000 tons from 1994. In making the plan for berth allocation for the vessels, the following premises are adopted considering the actual operations. Average cargo handling volume and hourly cargo handling productivity are the same as that at present.

- Average dwelling time of cargoes : 7 days
- Total volume of cargoes: unloaded: 1.04 million tons
  loaded: 117,000 tons
- Average cargo handling volume: 1,390 tons per vessel
- Number of calling vessels: 832 vessels per year

- Cargo handling productivity: 38 tons per hour
- Storage: Shed
- Land transport: 100% by trucks

Since general cargo volume will become more than double the present cargo volume, three more berths are necessary to accommodate future cargo. The following berths are allocated:

- Quay No.1, No.2, No.3, No.4 (4 berths)
- Passenger Quay (2 berths)
- Quay No.7, No.8, No.9, No.10, No.11, No.12, No.12A (4 berths)
- New berths (3 berths)

(2) General Cargo Vessel(Foodstuffs or agricultural products)

The following premises are adopted considering the record of actual operations.

- Total volume of cargoes unloaded from the vessels: 452,000 tons
- Average cargo handling volume: 1,950 tons per vessel
- Number of calling vessels: 232 vessels
- Cargo handling productivity: 35.4 tons per hour
- Average dwelling time: 7 days
- Storage: Shed
- Land transport by trucks

Foodstuffs and agricultural products shows similar cargo handling conditions to general cargo. The following berths are planned to serve the vessels.

- Quay No.1, No.2, No.3, No.4 (4 berths)
- Passenger Quay (2 berths)
- Quay No.7, No.8, No.9, (4 berths)
- New berths (3 berths)

(3) General Cargo Vessels(Steel products)

The following premises are adopted considering the record of actual operations.

- Total volume of cargoes unloaded from the vessels: 617,000 tons
- Average cargo handling volume: 1,880 tons per vessel
- Number of calling vessels: 329 vessels
- Cargo handling productivity: 80 tons per hour
- Average dwelling time: 9 days
- Storage: Open yard
- Land transport by trucks

Since wide area is already developed for heavy cargoes, present berths for heavy

cargo in the New Port area, Quay No.10, Quay No.11, Quay No.12 and a berth of the three new berths are allocated preferentially for steel vessels.
Average dwelling time is same as the present condition.

(4) General Cargo Vessels(Wood)

The following premises are adopted considering the record of actual operations.

- Total volume of cargoes unloaded from the vessels: 500,000 tons
- Average cargo handling volume: 1,370 tons per vessel
- Number of calling vessels: 365 vessels
- Cargo handling productivity: 22.2 tons per hour
- Average dwelling time: 9 days
- Storage: Open yard
- Land transport by trucks

Since the volume of the wood will be doubled in 2010, it requires a wide storage area. The following berths are allocated:

- Quay No.7, No.8, No.9, No.10, No.11, No.12(3 berths)
- New berth (1 berth)

(5) General Cargo Vessels(Car, machine,equipment)

The following premises are adopted considering the record of actual operations.

- Total volume of cargoes unloaded from the vessels: 281,000 tons
- Average cargo handling volume: 340 tons per vessel
- Number of calling vessels: 827 vessels
- Cargo handling productivity: 15.4 tons per hour
- Average dwelling time: 7 days
- Storage: Open yard
- Land transport by trucks

Since car, machine and equipment are handled through the entire area, similar berthing condition should be kept in the year 2010. The following berths are allocated:

- Quay No.1, No.2, Quay No.3, Quay No.4 (4 berths)
- Passenger Quay (2 berths)
- Quay No. 7, Quay No.8, Quay No.9, No.10 (4 berths)
- New berth (1 berth)

(6) General Cargo Vessels (Chemical products)

The following premises are adopted considering the record of actual operations.

- Total volume of cargoes unloaded from the vessels: 250,000 tons
- Average cargo handling volume: 2,550 tons per vessel
- Number of calling vessels: 99 vessels
- Cargo handling productivity: 36.8 tons per hour
- Average dwelling time: 7 days
- Storage: Shed
- Land transportation by trucks

Since the chemical products will be doubled comparing with that in 1994, a wide area is necessary for storage. The following berths are planned to serve the vessels;

- Quay No.1, No.2, No.3, No.4
- Passenger Quay (2 berths)
- Quay No.7, Quay No.8, Quay No.9 (3 berths)

(7) Ro/Ro Vessels

Ro/Ro vessels are berthing mainly at one berth in the Old Port, and one berth in the New Port (Passenger Quay, Quay No.13). Since wide open yard is already developed behind these berths, these berths are allocated also in the year 2010. The following premises are adopted considering the record of actual operations.

- Total volume of cargoes: unloaded: 211,000 tons
  loaded: 41,000 tons
- Average cargo handling volume: 990 tons per vessel
- Number of calling vessels: 255 vessels
- Cargo handling productivity: 36.4 tons per hour
- Average dwelling time: 5 days
- Storage: Open yard
- Land transportation by trucks

(8) Grain Carrier(Import)

The volume of grain to be unloaded at the port in the year 2010 is estimated as 440,000 tons, a 50 % increase over that in 1994. Although present cargo handling machines are only for loading, a new unloader is necessary to handle the forecast cargo.

The following alternatives are considered:

Case 1(Concentration):
- Number of Berths: 1(New Port Area)
- Cargo Handling Efficiency: 0.7
- Cargo Handling Equipment Capacity: 800 ton/hr/unit X 2units
- Handling Productivity:
  800ton/hr/unit X 2units X 0.7 X 0.36 = 403 ton/hr

Case 2(Concentration):

- Number of Berths: 1(New Port Area)
- Cargo Handling Efficiency: 0.7
- Cargo Handling Equipment Capacity: 400 ton/hr/unit X 2units
- Handling Productivity:
  400ton/hr/unit X 2unit X 0.7 X 0.5 = 280 ton/hr

Case 3(Split):

- Number of Berths: 2(Old Port and New Port Area)
- Cargo Handling Efficiency: 0.7
- Cargo Handling Equipment Capacity:
  400 ton/hr/unit X 2units(New Port)
  200 ton/hr/unit X 2units(Old Port)
- Handling Productivity:
  400ton/hr/unit X 2units X 0.7 X 0.5 = 280 ton/hr
  200 X 2 X 0.7 X 0.69= 193

Other premises are adopted commonly to all the alternatives considering the record of actual operations.

- Average cargo handling volume: 27,000 tons per vessel
- Number of calling vessels: 17 vessels
- Average dwelling time in silo: 10 days
- Land transport by trucks

(9) Grain Carrier(Export)

Grain export is expected to amount to 1.2 million tons in the year 2010. Though present silo quay is constructed for export grain, the cargo handling productivity is very low. In order to handle future cargo, existing handling equipment should be improved. Alternatives are considered in the same manner as the case of imported grain.

Case 1(Concentration):

- Number of Berths: 1(New Port Area)
- Cargo Handling Efficiency: 0.8
- Cargo Handling Equipment Capacity: 800 ton/hr/unit X 2units
- Handling Productivity:
  800ton/hr/unit X 2units X 0.8 X 0.33 = 422 ton/hr

Case 2(Concentration):

Case 1 and Case 2 are the same for exported grain.

Case 3(Split):

- Number of Berths: 2(Old Port and New Port Area)

- Cargo Handling Efficiency: 0.8
- Cargo Handling Equipment Capacity:
  400 ton/hr/unit X 2units(New Port)
  400 ton/hr/unit X 2units(Old Port)
- Handling Productivity:
  400ton/hr/unit X 2unit X 0.8 X 0.5 = 320 ton/hr(New Port)
  400 X 2 X 0.8 X 0.5 = 320 ton/hr(Old Port)

The following premises are adopted in common considering the vessel size and other conditions.

- Average cargo handling volume: 19,500 tons per vessel
- Number of calling vessels: 62
- Average dwelling time in silo: 10 days
- Land transportation by railway

(10) Container Vessel

The number of containers to be handled at the port is estimated as 791,000 TEUs in 2010, 8.6 times greater than that in 1992. In order to accommodate these containers, a new full-scale container terminal with an areas of at least 20 ha and berths of 700 meters long is needed. Since the existing container terminal is located at the northern end of the port, the new terminal is planned to be allocated adjacent to the existing terminal. Ten percent of the containers, (those are loaded by general cargo vessels), are assumed to be handled behind the Old Port.

In the next step, the proposed usage plan for the existing port facilities is determined by using a simulation method, excluding containers that are planned to be handled at the container terminals. In this study, reference to the actual statistical distribution forms for ship arrivals and mooring periods at the Latakia Port is made. Operational conditions at the port are as follows.

- Annual working days: 365 days
- Daily working hours: 24 hours

A result of the simulation is summarized as follows.

- Average ship waiting time:

1 General cargo vessels(Various kinds of cargoes): 5.5 hrs
2 General cargo vessels(Foodstuffs/agricultural products): 7.9 hrs
3 General cargo vessels(Steel products): 7.2 hrs
4 General cargo vessels(Wood): 8.9 hrs
5 General cargo vessels(Car, machine and equipment): 11.1 hrs
6 General cargo vessels(Chemical products): 16.4 hrs
7 Ro/Ro vessels: 18.8 hrs

8 Grain carrier: 29.2 hrs (case 1)
9 Grain carrier: 50.4 hrs (case 2)
10 Grain carrier: 4.3 hrs (case 3)

- Percentage of berth occupancy

Silo Quay: 25.8(%)
Quay No.1: 86.8
Quay No.2: 84.2
Quay No.3: 83.7
Quay No.4: 82.1
Passenger Quay No.5: 82.3
Passenger Quay No.6: 76.0
Quay No.7: 87.6
Quay No.8: 86.3
Quay No.9: 80.0
Quay No.10: 76.2
Quay No.11: 67.2
Quay No.12: 60.3
Quay No.12A: 62.7
Quay No.13: 55.4

Areas of public sheds and open yards occupied by various cargoes fluctuate according to daily arrivals, dwelling time and departures of the cargoes. When estimating the required areas for storing them, a daily maximum occupied area is adopted. The result of the simulation is as follows.

- Area in sheds: 12.2 ha
- Area in open yards: 11.7 ha
- Total area: 21.5 ha

Existing sheds occupied 10.5 ha and open yards occupied 13.3 ha. The total area, 23.8 ha is exceeds the necessary storage area. Consequently, the existing scale of storage area is sufficient for the future cargo.

Total ship waiting days in 2010 excluding container vessels are estimated as 1,142 days, 21% reduction from that of 1,440 days in 1994.

11.3 Modernization Plan of the Existing Facilities

11.3.1 Container Terminal

To increase container-handling capacity as much as possible, it is necessary to modernize the existing container terminal (Terminal-1) through the installation of dock-side container gantry cranes, rearrangement of yard facilities and introduction

of the closed terminal operation system.

The layout of terminal facilities is proposed in Fig.11.3-1.

According to the layout plan in the condition of straddle carrier system which is currently adopted, the ground slots are estimated as follows:

- Marshaling yard: 1,490 TEUs
- Backyard: 760 TEUs for empty containers

11.3.2 Grain Terminal

In order to accommodate future grain, the following alternatives are proposed.

Case 1(Concentration):
Existing grain terminal in the Old Port is superannuated. Berth depth is no more than 8.5m and available land behind the berth is not sufficient for expansion of silo. Since the existing grain terminal is located at the end of the port, dredging volume for access channel will become larger.

In this case, the new grain terminal will be located within the port, while existing terminal is used only for stock. Berth No.12A is suitable for the new terminal. Land behind the berth is usable for silo and other handling facilities and the depth of the berth is sufficient for a grain vessel up to 40,000 DWT.

The capacity of loader/unloader is 800 ton/hr/unit X 2 units large enough to handle grain in one berth.

Case 2(Concentration):
Case 2 is the same as Case 1 except capacity of cargo handling. The capacity of unloading equipment is 400 ton/hr/unit X 2 units in order to reduce the cost.

Case 3(Split):
In this case, the existing grain terminal will be improved and utilized for exported and imported grain. Since the space for expansion of the silo is not sufficient in the old port, the new terminal will also be planned in the new port area.

In order to decide appropriate berth scale the following cases are compared.

Case 1	Berth depth	-13 m	Length	220 m
Case 2	Berth depth	-12 m	Length	210 m
Case 3	Berth depth	-11 m	Length	200 m

Cost index of berth construction cost and vessel waiting cost is as follows: (Project Life: 30 year, Discount Rate 0.1)

Case 1	Case 2	Case 3
111	100	102

Consequently, appropriate berth depth is -12 m.

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

	Case 1	Case 2	Case 3	
Construction Cost			New	Existing
Berth	-	-	-	12.1
Silo	6.2	6.2	4.0	-
Machine Tower	2.9	2.7	2.5	2.3
Loader/unloader	9.7	7.3	6.0	4.6
Handling equip	28.4	26.5	19.0	16.0
Waiting Cost	16.5	25.7	0.2	
Total	63.7	68.45	66.7	
Index	100	107	104	

Total cost of Case 1 is the lowest and Case 3 is the second lowest. However, the difference between these alternatives is within 5 percent. Moreover, Case 3 has other advantages i.e. two berths are available for grain vessels.

(2) Cargo handling facilities

At present, Grain Terminal for grain export is located at the south-west end of Old Port Area. Outline of the existing Grain Terminal is as follows;

1. Berth
   Draft - 8.5m, Length 185m, dolphin type

2. Silo
   Capacity 35,000 ton (1000t×32 main bins and supplementary bins)

3. Loading facilities
   Ship loaders 150 t/h×2 units Belt conveyor 300 t/h 1 line

4. Receiving facilities from trucks
   Underground hopper, Belt conveyors 120 t/h×3 lines.

5. Others
   Fumigation device, Dust collection device,weighing device and recycle line

However, the terminal facilities and equipment shall be modified because of ;

1. Large size bulk carrier can not use the dolphin because of draft shortage and its length.

2. The cargo for import can not be handled at the terminal

3. Considering the cargo volume to be handled, the capacity of the existing silo and handling equipment is insufficient.

The design conditions for new terminal are as follows;

1. Ship size Max 50,000 DWT

2. Cargo volume IN 2003 export wheat 1,400,000 t/y import barley 120,000 t/y maize 140,000t/y

3. Operation

3-1 Receiving (loading)from(to) truck and unloading(loading) from(to) ship can not be done in both tow lines at same time but it is possible to operate each one line.
3-2 Receiving(loading) from(to) truck and loading(unloading) to(from) ship can be done in full capacity at same time
3-3 Considering peak season for each cargo,all silo bins shall be operated flexibly. 3-4 All cargo handling lines are used for all kind cargo
3-5 Berth occupancy is 0.4 considering above restrictions for operation.

4. Capacity of the Loader cum Unloaders

Conditions for calculation of the loader cum unloader
The following assumptions are made in advance

4-1 In due consideration of the number of berth (one berth only), the handling equipment which is used for loading and unloading, and local condition (after loading, about one day is required due to clear the document), the berth occupancy for net handling is decided as 0.4.
4-2 In due consideration of the fact that some cargo handling lines are used for both handling (loading and unloading), it is more economical to plan same capacity or 1:2 for loading and unloading capacity.
4-3 In due consideration of the ship trim and break down of the loader cum unloader, the number of equipment is decided as 2 units.

$$\{\{(1{,}200{,}000/(2 \times c \times 0.7 \times 24 \times 0.75)\} + \{(440{,}000/(c \times 0.55 \times 24 \times 0.75))\}/285 = 0.4$$

$c = 807 = 800$

Then Loading Capacity 800 t/h × 2 units
Unloading Capacity 400 t/h × 2 units

Outline of the Alternative Plan are as follows;

Case-1 (one berth system)	
1.New Berth (existing berth)	-12m 240m
2.New Loader cum Unloader	800/(400+400)t/h x 2unit
3.New Silo capacity	100,000 t (2,127t/b x 48 bins)
Case-2 (one berth system)	
1. New Berth (existing berth)	- 12m 240m
2. New Loader cum Unloader	800/(200+200)t/h × 2 units
3. New Silo capacity	100,000 t (2,127 t/b × 48 bins)
Case-3 (two berths system)	
Terminal-1(New Terminal)	
1. New Berth (existing berth)	- 12m 240m
2. New Loader cum Unloader	400/(200+200)t/h × 2 units
3. New Silo capacity	65,000 t (2,960 t/b × 22 bins)
Terminal-2 (Existing Terminal)	
1. Renewed Berth	- 12m 240m
2. New Loader cum Unloader	400/(100+100)t/h × 2 units
3. New Silo capacity	35,000 t (1,000 t/b × 32 main bins and supplementary bins)

The general arrangement for alternative 1~2 are shown in Fig. 11.3.1~3.

9. Other equipment

9-1 Recycle line
9-2 Fumigation equipment
9-3 Dust collection equipment
9-4 Weighing equipment
9-5 Truck receiving and loading equipment
9-7 Others

Most of above equipment will be installed in the machinery tower.

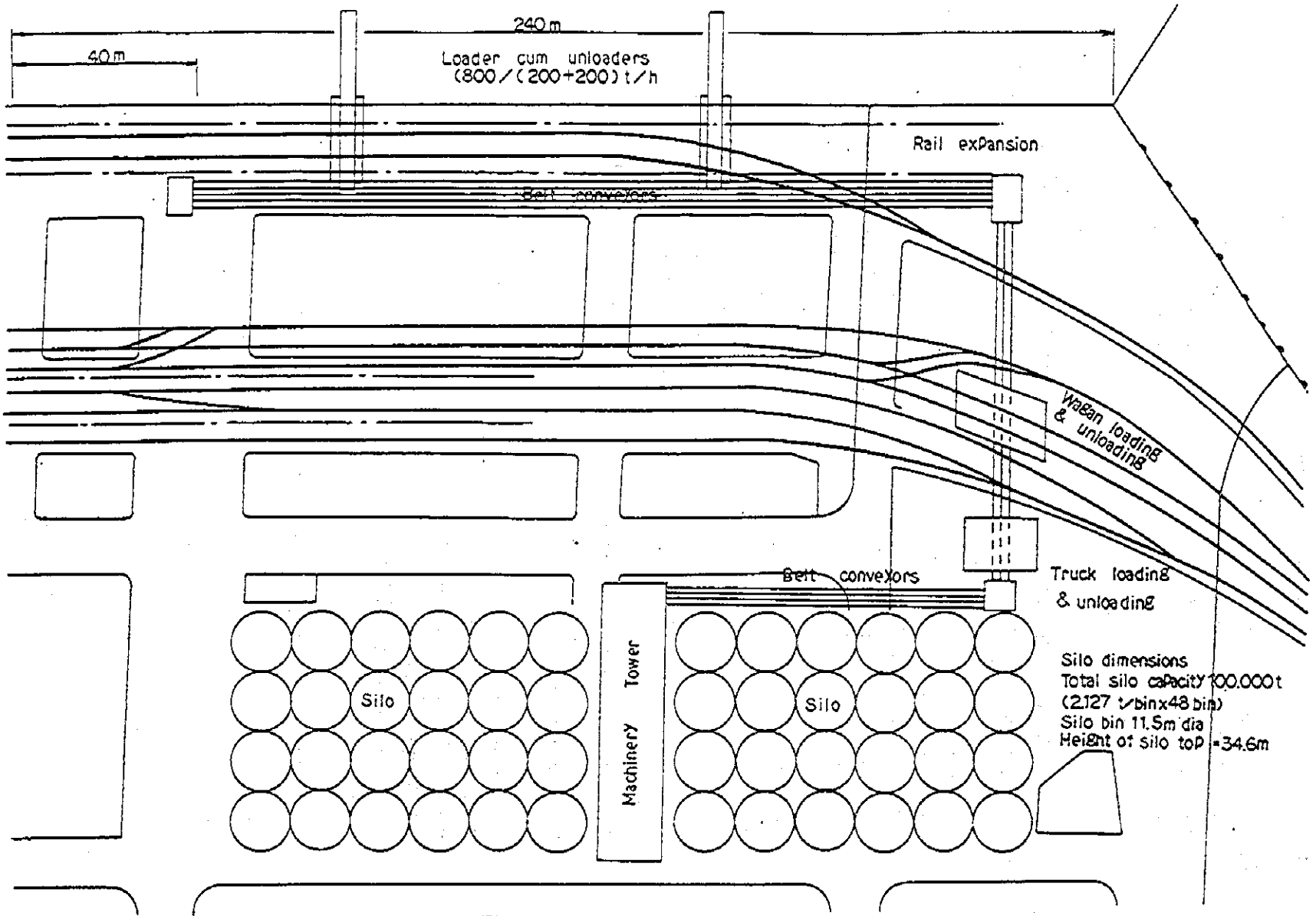

Fig. 11.3.1 Case-2 New Terminal

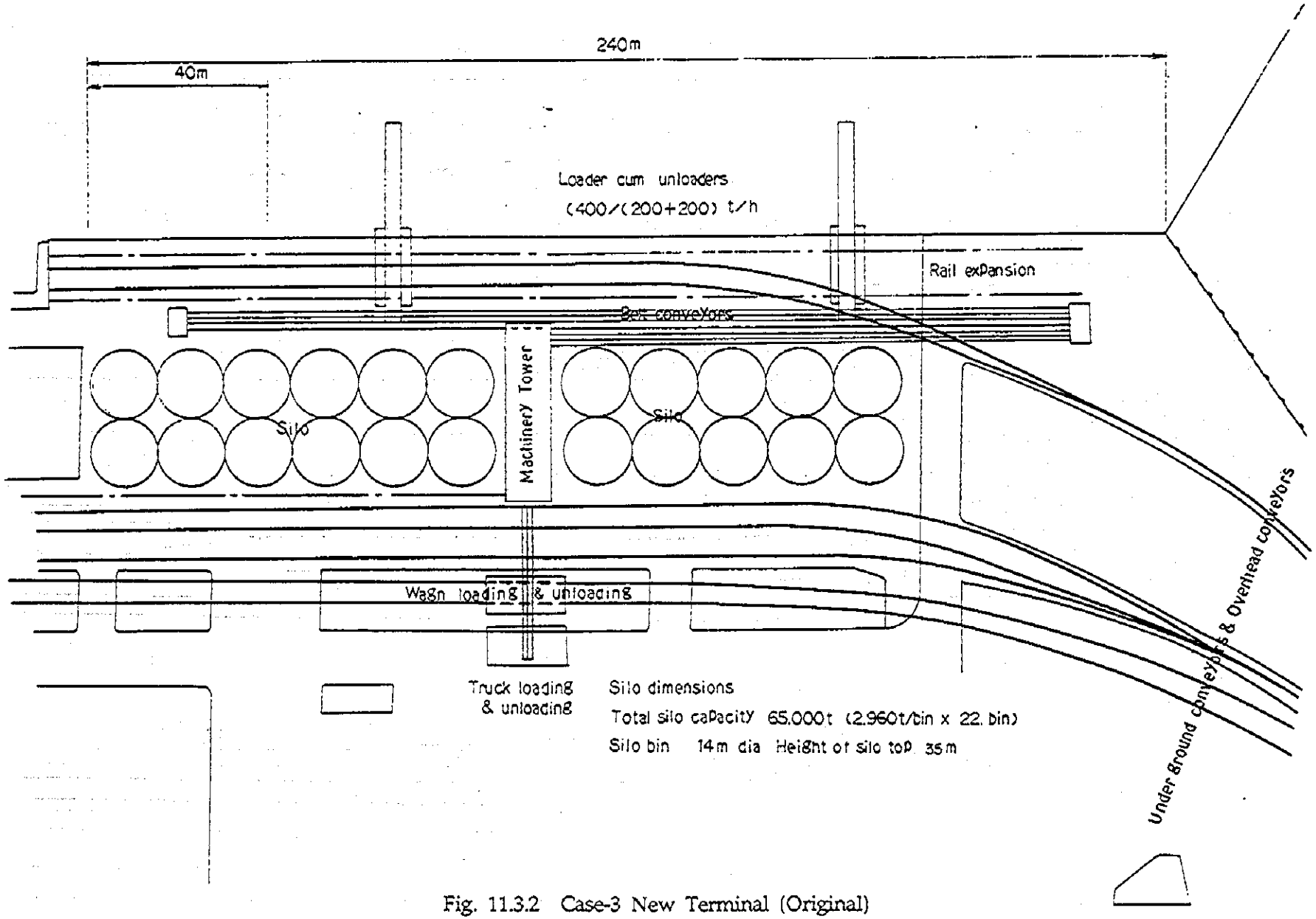

Fig. 11.3.2 Case-3 New Terminal (Original)

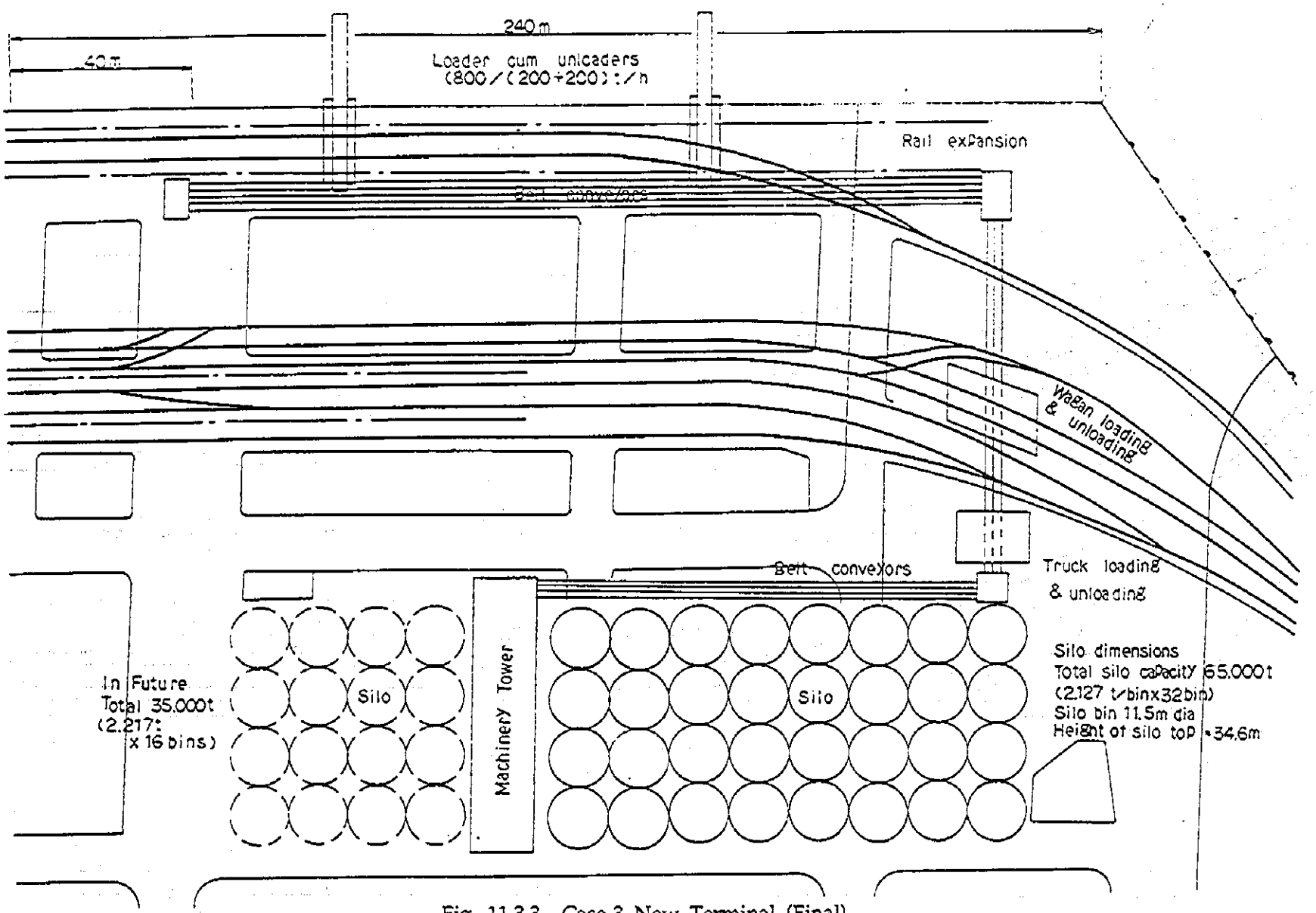

Fig. 11.3.3 Case-3 New Terminal (Final)

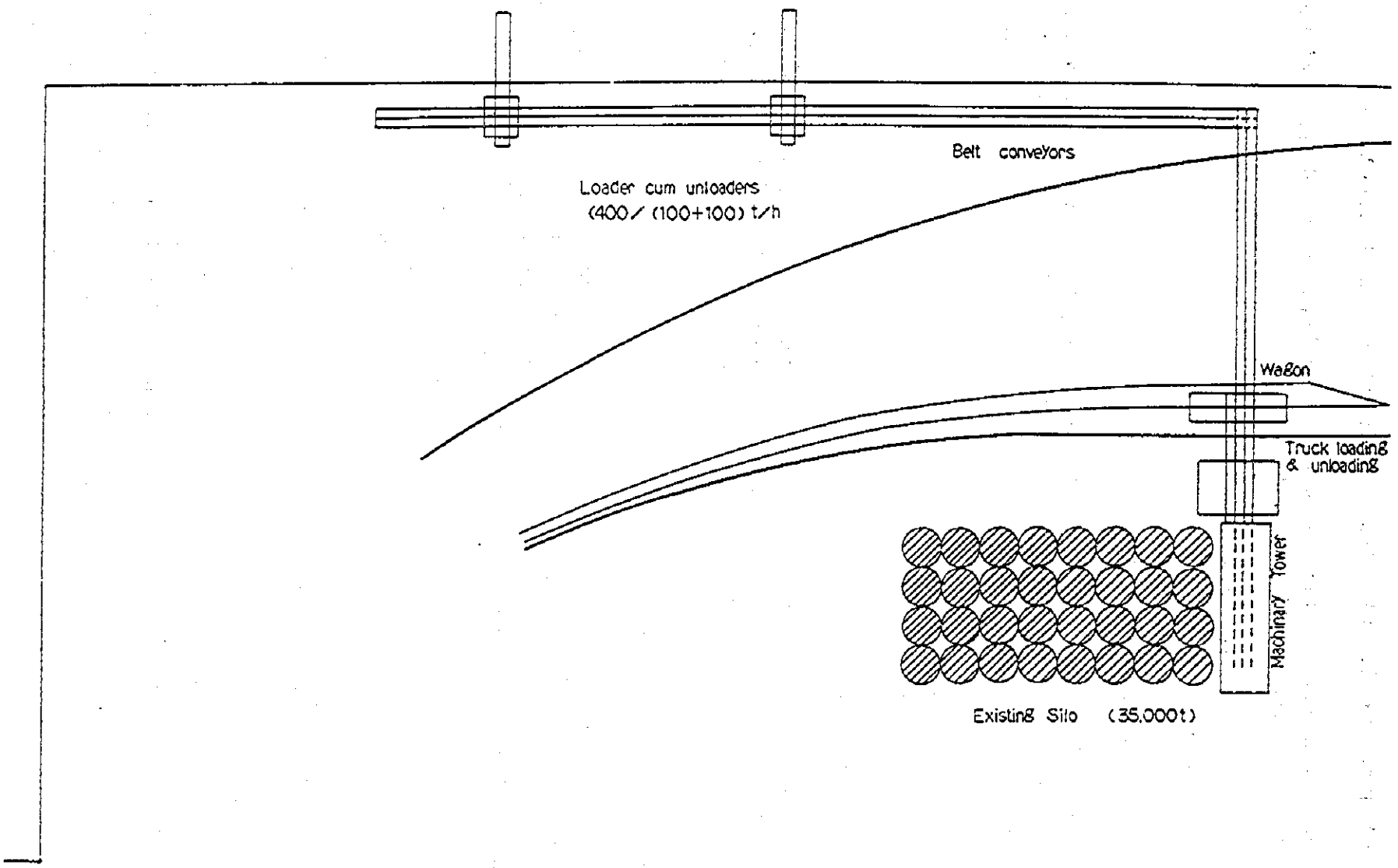

Fig. 11.3.4 Case-3 Existing Terminal