APPENDIX

APPENDIX

APPENDIX-1

Preliminary design of cargo handling equipment

1. LATAKIA PORT

1-1 Container Berth

a. Container berth No.16,17,18,19

b. Container volume (TEU)

Total 613,532 LCL 19,633 Empty 220,871

TEU/Boxes = 1.42

c. Container Crane Qc

c-1 Number of crane 2 units per berth, Total 8 units

c-2 Number of containers to be handled per crane

613,532/8 = 76,690 TEU/UNIT 53,630 BOXES/UNIT

d. Straddle carriers Qs

The required number of transfer cranes shall be calculated by the following formula

$Qs = QC \times 3 + 2 \sim 3$

$= 8 \times 3 + 3 = 27$ units

e. Minor handling equipment at the container yard

e-1 Fork-lift truck for general services

Under spreader 30.5t 2 units

20.4t 2 units

e-2 Fork-lift trucks for Empty Container Qfe

$Qfe = 220,871 \times 3 \times 1.3 \times /285 \times 24 \times 0.8 \times 15$

$= 10.5$

Under spreder 5 t 11 units

e-3 Fork-lift truck for CFS

a. Unstuffing

15,032 x 1.3 / 285 x 6 = 12

3t 12 units 1.5t 12 units

b. Stuffing

4,601 x 1.3 / 285 x 4 = 6

3t 6 units 2t 6 units

c. Total

3t 18 units 2t 18 units

1-2 Grain Terminal

Details are shown on 11.3.2 Grain terminal

1-3 General Cargo Berth

a. Berth

Various	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 20, 21, 22
Food	2, 3, 4, 5, 7, 8, 10, 11, 15, 20, 21, 22
Steel	12, 13, 14
Wood	9, 10, 11, 12, 13, 14, 20, 21, 22

b. Cargo

Various	1,080,000
Food	455,000
Steel	465,000
Wood	500,000

c. Required cargo handling equipment

c-1 The required cargo handling equipment for from/to ship

All cargoes are handled by quay side crane and/or ship gear.

c-1-1 Replacement

Eleven(11)(No2 crane~No12 crane) portal jib cranes have been installed at Kahaleh berth from No1 to No4 at present.

However all cranes shall be disposed and new cranes shall be installed because they are very old (procured in1957)and their condition are insufficient.

Twelve(12) cranes were arranged there in original and one crane was already disposed.

The required number of crane is twelve(12) units (4t x 27m 9 units, 6t x 27m 3 units)

c-1-2 New cranes

Three(3)units of 16t portal jib crane and six(6) units of 6.3t portal jib crane shall be installed at new three(3) general cargo berth.

c-2 The required cargo handling equipment at apron,at yard and in shed handling.

They are estimated by following assumption.

c-2-1 Bagged cargo

It is assumed that all cargoes are palletized

At apron	20%	Direct transported to transit shed by quay crane
	10%	Direct delivery to out side by trucks
	50%	Transported to transit shed by forklift trucks
	20%	Transported to transit shed by trailer

Required equipment for one berth(4gangs per ship).

Forklift trucks	3 t 9.2 units
At apron	4g x 3 units x 50% = 4.8
	4g x 20% = 0.8
In shed	Receiving 4g x 20 % = 0.8
	Delivery 4g x 70% = 2.8
Trailer	1.6 units 4g x 2 x 20% = 1.6

c-2-2 Roled paper and role steel coil or plate

At apron	40% to shed by trailer
	60% to shed by forklift truck

Required equipment

Forklift truck	special type 5t 9 units
At apron	3g x 2 x 60% = 3.6
	3g x 1 x 40% = 1.2
In shed	Receiving 1.2
	Delivery 3
Trailer	2.4 units (3g x 2 x 0.4 = 2.4)

c-2-3 Timber bundled

At apron	20% Direct delivery to out side
	60% to open yard by forklift
	20% to open yard by trailer

Required equipment

Forklift truck	5 t 7.2 units
At apron	3g x 2 x 60% = 3.6 3g x 20% = 0.6
At yard	Receiving 3g x 20% = 0.6 Delivery 3g x 80% = 2.4
Trailer	1.2 units (3g x 2 x 20%)

c-2-4 Loosed Timber

At apron	40 % Direct delivery to out side
	60 % to open yard by trailer

Required equipment

Trailer	4.8 units (4g x 2 x 0.6)
Mobile crane	45 t 4.4 units
At apron	4g x 0.5 = 2
At open yard	4g x 0.5 x (1 + 1) x 60 % = 2.4

c-2-5 Heavy cargo

At apron	60 % moved to open yard by forklift
	40 % moved to open yard by trailer

Required equipment

Forklift truck	10 t 7.2 units
At apron	3g x 2 x 60% = 3.6
At open yard and/or in shed	3g x 60% x 2 = 3.6

Trailers	2.4 units (3g x 2 x 0.4)
Mobile crane	65 t 3.6 units
At apron	3g x 40% = 1.2
At Open yard	3g x 40% x 2 = 2.4

c-2-6 Others cargo

At apron	20 % delivery to outside directory
	50 % move to shed or open yard by forklift trucks
	30 % moved to shed or open yard by trailer
At yard or in shed	15 % unloaded by forklift truck
	15 % unloaded by mobile crane
	65 % loaded by forklift truck
	15 % loaded by mobile crane
Required equipment	
At apron	
Forklift truck	3t(60%) and 5t(40%) 7.2 units
	(4g x 3 x 50% = 6, 4g x 30% = 1.2)
Trailer	4g x 2 x 30 % = 2.4 units
Mobile crane	45t 1.2 units
	(4g x 0.3 = 1.2)
At yard or in shed	
Forklift trucks	4 x (0.15 + 0.65) = 3.2
Mobile crane 45t	4 x 2 x 0.15 = 1.2
Total	
Forklift trucks	5 t 4.16 units
	3 t 6.24 units
Trailer	2.4 units

The total required cargo handling equipment are estimated by above assuption. The result of calculations are shown in below table.

Bagged 3, Roled paper1, Timber bundled1, Loosed Timber 1, Heavy cargo 2, Other 9 Total 17 berth

	Forklift 3t	5t(sp)	5t	10t	Mobil 45t	65t	Trailer
Bagged(3)	27.6	0	0	0	0	0	4.8
Roled paper(1)	0	9	0	0	0	0	2.4
Timber bundled	0	0	7.2	0	0	0	1.2
Loosed Timber	0	0	0	0	4.4	0	4.8
Heavy Cargo	0	0	0	7.2	0	3.6	2.4
Others(9)	56.16	0	37.44	0	21.6	0	21.6
Total	83.8	9	44.6	7.2	26	3.6	37.2
Net(0.8x1.15=0.92)	77.1	8.3	41	6.6	23.9	3.3	34.2
Existing(available)	20	0	0	15	34	4(*)	24
To be procured	57	8	31	0	0	4	10

Remarks * Very old.

2. TARTOUS PORT

2-1 Container Berth

a. Container berth No.4, No.5

b. Container volume (TEU)

Total 200,302 LCL 6,309 Empty 74,111

TEU/Boxes = 1.42

c. Container cranes Qc

c-1 Considering the containers to be transported by Ro/Ro vessels, three fourth of the container to be handled will be handled by container cranes.

2 container cranes shall be installed.

(Nv = 200,301×0.75/2 ≒ 75,000 TEU , 52,900 Boxes/units)

d. Transfer cranes

d-1 Rail-mounted transfer cranes

Considering the containers to be handled and total travelling distance, three 3(2) rail-mounted transfer cranes shall be installed.

d-2 Tire-mounted transfer cranes

Considering the container volume to be handled and total travelling distance, three 3(2) tire-mounted transfer cranes shall be installed.

e. Minor handling equipment at the container yard

e-1 Fork-lift truck for general services

Under spreader 30.5t 1(0) unit

20.4t 2(0) units

e-2 Fork lift truck for empty container Qfe

Qfe = 74,111 x 3 x 1.3 / 285 x 24 x 0.8 x 15

= 4(0)

e-3 Fork-lift truck for CFS

a. Unstuffing

4,907 x 1.3 / 285 x 6 = 4(0)

b. Stuffing

1,402 x 1.3 / 285 × 4 = 2(0)

c. Total 3t 6 units 1.5t 6 units

3t 5(0) units

2t 5(0) units

2-2 General Cargo (Various, Food, Steel, Wood) Berth

a. Berth

Various No.1, No.2, No.3, No.7, No.8, No.9, No.10, No.11, No.14, No.15, No.16

Food	No.1, No.2, No.3, No.7, No.8, No.9, No.10, No.11, No.13
Steel	No.23, No.24, No.25
Wood	No.1, No.2, No.3, No.7, No.8, No.9, No.10, No.11, No.13, No.14, No.15, No.16, No.23, No.24, No.25

b. Cargo

Various	1,028,000
Food	464,000
Steel	881,000
Wood	513,000

c. Required cargo handling equipment

c-1 The required cargo handling equipment for from/to ship
All cargoes are handled by quay side crane and/or ship gear.

c-1-1 Replacement

Six(6) portal jib cranes (Lifting capacity 6t) and eleven(11) portal jib cranes (3t) have been installed at Pier A.

However six(6) portal jib cranes shall be disposed and new cranes (16t 3 units, 3t 3 untis) shall be installed because they are very old and their condition are insufficient.

c-1-2 New cranes

The cargo handling from/to ship at Pear B has been carried by mobile tower cranes and/or ship gear because there is no quay crane.

It is recommended that three(3) mobile tower cranes (6t x 20m) shall be arranged for handling from/to ship and at yard.

c-2 The required cargo handling equipment for at apron,at yard and in shed.

They are estimated by same assumption except berth arrangement at Latakia Port.

The result of estimation is shown in below table

Bagged 2, Roled paper and roled coil and steel sheet 2, Timber bundled 1, Loosed Timber 1,Heavy cargo 3, Others 7. Total 16 berth

	Forklift 3t	5t(sp)	5t	10t	Mobil 45t	65t	Trailer
Bagged(2)	18.4	0	0	0	0	0	3.2
Roled (1)	0	18	0	0	0	0	4.8
Timber bundled	0	0	7.2	0	0	0	1.2
Loosed Timber	0	0	0	0	4.4	0	4.8
Heavy Cargo	0	0	0	21.6	0	10.8	7.2
Others(7)	43.7	0	29.12	0	16.8	0	16.8
Total	62.1	18	36.3	21.6	21.2	10.8	38
Net(0.8x1.15=0.92)	57.1	16.6	33.4	19.9	19.5	9.9	35
Adjustment	57	17	33	20	20	10	35
Reference							
Existing(available)	44	0	8	3	57	2	9
To be procured	13	17	25	17	0	0	26

3. NEW PORT

3-1 Phosphate

Details are shown on 13.2.1 Phosphate Terminal

3-2 Cement clinker 1,100,000t/y

a. Design condition
a-1 Number of berth 1
a-2 Ship size Max 65,000 DWT
a-3 Shed 87,000t

b. Ship loader
Considering ship trim and breakdown of the loader, two(2) set of loader shall be installed on berth.
The required loader capacity is calculated by the following formula.

$$Qt = 1,100,000 / 285 \times 0.5 \times 24 \times 0.75 \times 0.7 \times 2$$
$$= 306 \quad 350 \text{ t/h} \quad 2 \text{ unit}$$

c. Belt conveyor
350t/h 2 lines

3-3 Pellet 1,250,000t/y

a. Design condition
a-1 Number of berth 1
a-2 Ship size Max 65,000 DWT

b. Handling system at open yard
Most bulk cargo handling system at open yard can be classified into the stacker and reclaimer system, stacker cum reclaimer system and truck, shovel loader and bulldozer system.
The most economical and reasonable choice depends on the cargo volume to be handled at the yard.
In this case, stacker cum reclaimer system is recommended to be introduced.

c. Unloader
Considering ship trim and breakdown of the unloader,two(2) set of unloader shall be installed on berth.
The minimum required unloader capacity is calculated by the following formula.

$$Qp = 1,250,000/285 \times 0.5 \times 24 \times 0.75 \times 0.6 \times 2$$
$$= 406$$

However, judging from ship size to be called, 500t/h unloaders are recommended to be introduced.

d. Belt conveyor
500t/h 2 lines

3-4 Scrap 250,000t/y

a. Ship size Max 9,000
b. Unloader
Considering low productivity per one gang and ship size, three(3) unloader are installed on one berth.
The required unloader capacity is calculated by the following formula.
Qs = 250,000 / 285 × 0.7 × 16 × 0.8 × 0.6 x 3
= 54.4 t/h
Required net lifting weight Lt
Lt = 54.4 / 20 = 2.7t
Required lifting capacity Lc
DL type 11t LLC 3 units

3-5 Sulphur Export 500,000t/y

a. Design condition
a-1 Number of berth 1
a-2 Ship size Max 40,000 DWT
a-3 Shed 45,000 t
b. Handling System
b-1 Receiving from wagon
The cargoes which are unloaded from wagon will be transported to shed by belt conveyors and stored in shed.
b-2 Loading to ship
The cargoes which are stored in shed will be handled in combination of shovel loaders, trucks and movable ship loaders.
c. Handling equipment
c-1 Receiving lines
500,000/285 × 0.7 × 16 × 0.8 × 2 × 0.7 = 149 i,e, 150 t/h × 2 units
Conveyor lines 150 t/h × 2 lines
c-2 Loading lines
500,000/285 × 0.5 × 24 × 0.75 × 3 × 0.7 = 93 Minimum required capacity 93 t/h/g
Movable ship loader 150 t/h × units (including spare 1 unit)(*)
Shovel loader 7 units(*)
Trucks 9 units(*)

3-6 Oil Cokes Export 500,000t/y

a. Design condition
a-1 Number of berth 1
a-2 Ship size Max 15,000

a-3 Open yard 20,000 sq m

b. Handling System

b-1 Receiving from wagon or truck

The cargoes will be transported in combination of shovel loaders and trucks.

b-2 Loading to ship

The cargoes which are stored at open yard will be handled in combination of shovel loaders, trucks and movable ship loaders.

c. Handling equipment

Movable ship loaders	150 t/h × 3 units(*)
Shovel loader	3 units(*)
Trucks	9 units(*)

3-7 Fertilizer **Export in 2003 510,000t/y in 2010 480,000t/y**
Import in 2003 170,000t/y in 2010 210,000t/y

a. Design condition

a-1 Number of berth	1
a-2 Ship size	Max 50,000 DWT
a-3 Shed	50,000 t

b. Handling system

For export cargoes

The cargoes for export are assumed to be a bulk cargo. They are transported to shed by belt conveyors and stored in shed. The cargoes which are stored in shed will be loaded to ship in combination of shovel loaders, trucks and movable loaders.

For imported cargoes

The imported cargoes are assumed to be a big bagged cargoes. They are handled in combination mobile cranes and forklift trucks at port.

c. Handling equipment

Receiving belt conveyor	120 t/h × 2 lines(*)
Movable ship loader	150 t/h × 3 units(*)
Shovel loader	3 units(*)
Trucks	9 units(*)
Mobile cranes	45 t 4 units
Forklift trucks	5 t 5 units

Remarks The equipment with * are used at the some berth as multi purpose equipment.

Appendix.6 Methodology to Estimate Port Capacity

A.6.1 Methodology

Several kinds of methodologies are used to estimate the capacity of existing or planned port facilities as follows:

(1) The standard berth throughput method

The standard berth throughput method is adopted to estimate berth capacity of general cargo berths handling mainly break-bulk cargoes. The standard berth throughput used internationally ranges from 700-1,000 tons per unit berth length of one meter. A merit of this simple method is that berth capacity is easily estimated without complicated calculations. However, actual berth throughput records at seriously congested ports range widely outside the range of the standard figures. In this regard, the method has a demerit that it can hardly give a theoretical proof on its standard figures since the figures of the standard were experientially given.

(2) The standard berth occupancy ratio method

The standard berth occupancy ratio method is adopted to estimate berth capacity in combination with assumed cargo-handling productivity. The standard berth occupancy ratio used internationally ranges from 60% to 70% through the year. A merit of this method is simplicity, the same as with the standard berth throughput method mentioned above. Actual berth occupancy ratios in case of serious congestion at ports in the world which seemed to be almost in full capacity conditions, however, are much higher and in some cases exceed 90%. In this regard, it is not suitable to adopt the method to indicate full capacity conditions linked with saturation, since the figures of the standard were merely given so as to avoid considerable congestion without clear proof.

(3) Maximum berth capacity estimation method

To estimate maximum port capacity, critical conditions that all berths are fully occupied and the number of ships waiting off-shore are ever accumulating, showing absolutely saturated conditions; generally berth occupancy ratios can exceed 90%. Such saturated conditions are prescribed by ship arrival distribution and berthing time distribution which has linkage with cargo volume and cargo-handling productivity of individual ships. Maximum

capacity can be estimated analytically by using queuing theory in some simplified conditions of both ship arrival distribution form and berthing time distribution form. Maximum capacity can be also estimated by using a simulation method. In the latter method, complicated conditions can be used to simulate actual port traffic both of ships and cargoes and storage conditions with precise. By using the method, upper limit of port cargo throughput is revealed, linked directly to the maximum port capacity.

(4) Optimum berth capacity estimation method

To determine the required number of new berths in addition to existing berths, cargo-handling capacity of the existing berths must be estimated taking account of a saturated condition of the existing berths. Overflowed cargo from the existing berths needs to be received by the new berths. The saturated condition of the existing berths is defined to be the point when savings of transportation costs for port cargoes induced by preparation of additional berths come to exceed the investment costs to construct the additional berths. Savings of transportation costs for port cargoes are calculated by the difference of off-shore ship waiting costs and the difference of cargo transport costs by sea between the without-the-project case (only use of the existing berths) and the with-the-project case (new berths are used in addition to the existing berths). In the with-the-project case, off-shore ship waiting is expected to be reduced compared with the without-the-project case. If deeper new berths are constructed, cargo transport costs by sea are expected to be also reduced compared with the without-the-project case by using large-sized ships.

Generally "the optimum berth capacity " is less than "the maximum berth capacity" mentioned in the above paragraph (3). This means that an additional new berth needs to be constructed before the existing berths reach "the maximum berth capacity".

Optimum berth capacity can be estimated by using a queuing theory analytically or by using a simulation method the same as in the maximum berth capacity method.

A.6.2 Capacity of the Existing Ports

Among the methods listed above, "the optimum berth capacity method" was adopted in this study as shown in Chapters 11-13 in the main report.

(1) Latakia Port

As to conventional cargo-handling excluding container-handling at the container terminal, Latakia Port is forecast to reach saturation in the year 2006 and the capacity of the existing berths excluding grain pier for export in terms of cargo throughput is estimated as 3.0 million tons per annum. The resulting berth throughput is estimated as 1,230 tons per meter. The resulting berth occupancy ratio is 77%.

On the other hand, in case of container-handling, capacity of the existing terminal is determined according to the number of dwelling containers in peak condition and stacking capacity of container yards. The number of dwelling containers highly depends on an average dwelling time and peaking factor, and stacking capacity depends on types of container-handling machines to be procured after this. By assuming that dwelling time will be shortened by under five days in import and thee days in export from the present level by the introduction of the closed terminal operation system, dock-side container-gantry cranes will be installed and straddle carriers (three high stacking and four high clear) will be introduced, container-handling capacity of the existing terminal is estimated as around 300,000 TEUs per annum. Hence, the terminal will be saturated soon after the year 2003.

(2) Tartous Port

As to conventional cargo-handling excluding grains in bulk and containers handled at the container terminal, Tartous Port is forecast to reach saturation in the year 2003 if the new port is not created. Even if the new port is created, then the Tartous Port is forecast to reach saturation in the year 2009 and the capacity of the existing berths excluding the existing phosphate pier in terms of cargo throughput is estimated as 3.8 million tons per annum. The resulting berth throughput is estimated as 1,520 tons per meter. The resulting berth occupancy ratio is 80%.

On the other hand, in case of container-handling, capacity of the existing terminal is determined according to the number of dwelling containers in peak condition and stacking capacity of container yards. The number of dwelling containers highly depends on an average dwelling time and peaking factor, and stacking capacity depends on types of container-handling machines to be procured after this. By assuming that dwelling time will be shortened by under five days in import and three days in export from the present level by the

introduction of the closed terminal operation system, dock-side container-gantry cranes will be installed and transfer crane (three high stacking and four high clear) will be introduced. container-handling capacity of the existing terminal is estimated as around 200,000 TEUs per annum. Hence, the terminal will be saturated soon after the year 2010.

Appendix-7 (Phosphate)

1. Number of Ships and Average Cargo-handling Volume per Ship

Ns = Vsu/Cs
Vs = Vsu/Ns

Ns : Number of ships by route by grade
Vsu : Cargo handling volume of phosphate by rote by grade
Cs : The maximum capacity of ships by route by grade
Vs : Average cargo handling volume per ship by route by grade

Table AP.7.1 Cargo Handling Volume per Ship and Number of Ships by Route

	Number of ships (ships)	Cargo handling volume per ship (tons)
Constanza	35	36,200
Marseille	57	35,700
Rotterdam	14	58,600
Total	106	

2. Interval of Calling Ships for Same Route

Isu = Da/Ns

Isu : Interval of calling ships of phosphate for same route
Da : Number of annual days(365 days)
Ns : Number of ships by route

Result of calculation

Constanza : 11 days
Marseille : 46 days
Rotterdam : 7 days

3. Calculation of Cargo Handling Time

3-1. From wagons of train to the apron of open yard

Tt = Vs/Vd
Vd = Nd x Vt
Vt = Nw x Vw

Tt : Cargo handling time per ship between wagons and hoppers at receiving facility. (unit:days)
Vs : Cargo volume per ship (unit:tons/ship)
Vd : Cargo handling volume per day from wagons to hoppers (tons/day)

Nd : Productivity of cargo handling from wagons to hoppers (12.8 trains/days)
Vt : Cargo volume per train (unit:tons/train)
Nw : Number of wagons per train (14 wagons/train)
Vw : Cargo volume per wagon (50 tons/wagon)

Table AP.7.2 Cargo Handling Time per Ship from Wagons of Train to Hopper

Route		Marseille	Rotteldam	Constanza
Cargo volume per ship	(tons/ship)	35,965	58,571	35,143
Cargo handling volume per day from wagon to hoppers	(tons/ship)	8,960	8,960	8,960
Productivity of cargo handling from wagons to hoppers	(trains/day)	6.4	6.4	6.4
Working ratio		0.8	0.8	0.8
Number of lines	(lines)	2	2	2
Cargo Volume per train	(tons/train)	1,400	1,400	1,400
Number of wagons per train	(wagons/train)	28	28	28
Cargo volume per wagon	(tons/wagon)	50	50	50
Cargo handling time per ship from wagons to hoppers	(day)	5	7	4

3-2. From apron on the quay to the ship

$$Ts = Vs/V_{Ld}$$
$$V_{Ld} = C_L \times N_L \times Tw \times e$$

Ts : Cargo handling time per ship between ship and the silos. (unit:days)
Vs : Cargo volume per ship (unit:tons/ship)
V_{Ld} : Cargo handling productivity between ship and the silo. (unit:tons/day)
C_L : Capacity of Loader (unit:tons/hour)
N_L : Number of Loader
Tw : Working hours per day (24 hours)
e : Cargo handling efficiency including Working ratio (0.8)

Table AP.7.3 Berthing time per Ship and Productivity per Day

	Unit	Marseille	Rotterdam	Constanza
Cargo volume per ship	(tons)	35,965	58,571	35,143
Capacity of loader	(tons/hour)	750	1,400	750
Cargo handling efficency		0.64	0.64	0.64
Working hours per day	(hours/day)	24	24	24
Productivity per day	(tons/day)	11,520	21,504	11,520
Cargo Handling time	(days/ship)	3.1	2.7	3.1
Others	(hours/ship)	2	2	2
Berthing time per ship	(days/ship)	4.0	3.0	4.0
Aerage cargo handling volume per day	(tons/day)	8,991	19,524	8,786

Appendix-8 (Cement Clinker)

1. Number of Ships

$$Ns = Vsu/Cs$$
$$Vs = Vsu/Ns$$

Ns : Number of ships by route
Vsu : Cargo handling volume of cement clinker by route
Cs : The maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.8.1 Number of Ships and Cargo Handling Volume per Ship by route

Route	Unit	New York	Abidjan	Istanbul	Borgas	Marsaille
Cargo Volume by Route	(tons)	300,000	200,000	200,000	100,000	200,000
Maxmum Capacity of Ship	(tons/ship)	58,500	58,500	28,980	28,980	36,000
Number of Ships by Route	(ships/year)	6	4	7	4	6
Cargo Volume per Ship	(tons/ship)	50,000	50,000	28,571	25,000	33,333

2. Interval of Calling Ships for Same Route

$$Isu = Da/Ns$$

Isu : Interval of calling ships of cement clinker for same route
Da : Number of annual days(365 days)
Ns : Number of ships by route

Result of the calculation.

New York : 61 days
Abidjan : 91 days
Istanbul : 52 days
Borgas : 91 days
Marseille : 61 days

3. Calculation of Cargo Handling Time

3-1. From wagons of train to the apron of open yard

$$Tt = Vs/Vd$$
$$Vd = Nd \times Vt$$
$$Vt = Nw \times Vw$$

Tt : Cargo handling time per ship between wagons and hopper of open yard (unit:days)
Vs : Cargo volume per ship (unit:tons/ship)
Vd : Cargo handling volume per day from wagons to hoppers

(tons/day)

Nd : Productivity of cargo handling from wagons to hoppers (5 trains/days)

Vt : Cargo volume per train (unit:tons/train)

Nw : Number of wagons per train (30 wagons/train)

Vw : Cargo volume per wagon (50 tons/wagon)

Table AP.8.2 Cargo Handling Time per Ship from Wagones of Train to Hoppers

Rout	New York	Abidjan	Istanbul	Borgas	Marsaille
Number of wagons per train (wagons/train)	28	28	28	28	28
Cargo volume per wagon (tons/wagon)	50	50	50	50	50
Cargo volume per train (tons/train)	1,400	1,400	1,400	1,400	1,400
Productivity of cargo handling from wagon to hopper (train/day)	5.4	5.4	5.4	5.4	5.4
Cargo handling volume per day from wagon to hopper (tons/day)	7,560	7,560	7,560	7,560	7,560
Cargo handling per ship (tons/ship)	50,000	50,000	28,571	25,000	33,333
Cargo handling time per ship between wagons and hopper (day)	7	7	4	4	4

3-2. From apron on the quay to the ship

$$Ts = Vs/V_{Ld}$$

$$V_{Ld} = C_L \times N_L \times Tw \times e$$

Ts : Cargo handling volume per ship between ship and apron on the quay (unit:days)

Vs : Cargo volume per ship (unit:tons/ship)

V_{Ld} : Cargo handling productivity between ship and apron on the quay (unit:tons/day)

C_L : Capacity of Loader (500 tons/hour)

N_L : Number of Loader (2 loaders)

Tw : Working hours per day (16 hours)

e : Cargo handling efficiency (0.8)

Table AP.8.3 Cargo Handling Time per Ship from Apron on the Quay to Ship

Route	New York	Abidjan	Istanbul	Borgas	Marsaille
Capacity of Loader (ton/hour)	500	500	500	500	500
Number of Loader (unit)	2	2	2	2	2
Working time per day (hour/day)	16	16	16	16	16
Cargo handling efficency	0.8	0.8	0.8	0.8	0.8
Cargo Handling Productivity between Ship and Apron (tons/day)	12,800	12,800	12,800	12,800	12,800
Cargo Volume per Ship (tons/ship)	50,000	50,000	28,571	25,000	33,333
Cargo Handling Time per Ship between Ship and Apron (days)	3.9	3.9	2.2	1.9	2.6

4. Required Storage Area for Cement clinker

$$Ar = (Vr/vu)/r$$

Ar : Required area for cement clinker (unit:m^2)
Vr : Required storage volume (87,000 tons)
vu : Volume of cargo per unit space (4.56 tons/m^2)
r : Utilization ration (0.667)

The resultant required storage area is approximately 28,600 m^2.

Appendix-9 (Iron Pellet)

1. Number of Ships

$$Ns = Vip/Cs$$
$$Vs = Vip/Ns$$

Ns : Number of ships by route
Vip : Cargo handling volume of iron pellet by rote
Cs : The maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.9.1 Number of Ships and Cargo Handling Volume per Ship by route

Route		South America	Sweden
Cargo Handling Volume of Iron Pellet	(tons/year)	625,000	625,000
Maximum capacity of ships	(tons/ship)	72,000	58,500
Number of Calling ships in a Year	(ships/year)	9	11
Average cargo handling volume per Ship	(tons/ship)	69,500	56,800

2. Interval of Calling Ships for Same Route

Interval (days) = 365days/(Number of ships by route)

Result:

South America : 41 days
Sweden : 33 days

3. Calculation of Cargo Handling Time

3-1. From ship to the apron on the quay

$$Ts = Vs/Vd$$
$$Vd = Cu \times Nu \times tw \times e$$

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from ship to apron (tons/day)
Cu : Capacity of unloader (tons/hour)
Nu : Number of unloader
tw : Working time per day (24 hours)
e : Working ratio (0.56)

Table AP.9.2 Cargo Handling Time per Ship from Ship to Apron on the Quay

Route	South America	Sweden
Capacity of unloader (tons/hour)	500	500
Number of unloader (unit)	2	2
Working time per day (hour/day)	24	24
Working ratio	0.56	0.56
Cargo handling volume per day from ship to apron (tons /day)	13,440	13,440
Cargo volume per ship (tons/ship)	69,500	56,800
Cargo handling time per ship from ship to apron (days/ship)	6	5

3-2. From loader to wagons of train

$$Tr = Vs/V_{Ld}$$
$$V_{Ld} = Nt \times Vt$$
$$Nt = (tw/Tt) \times r$$
$$Tt = (Nw \times Tw)/N_L$$
$$Tw = Vw/(C_L \times e)$$
$$Vt = Nw \times Vw$$

Tr : Cargo handling time per ship from loader for loading to trin to wagons of train (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
V_{Ld} : Cargo handling productivity per day from loader to wagons (unit: tons/day)
Nt : Cargo handling productivity per day from loader to wagons by train (unit: trains/day)
Vt : Cargo volume per train (unit: tons/train)
tw : Working time per day (24 hours/day)
Tt : Cargo handling time per train between loader to train (unit: hours/train)
r : Operating efficiency (0.8)
Nw : Number of wagons per train (30 wagons/train)
Tw : Cargo handling time per wagon between loader and wagon (unit: hours/wagon)
Vw : Capacity of wagon (50 tons/wagon)
C_L : Capacity of loader (650 tons/hour)
e : Cargo handling efficiency (0.8)
N_L : Number of Loaders

Table AP.9.3 Cargo Handling Time from Loader to Wagons of Train

Route		South America	Sweden
Capacity of wagon	(tons/wagon)	50	50
Number of wagons per train	(Wagons)	28	28
Cargo volume per train	(tons/train)	1,400	1,400
Capacity of loader	(tons/hour)	650	650
Working ratio		0.8	0.8
Cargo handling time per wagon between loader to wagon	(hours/wagon)	0.0962	0.0962
Cargo handling time per train between loader to train	(hours/train)	2.6923	2.6936
Working time per day	(hours/day)	24	24
Cargo handling efficiency		0.8	0.8
Cargo handling productivity per day from loader to wagon	(trains/day)	7.1	7.1
Cargo volume per ship	(tons/ship)	69,500	56,800
Cargo handling time per ship from loader to wagons	(days/ship)	7	6

4. Required Storage Area for Iron Pellet

$$Ar = (Vr/vu)/r$$

Ar : Required area for iron pellet (unit: m^2)
Vr : Required storage volume (152,000 tons)
vu : Volume of cargo per unit space (8 tons/m^2)
r : Utilization ration (0.667)

The resultant required storage area is approximately 28,500 m^2.

Appendix-10 (Scrap)

1. Number of Ships

Ns = Vsc/Cs
Vs = Vsc/Ns

Ns : Number of ships by route
Vsc : Cargo handling volume of scrap by rote
Cs : The maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.10.1 Number of Ships and Cargo Handling Volume per Ship by route

Route		Novorosisk	Istanbul	Rotterdam
Cargo handling volume of scrap	(tons/year)	140,000	20,000	40,000
Maximum capacity of ships	(tons/ship)	9,000	9,000	9,000
Number of Calling ships in a Year	(ships/year)	16	3	5
Average cargo handling volume per Ship	(tons/ship)	8,750	6,667	8000

2. Interval of Calling Ships for Same Route

Interval(days) = 365days/(Number of ships by route)

Result:

Novorosisk : 23 days
Istanbul : 122 days
Rotterdam : 73 days

3. Calculation of Cargo Handling Time

3-1. From ship to the apron on the quay

Ts = Vs/Vd
Vd = Cu x Nu x tw x e

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)
Vs : Cargo handling volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from ship to apron (tons/day)
Cu : Capacity of cran (50 tons/hour)
Nu : Number of cranes (3 cranes)
tw : Working time per day (16 hours)
e : Working ratio (0.49)

The results of the calculation are as follows:

Cargo handling volume per day from ship to apron (Vd): 1,176 tons/day
Cargo handling time per ship from ship to apron by shipping route (Ts):

Novorosisk : 8 days
Istabul : 6 days
Rotterdam : 7 days

3-2. From apron at open yard to wagons of train

$Tr = Vs/V_{Ld}$
$V_{Ld} = Nt \times Vt$
$Nt = (tw/Tt) \times r$
$Tt = (Nw \times Tw)/N_L$
$Tw = Vw/(C_L \times e)$
$Vt = Nw \times Vw$

Tr : Cargo handling time per ship from apron at open yard to wagons of train (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
V_{Ld} : Cargo handling productivity per day from yard to wagons (unit: tons/day)
Nt : Cargo handling productivity per day from yard to wagons by train (unit: trains/day)
Vt : Cargo volume per train (unit: tons/train)
tw : Working time per day (16 hours/day)
Tt : Cargo handling time per train between yard to train (unit: hours/train)
r : Operating efficiency (0.55)
Nw : Number of wagons per train (30 wagons/train)
Tw : Cargo handling time per wagon between yard to wagon (unit: hours/wagon)
N_L : Number of cranes (2 cranes)
Vw : Capacity of wagon (35 tons/wagon)
C_L : Capacity of crane (75 tons/hour)
e : Cargo handling efficiency (0.85)

Table AP.10.2 Cargo Handling Time from Yard to Wagons of Train

Route	Novorosisk	Istanbul	Rotterdam
Capacity of wagon (tons/wagon)	35	35	35
Number of wagons per train (wagons)	40	40	40
Cargo volume per train (tons/train)	1400	1400	1400
Capacity of cran (tons/hour)	75	75	75
Number of cranes (cranes)	2	2	2
Cargo handling efficency	0.85	0.85	0.85
Cargo handling time per wagon between yard to wagon (hours/wagon)	0.5490	0.5490	0.5490
Cargo handling time per train between yard to train (hours/train)	10.9804	10.9804	10.9804
Working time per day (hour/day)	16	16	16
Operating efficency	0.55	0.55	0.55
Cargo handling productivity per day from yard to wagon (train/day)	0.8014	0.8014	0.8014
Cargo handling productivity per day from yard to wagon by tons (tons/day)	1122	1122	1122
Cargo volume per ship (tons/ship)	8,750	6,667	8,000
Cargo handling time per ship from yard to wagons (days/ship)	8	6	8

4. Required Storage Area for Scrap

$$Ar = (Vr/vu)/r$$

Ar : Required area for scrap (unit: m^2)
Vr : Required storage volume (17,600 tons)
vu : Volume of cargo per unit space (1.25 tons/m^2)
r : Utilization ratio (0.667)

The resultant required storage area is about 21,500 m^2.

Appendix-11 (Oil Coke)

1. Number of Ships

$$Ns = Vo/Cs$$
$$Vp = Vo/Ns$$

Ns : Number of ships by route
Vo : Cargo handling volume of oil coke by route
Cs : The maximum capacity of ships by route
Vp : Average cargo handling volume per ship by route

Table AP.11.1 Number of ships and Cargo Handling Volume per Ship by route

Route	Unit	Constanza	Istanbul
Cargo Volume by Route	(tons)	100,000	100,000
Maxmum Capacity of Ship	(tons/ship)	13,500	13,500
Number of Ships by Rout	(ships/year)	8	8
Cargo Volume per Ship	(tons/ship)	12,500	12,500

2. Interval of Calling Ships for Same Route

$$Id = Da/Ns$$

Id : Interval of calling ships of oil coke for same route
Da : Number of annual days (365 days)
Ns : Number of ships by route

Result :

Constanza : 46 days
Istanbul : 46 days

3. Calculation of Cargo Handling Time

3-1. From wagons of train to the apron of open yard

$$Tt = Vs/Vd$$
$$Vd = Nd \times Vt$$
$$Vt = Nw \times Vw$$

Tt : Cargo handling time per ship between wagons and hoppers at open yard (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from wagons to hoppers (tons/day)
Nd : Productivity of cargo handling from wagons to hoppers (unit: trains/day)

Vt : Cargo volume per train (unit: tons/train)
Nw : Number of wagons per train (unit: wagons/train)
Vw : Cargo volume per wagon (unit: tons/wagon)

Table AP.11.2 Cargo Handling Time per Ship Wagons of Train to Hopper

Port	Constanza	Istanbul
Number of Wagons per train (wagons/train)	30	30
Cargo Volume per Wagon (tons/wagon)	20	20
Cargo Volume per Train (tons/train)	600	600
Productivity of Cargo Handling from Wagons to Hopper (train/day)	3	3
Cargo Hanndling Volume per day from Wagons to Hopper (tons/day)	1,800	1,800
Cargo Volume per Ship (tons/ship)	12,500	12,500
Cargo Handling Time per Ship between Wagons and Hopper (days)	7	7

3-2. From apron on the quay to the ship

$$Ts = Vs/V_{Ld}$$
$$V_{Ld} = C_L \times N_L \times Tw \times e$$

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
V_{Ld} : Cargo handling productivity between ship and apron on the quay (unit: tons/day)
C_L : Capacity of Loader (unit: tons/hour)
N_L : Number of Loader
Tw : Working hours per day (16 hours)
e : Cargo handling efficiency including Working ratio (0.64)

Table AP.11.3 Cargo Handling Time per Ship from Apron to Ship

Route	Constanza	Istanbul
Capacity of Loader (ton/hour)	150	150
Number of Loader (unit)	2	2
Working time per day (hour/day)	16	16
Cargo handling efficency	0.64	0.64
Cargo Handling Productivity between Ship and Apron (tons/day)	3,072	3,072
Cargo Volume per Ship (tons/ship)	12,500	12,500
Cargo Handling Time per Ship between Ship and Apron (days)	5.0	5.0

4. Required Storage Area for Oil Coke

$$Ar = (Vr/vu)/r$$

Ar : Required area for oil coke (unit:m^2)
Vr : Required storage volume (19,500 tons)
vu : Volume of cargo per unit space (2 tons/m^2)
r : Utilization ration (0.667)

The resulting minimum required storage area is about 15,000 m^2.

Appendix-12 (Sulphur)

1. Number of Ships

$$Ns = Vsu/Cs$$
$$Vs = Vsu/Ns$$

Ns : Number of ships by route
Vsu : Cargo handling volume of sulphur by route
Cs : The Maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.12.1 Number of ships and Cargo Handling Volume per Ship by route

Route		Casablanca	Tunis	Marsaille
Cargo volume	(tons)	250,000	150,000	100,000
Maximum Capacity of Ship	(tons/ship)	36,000	36,000	36,000
Number of Ships	(ships/year)	7	5	3
Average cargo handling volume per ship	(tons/ship)	35,714	30,000	33,333

2. Interval of Calling Ships for Same Route

$$Isu = Da/Ns$$

Isu : Interval of calling ships of sulphur for same route
Da : Number of annual days (365 days)
Ns : Number of ships by route

Result:

Casablanca : 52 days
Tunis : 73 days
Marseille : 122 days

3. Calculation of Cargo Handling Time

3-1. From wagons of train to the apron of open yard

$$Tt = Vs/Vd$$
$$Vd = Nd \times Vt$$
$$Vt = Nw \times Vw$$

Tt : Cargo handling time per ship between wagons and hoppers at open yard (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from wagons to hoppers (tons/day)
Nd : Productivity of cargo handling from wagons to hoppers

(5trains/days)

Vt : Cargo volume per train (unit: tons/train)

Nw : Number of wagons per train (30 wagons/train)

Vw : Cargo volume per wagon (50 tons/wagon)

Table AP.12.2 Cargo Handling Time per Ship from Wagons of Train to Hopper

Route	Casablanca	Tunis	Marsaille
Number of wagons per train (Wagons/train)	28	28	28
Cargo volume per wagon (tons/wagon)	50	50	50
Cargo volume per train (tons/train)	1,400	1,400	1,400
Productivity of cargo handling from wagons to hoppers (trains/day)	5.4	5.4	5.4
Cargo handling volume per day from wagon to hoppers (tons/ship)	7,560	7,560	7,560
Cargo volume per ship (tons/ship)	35,714	30,000	33,333
Cargo handling time per ship between wagons and hopper (day)	5	4	5

3-2. From apron on the quay to the ship

$$Ts = Vs/V_{Ld}$$

$$V_{Ld} = C_L \times N_L \times Tw \times e$$

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)

Vs : Cargo volume per ship (unit: tons/ship)

VLd : Cargo handling productivity between ship and apron on the quay (unit: tons/day)

CL : Capacity of Loader (unit: tons/hour)

NL : Number of Loader

Tw : Working hours per day (16 hours)

e : Cargo handling efficiency including Working ratio (0.64)

Table AP.12.3 Cargo Handling Time per Ship from Apron on the Quay to Ship

Route	Casablanca	Tunis	Marsaille
Cargo volume per ship (tons/ship)	35,714	30,000	33,333
Capacity of loader (tons/hour)	400	400	400
Number of loader (unit)	2	2	2
Working hour per day (hour/day)	16	16	16
Cargo handling efficency	0.64	0.64	0.64
Cargo handling productivity between ship and apron on the qu (tons/day)	8192	8192	8192
Cargo handling time per ship between ship and apron on the qu (day/ship)	5	4	5

4. Required Storage Area for Sulphur

$$Ar = (Vr/vu)/r$$

Ar : Minimum required area for powder sulphur (unit: m^2)
Vr : Required storage volume (45,000 tons)
vu : Volume of cargo per unit space (2 tons/m^2)
r : Utilization ration (0.667)

The resulting required storage area is about 34,000 m^2.

Appendix-13 (Fertilizer(Export))

1. Number of Ships

$$Ns = Vfe/Cs$$
$$Vs = Vfe/Ns$$

Ns : Number of ships by route
Vfe : Cargo handling volume of export fertilizer by route
Cs : The maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.13.1 Number of Ships and Cargo Handling Volume per Ship by route

Route		Bombay	Marsaille	Algier	Beirut	Piraeus
Cargo volume	(tons)	204,000	51,000	102,000	51,000	102,000
Maximum Capacity of Ship	(tons/ship)	36,000	36,000	36,000	9,000	28,980
Number of Ships	(ships/year)	6	2	3	6	4
Average cargo handling volume per ship	(tons/ship)	34,000	25,500	34,000	8,500	25,500

2. Interval of Calling Ships for Same Route

$$Ife = Da/Ns$$

Ife : Interval of calling ships for export fertilizer for same route
Da : Number of annual days (365 days)
Ns : Number of ships by route

Result:

Bombay : 61 days
Marseille : 183 days
Algiers : 122 days
Beirut : 61 days
Piraeus : 91 days

3. Calculation of Cargo Handling Time

3-1. From wagons of train to the receiving facility

$$Tt = Vs/Vd$$
$$Vd = Nd \times Vt$$
$$Vt = Nw \times Vw$$

Tt : Cargo handling time per ship between wagons and hoppers at receiving facility (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from wagons to hoppers (tons/day)

Nd : Productivity of cargo handling from wagons to hoppers (4 trains/days)
Vt : Cargo volume per train (unit: tons/train)
Nw : Number of wagons per train (30 wagons/train)
Vw : Cargo volume per wagon (50 tons/wagon)

Table AP.13.2 Cargo Handling Time per Ship from Wagon of Train to Hoppers

Route		Bombay	Marsaille	Algier	Beirut	Piraeus
Number of wagons per train	(wagons/train)	28	28	28	28	28
Cargo volume per wagon	(tons/wagon)	50	50	50	50	50
Cargo volume per train	(tons/train)	1,400	1,400	1,400	1,400	1,400
Productivity of cargo handling from wagons to hoppers	(trains/day)	4.3	4.3	4.3	4.3	4.3
Cargo handling volume per day from wagon to hoppers	(tons/ship)	6,020	6,020	6,020	6,020	6,020
Cargo volume per ship	(tons/ship)	34,000	25,500	34,000	8,500	25,500
Cargo handling time per ship between wagons and hopper	(day)	6	5	6	2	5

3-2. From apron on the quay to the ship

$$Ts = Vs/V_{Ld}$$
$$V_{Ld} = C_L \times N_L \times Tw \times e$$

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
V_{Ld} : Cargo handling productivity between ship and apron on the quay (unit: tons/day)
C_L : Capacity of Loader (150 tons/hour)
N_L : Number of Loader (Bombay: 4, Marseille: 3, Algiers: 4, Beirut: 2, Piraeus: 3)
Tw : Working hours per day (24 hours)
e : Cargo handling efficiency including Working ratio (0.6)

Table AP.13.3 Cargo Handling Time per Ship from Apron on the Quay to Ship

Route		Bombay	Marsaille	Algier	Beirut	Piraeus
Cargo volume per ship	(tons/ship)	34,000	25,500	34,000	8,500	25,500
Capacity of loader	(tons/hour)	150	150	150	150	150
Number of loader	(unit)	4	3	4	2	3
Working hour per day	(hour/day)	24	24	24	24	24
Cargo handling efficency		0.6	0.6	0.6	0.6	0.6
Cargo handling productivity between ship and apron on the quay	(tons/day)	8,640	6,480	8,640	4,320	6,480
Cargo handling time per ship between ship and apron on the quay	(day/ship)	4	4	4	2	4

4. Required Storage Area for Export Fertilizer

$$Ar = (Vr/vu)/r$$

Ar : Minimum required area for export fertilizer (unit: m^2)
Vr : Required storage volume (55,000 tons)
vu : Volume of cargo per unit space (4.0 tons/m^2)
r : Utilization ration (0.667)

The resulting required storage area is about 21,000 m^2.

Appendix-14 (General Cargo (Fire brick and Others))

1. Number of Ships

$$Ns = Vip/Cs$$
$$Vs = Vip/Ns$$

Ns : Number of ships by route
Vip : Cargo handling volume of fire bricks and others by rote
Cs : The maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.14.1 Number of Ships and Cargo Handling Volume per Ship by route

Route		Constanza	Marseille
Annual cargo handling volume	(tons/year)	75,000	75,000
Maximum capacity of ships	(tons/ship)	9,000	9,000
Number of calling ships in a year	(ships/year)	9	9
Average cargo handling volume per Ship	(tons/ship)	8,334	8,334

2. Interval of Calling Ships for Same Route

Interval (days) = 365 days / (Number of ships by route)

Result:

Constanza : 41 days
Marseille : 41 days

3. Calculation of Cargo Handling Time

3-1. From ship to the apron on the quay

$$Ts = Vs/Vd$$
$$Vd = Cu \times Nu \times tw \times e$$

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from ship to apron (unit: tons/day)
Cu : Cargo handling volume per hour per crane from ship to apron (60 tons/hour)
Nu : Number of cranes (3 cranes)
tw : Working time per day (24 hours)
e : Working ratio (0.75)

Table AP.14.2 Cargo Handling Time per Ship from Ship to Apron on the Quay

Route		Constanza	Marseille
Cargo volume per ship	(tons/ship)	8334	8334
Cargo volume per sling	(tons/sling)	3	3
Number of cranes	(unit)	3	3
Working hour	(hour/day)	24	24
Cargo handling efficency		0.75	0.75
Cargo handling volume per hour	(tons/hour)	60	60
Cargo handling productivity	(tons/day)	3240	3240
Cycle time of crane	(minut/time)	3	3
Cargo handling time	(day/ship)	2.6	2.6

3-2. From Loading Yard to Wagons of Train

$$Tr = Vs/V_{Ld}$$
$$V_{Ld} = Nt \times Vt$$
$$Nt = (tw/Tt) \times r$$
$$Tt = (Nw \times Tw)/Nc$$
$$Tw = Vw/C_L$$
$$Vt = Nw \times Vw$$

Tr : Cargo handling time per ship from loading yard to wagons of train (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
V_{Ld} : Cargo handling productivity per day from loading yard to wagons (unit: tons/day)
Nt : Cargo handling productivity per day from loading yard to wagons by train (unit: trains/day)
Vt : Cargo volume per train (unit: tons/train)
tw : Working time per day (24 hours/day)
Tt : Cargo handling time per train between loading yard to train (unit: hours/train)
r : Operating efficiency (0.7)
Nw : Number of wagons per train (30 wagons/train)
Nc : Number of cranes (2 cranes)
Tw : Cargo handling time per wagon between loading yard to wagon (unit: hours/wagon)
Vw : Capacity of wagon (50 tons/wagon)
C_L : Cargo handling volume of crane per hour (72 tons/hour/crane)

Table AP.14.3 Cargo Handling Time from Loading yard to Wagons of Train

Route		Constanza	Marseille
Number of wagons per train	(wagons)	30	30
Cargo volume per cycle	(tons/cycle	3	3
Capacity of wagon	(tons)	50	50
Cargo volume per train	(tons)	1500	1500
Cargo handling efficency		0.7	0.7
Productivity per hour	(tons/hour)	72	72
Cycle time of crane	(minute/time	2.5	2.5
Productivity of loading	(wagons/hou	1.44	1.44
Number of cranes	(unit)	2	2
Working houres per day	(houres/day)	24	24
Number of train per day	(train/day)	1.6128	1.6128
Loading volume per day	(tons/day)	2419.2	2419.2
Cargo volume per ship	(tons/ship)	8334	8334
Loading time per ship	(days/ship)	4	4

4. Required Storage Area for Fire Bricks and Others

$$Ar = (Vr/vu)/r$$

Ar : Required area for fire bricks and others (unit: m^2)
Vr : Required storage volume (20,000 tons)
vu : Volume of cargo per unit space (4.5 tons/m^2)
r : Utilization ration (0.667)

The resultant required storage area is approximately 6,500 m^2.

Appendix-15 (General Cargo (Bagged Fertilizer))

1. Number of Ships

$$Ns = Vip/Cs$$
$$Vs = Vip/Ns$$

Ns : Number of ships by route
Vip : Cargo handling volume of import bagged fertilizer by route
Cs : The maximum capacity of ships by route
Vs : Average cargo handling volume per ship by route

Table AP.15.1 Number of Ships and Cargo Handling Volume per Ship by route

Route		Constanza	Marseille
Annual cargo handling volume	(tons/year)	105,000	105,000
Maximum capacity of ships	(tons/ship)	12,000	12,000
Number of calling ships in a year	(ships/year)	9	9
Average cargo handling volume per Ship	(tons/ship)	11,667	11,667

2. Interval of Calling Ships for Same Route

Interval(days) = 365days/(Number of ships by route)

Result:

Constanza : 41 days
Marseille : 41 days

3. Calculation of Cargo Handling Time

3-1. From ship to the apron on the quay

$$Ts = Vs/Vd$$
$$Vd = Cu \times Nu \times t_w \times e$$

Ts : Cargo handling time per ship between ship and apron on the quay (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
Vd : Cargo handling volume per day from ship to apron (unit: tons/day)
Cu : Cargo handling volume per hour per crane from ship to apron (unit: tons/hour)
Nu : Number of cranes
t_w : Working time per day (24 hours)
e : Working ratio (0.75)

Table AP.15.2 Cargo Handling Time per Ship from Ship to Apron on the Quay

Route		Constanza	Marseille
Cargo volume per ship	(tons/ship)	11,667	11,667
Cargo volume per sling	(tons/sling)	2.5	2.5
Number of cranes	(unit)	3	3
Working time	(hour/day)	24	24
Cargo handling efficency		0.75	0.75
Cargo handling volume per hour	(tons/hour)	50	50
Cargo handling productivity	(tons/day)	2,700	2,700
Cycle time of crane	(minut/time)	3	3
Cargo handling time	(day/ship)	5	5

3-2. From shed to trucks

$$T_L = Vs/V_L$$
$$V_L = N_T \times V_T$$
$$N_T = (t_w/Tt) \times N_H \times r$$
$$Tt = V_T/V_h$$
$$V_h = (60/Cs) \times Vc \times e$$

T_L : Cargo handling time per ship from shed to trucks (unit: days)
Vs : Cargo volume per ship (unit: tons/ship)
V_L : Cargo handling productivity per day from shed to trucks (Unit: tons/day)
N_T : Number of trucks for transportation to consignees per day (unit: trucks/day)
N_H : Number of cargo handling point (2 points)
V_T : Capacity of truck (15 tons/train)
t_w : Working time per day (24 hours/day)
Tt : Cargo handling time per truck between shed and truck (unit: hours/train)
r : Working ratio (0.8)
V_h : Cargo handling productivity per hour from shed to trucks (unit: tons/hour)
Cs : Cycle time of fork-lift truck between shed and truck for loading (4 minutes/cycle)
Vc : Cargo handling volume per cycle of fork-lift truck (2.5 tons/cycle)
e : Operating ratio (0.8)

Table AP.15.3 Cargo Handling Time per ship from Shed to Trucks

Route		Constanza	Marseille
Cycle time of fork-lift	(minute/time)	4	4
Cargo volume per cycle	(tons/cycle)	2.5	2.5
Capacity of Truck	(tons/truck)	15	15
Productivity per hour	(tons/hour)	30	30
Working ratio		0.8	0.8
Cargo handling time per truck	(hours/truck)	0.5	0.5
Working houres per day	(houres/day)	24	24
Cargo handling efficency		0.8	0.8
Number of cargo handling point		2	2
Number of truck per day	(truck/day)	76.8	76.8
Loading volume per day	(tons/day)	1,152	1,152
Cargo volume per ship	(tons/ship)	11,667	11,667
Loading time per ship	(days/ship)	11	11

4. Required Storage Area for Import Bagged Fertilizer

$$Ar = (Vr/vu)/r$$

Ar : Required area for import bagged fertilizer (unit: m^2)
Vr : Required storage volume (28,000 tons)
vu : Volume of cargo per unit space (4.0 tons/m^2)
r : Utilization ration (0.667)

The resultant minimum required storage area of is about 10,000 m^2.

Appendix 16

16-1 Required Number of Employees at Steel Terminal

Terminal manager:1
- Secretary:1
- Driver:1

1.Administration Department(46-52)
- Manager:1
- General affairs section:about 5
- Accounting section:4 or 5
- Guard section:36 or 41

2.Operation Department(137-140)
- Manager:1
- Planning section:about 7 or 8
- Pellet terminal section:about 57
- Scrap terminal section:about 67
- Documentation section:5 or 7

3.Maintenance Department(14-15)
- Manager:1
- Equipment and facilities section:about 8
- Electricity section:5 or 6

Total:200 - 210

16-2 Required Number of Employees at Phosphate Terminal

Director(1)

1.Secretariat(3)

2.Technical Department(139)
- Manager:1
- Maintenance section:43
- Loading/storing section:85
- Laboratory section:8
- Industrial security section:2

3.Administrative Department(40)
- Manager:1
- Service section:14
- Working affairs section:10
- Garage section:15

4.Financial Department(14)
- Manager:1
- Financial affairs section:6
- Accuracy section:2
- Warehouses section:5

5.Commercial Department(5)
- Manager:1
- Commercial affairs section:2
- Clearance section:2

6.Inventory Department(5)
Manager:1
Material section:2
General accounting section:2
7.Planning Division(2)
8.Internal Observation Office(1)
Total: 210

16-3 Required Number of Employees at Export Fertilizer Terminal
Terminal manager:1
Secretary:1
Driver:1
1.Administration Department(28-34)
Manager:1
General affairs section:about 5
Accounting section:4 or 5
Guard section:18 or 23
2.Operation Department(65-68)
Manager:1
Planning section:4 or 5
Research section:2 or 3
Terminal section:about 54
Documentation section:4 or 5
3.Maintenance Department(14-15)
Manager:1
Equipment and facilities section:about 8
Electricity section:5 or 6
Total:110 - 120

16-4 Required number of employees at Cement clinker terminal
Terminal manager:1
Secretary:1
Driver:1
1.Administration Department(27-33)
Manager:1
General affairs section:about 5
Accounting section:4 or 5
Guard section:17 or 22
2.Operation Department(56-59)
Manager:1
Planning section:4 or 5
Research section:2 or 3
Terminal section:about 45
Documentation section:4 or 5

3.Maintenance Department(14-15)
Manager:1
Equipment and facilities section:about 8
Electricity section:5 or 6
Total:100 - 110

16-5 Required Number of Employees at Sulphur Terminal

Required number of employees for performing above functions as follows:
Terminal manager:1
Secretary:1
1.Administration Department(10-11)
Manager:1
General affairs section:about 5
Accounting section:4 or 5
2.Operation Department(89-92)
Manager:1
Research section:2 or 3
Planning section:4 or 5
Terminal section:about 80
Documentation section:2 or 3
3.Maintenance Department(14-15)
Manager:1
Equipment and facilities section:about 8
Electricity section:5 or 6
Total:115 - 120

Appendix 17 (Port Management and Operation)

-Calculation of Number of Cargo-Handling Workers-

I. Cargo-handling for Conventional General Cargo Ship

1. Latakia Port

(A) Commodity Group

(a) Foodstuffs or Agriculture Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Case

(b) Steel & Steel Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Bundle, roll and case

(c) Wood & Wood Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Bundle, case

(d) Car, machine and equipment
- Type of Vessel:General Cargo Vessel
- Major packing style:Case and unpacked

(e) Chemical Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Bag and drum

(f) Various(other conventional break bulk cargo)
- Type of Vessel:General Cargo Vessel
- Major packing style:Case, carton and bag, etc.

(B) Calculation

(a) Ratio of Number of Required Shifts for each Commodity Group to Total Number of Required Shifts
- Formulas

$Scy = \{(Vp/Pv)/Tws\}/Ngc$

Scy : Number of required shifts for the commodity group
Vp : Cargo-handling volume for the commodity group in 2010
Pv : Cargo-handling productivity per hour per gang
Tws : Working hours per shift(8 hours/shift)
Ngc : Number of gangs per shift per ship for the commodity group

$Rsy = Scy/Sy$

Rsy : Ratio of number of required shifts for each commodity group to total number of required shifts
Scy : Number of required shifts for the commodity group
Sy : Total number of required shifts

- Results of the calculation are shown in Table A.17-1 for Master Plan and Table A.17-10 for Short-term Plan.

(b) Average Number of Required Gangs per Day for each Commodity Group
- Formulas

$Nsc = Bn \times Nsa \times (Rb/100) \times Rsy$

Nsc : Average number of required shifts per day for the commodity group

Bn : Number of berth
Nsa : Average number of shifts per ship per day
Rb : Average berth occupancy rate in 2010
Rsy : Ratio of number of required shifts for the commodity group to total number of required shifts

Gnc = Nsc x Ngc

Gnc : Average number of required gangs per day for the commodity group
Nsc : Average number of required shifts per day for the commodity group
Ngc : Number of required gangs per vessel per shift for the commodity group

- Results of the calculation are shown in Table A.17-2 for Master Plan and Table A.17-11 for Short-term Plan.

(c) Number of Required Workers per Day for each commodity group

- Formulas

Ngy = Ngc x Nsv x Nv

Ngy : Total number of required gangs for all berthing ships in a year for the commodity group(peak condition of one day is selected for calculation)
Ngc : Number of gangs per shift per ship for the commodity group
Nv : Annual number of ships for the commodity group

Nwy = Nwg x Ngy

Nwy : Total number of required workers for all berthing ships in a year for the commodity group(peak condition of one day is selected for calculation)
Nwg : Number of workers(including workers at storage area) per gang for the commodity group
Ngy : Total number of required gangs in a day during peak condition for all berthing ships in a year for the commodity group

Nsw = Ntw/Ntg

Nsw : Number of standard workers per gang
Ntw : Sum of Nwy for all commodity of general cargo vessels
Ntg : Sum of Ngy for all commodity of general cargo vessels

Nwc = Nsw x Gnc

Nwc : Number of required workers per day for the commodity group
Nsw : Number of standard workers per gang
Gnc : Average number of required gangs per day for the commodity group

- Results of the calculation are shown in Table A.17-3 for Master Plan and Table A.17-12 for Short-term Plan.

2. Tartous Port

(A) Commodity Group

(a) Foodstuffs or Agriculture Products

- Type of Vessel:General Cargo Vessel

- Major packing style:Case

(b) Steel & Steel Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Bundle, roll and case

(c) Wood & Wood Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Bundle, case

(d) Machine and equipments
- Type of Vessel:General Cargo Vessel
- Major packing style:Case and unpacked

(e) Chemical Products
- Type of Vessel:General Cargo Vessel
- Major packing style:Bag and drum

(f) Various(other conventional break bulk cargo)
- Type of Vessel:General Cargo Vessel
- Major packing style:Case, carton and bag, etc.

(B) Calculation

Method of calculation for number of cargo handling workers is the same as for Latakia Port.

Table A.17-4, A.17-5 and A.17-6 for Master Plan and Table A.17-13, A.17-14 A.17-15 for Short-term Plan show calculation results for ratio of number of required shifts for each commodity group to total number of required shifts, average number of required gangs per day for each commodity group and number of required workers per day for each commodity group, respectively.

3. New Port

(A) Commodity Group

(a) Fire Brick and Related Products of Steel Industry
- Type of Vessel:General Cargo Vessel
- Major packing style:Case and unpacked

(b) Oil Coke and Others
- Type of Vessel:General Cargo Vessel
- Major packing style:Bulk and case

(c) Fertilizer and Others
- Type of Vessel:General Cargo Vessel
- Major packing style:Bag and case

(B) Calculation

Table A.17-7, A.17-8 and A.17-9 show calculation results for ratio of number of required shifts for each commodity group to total number of required shifts, average number of required gangs per day for each commodity group and number of required workers per day for each commodity group, respectively.

According to Table A.17-9, the number of required cargo-handling workers per day for each commodity group is less than the number of required cargo-handling workers per shift for each commodity group. And, each group is handled at a different terminal. Therefore, the number of required cargo-handling workers per day for each commodity group is assumed to be the same as the number of workers per shift for each commodity group.

Calculation formulas are as follows:

Nwc = Ngc x Nwg

Nwc : Number of required workers per day for the commodity group
Ngc : Number of gangs per shift per ship for the commodity group
Nwg : Number of workers(including workers at storage area) per gang for the commodity group

- Result of the calculation is shown in Table A.17-16.

Table A.17-1 Number of Required Shifts for each Commodity at Latakia Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total
Cargo volume(Vp)	tons/year	452,000	617,000	500,000	281,000	250,000	1,157,000	3,257,000
Cargo-handling productivity per gang(Pv	tons/hour	50	60	60	75	35	41	-
Working hours per shift(Tws)	hours	8	8	8	8	8	8	-
Number of gangs per ship(Ngc)	gangs/shift	3	5	2	1	4	3	-
Number of shifts(Scy)	shifts/year	377	257	521	468	223	1,176	3,022
Ratio of number of required shifts(Rsy)	-	0.12	0.09	0.17	0.15	0.07	0.39	1.00

Table A.17-2 Average Number of Required Shifts per Day for each Commodity Group at Latakia Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of berths at Latakia Port(Bn)	berths	-	-	-	-	-	-	17
Average number of shifts per ship(Nsa)	shifts/day	3	3	3	3	3	3	3
Average berth occupancy rate in 2010(Ro	%	-	-	-	-	-	-	77.1
Ratio of number of required shifts(Rsy)	-	0.12	0.09	0.17	0.15	0.07	0.39	1
Average number of required shifts(Nsc)	shifts/day	4.90	3.35	6.78	6.10	2.91	15.30	39.33
Number of required gangs per vessel(Ngc	gangs/shift	About 3	About 5	About 2	About 1	About 4	About 3	About 18
Average number of required gangs(Gnc)	gangs/day	14.70	16.75	13.56	6.10	11.64	45.90	-

Table A.17-3 Number of Required Workers per Day at Latakia Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of required gangs per vessel(Ngc	gangs/shift	About 3	About 5	About	About	About 4	About 3	About 18
Number of shifts per day(Nsv)	shifts/ship	3	3	3	3	3	3	-
Annual number of ships(Nv)	ships/year	232	329	365	827	99	832	2,684
Total number of gangs per day(Ngy)	gangs/year	About 2,088	About 4,935	About 2,19	About 2,48	About 1,188	About 7,488	About 20,370
Number of workers per gang(Nwg)	workers/gang	About 12	About 21	About 1	About 1	About 15	About 15	-
Total number of workers in a year(Nwy)	workers/year	About 25,056	About103,635	About41,61	About 42,17	About17,820	About112,320	About342,617
Number of standard workers per gang(Nsw	workers/gang	-	-	-	-	-	-	About 16.8
Average number of required gangs(Gnc)	gangs/day	14.7	16.75	13.56	6.1	11.64	45.9	-
Number of required workers per day(Nwc)	workers/day	About 240	About 280	About 230	About 100	About 190	About 770	About 1,810

Table A.17-4 Number of Required Shifts for each Commodity at Tartous Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total
Cargo volume(Vp)	tons/year	512,000	1,060,000	693,000	295,000	480,000	1,188,000	4,228,000
Cargo-handling productivity per gang(Pv	tons/hour	50	60	60	75	35	41	-
Working hours per shift(Tws)	hours	8	8	8	8	8	8	-
Number of gangs per ship(Ngc)	gangs/shift	3	5	2	1	4	3	-
Number of shifts(Scy)	shifts/year	427	442	722	434	429	1,207	3,661
Ratio of number of required shifts(Rsy)	-	0.12	0.12	0.20	0.12	0.12	0.33	1.00

Table A.17-5 Average Number of Required Shifts per Day for each Commodity Group at Tartous Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of berths at Latakia Port(Bn)	berths	-	-	-	-	-	-	15
Average number of shifts per ship(Nsa)	shifts/day	3	3	3	3	3	3	3
Average berth occupancy rate in 2010(Rb	%	-	-	-	-	-	-	81.8
Ratio of number of required shifts(Rsy)	-	0.12	0.12	0.2	0.12	0.12	0.33	1
Average number of required shifts(Nsc)	shifts/day	4.29	4.44	7.26	4.36	4.31	12.14	36.80
Number of required gangs per vessel(Ngc	gangs/shift	About 3	About 5	About 2	About 1	About 4	About 3	About 18
Average number of required gangs(Gnc)	gangs/day	12.87	22.20	14.52	4.36	17.24	36.42	-

Table A.17-6 Number of Required Workers per Day at Tartous Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of required gangs per vessel(Ngc	gangs/shift	About 3	About 5	About 2	About	About 4	About 3	About 18
Number of shifts per day(Nsv)	shifts/ship	3	3	3	3	3	3	-
Annual number of ships(Nv)	ships/year	144	475	499	568	242	696	2,624
Total number of gangs in a year(Ngy)	gangs/year	About 1,296	About 7,125	About 2,994	About 1,704	About 2,904	About 6,264	About 22,287
Number of workers per gang(Nwg)	workers/gang	About 12	About 21	About 19	About 17	About 15	About 15	-
Total number of workers in a year(Nwy)	workers/year	About 15,552	About149,625	About56,886	About 28,968	About43,560	About 93,960	About388,551
Number of standard workers per gang(Nsw	workers/gang	-	-	-	-	-	-	About 17
Average number of required gangs(Gnc)	gangs/day	12.87	22.21	14.52	4.36	17.24	36.43	-
Number of required workers per day(Nwc)	workers/day	About 220	About 270	About 240	About 70	About 290	About 600	About 1,810

Table A.17-7 Number of Required Shifts for each Commodity at New Port

Item	Unit	Fire Brick and Related produc of steel Ind.	Oil Coak and Others	Firtilizer and Others	Total
Cargo volume(Vp)	tons/year	150,000	200,000	210,000	560,000
Cargo-handling productivity per gang(Pv)	tons/hour	60	120	40	-
Working hours per shift(Tws)	hours	8	8	8	-
Number of gangs per ship(Ngc)	gangs/shift	3	5	5	-
Number of shifts(Scv)	shifts/year	104	42	131	277
Ratio of number of required shifts(Rsy)	-	0.38	0.15	0.47	1.00

Table A.17-8 Average Number of Required Shifts per Day for each Commodity Group at New Port

Item	Unit	Fire Brick and Related produc of steel Ind.	Oil Coak and Others	Firtilizer and Others	Total
Number of berths at Latakia Port(Bn)	berths	-	-	-	3
Average number of shifts per ship(Nsa)	shifts/day	2	2	2	2
Average berth occupancy rate in 2010(Rb)	%	-	-	-	37
Ratio of number of required shifts(Rsy)	-	0.38	0.15	0.47	1
Average number of required shifts(Nsc)	shifts/day	0.83	0.33	1.05	2.21
Number of required gangs per vessel(Ngc)	gangs/shift	About 3	About 5	About 5	About 13
Average number of required gangs(Gnc)	gangs/day	2.50	1.65	5.25	

Table A.17-9 Number of Required Workers per Day for each Commodity at New Port

Item	Unit	Fire Brick and Related produc of steel Ind.	Oil Coak and Others	Firtilizer and Others	Total
Number of required gangs per vessel(Ngc)	gangs/shift	About 3	About 5	About 5	About 13
Number of shifts per day(Nsv)	shifts/ship	2	2	2	2
Annual number of ships(Nv)	ships/year	17	17	18	52
Total number of gangs in a year(Ngy)	gangs/year	About 102	About 170	About 180	About 1,704
Number of workers per gang(Nwg)	workers/gang	About 16	About 15	About 17	About 48
Total number of workers in a year(Nwy)	workers/year	About 1,630	About 2,550	About3,060	About 7,240
Number of standard workers per gang(Nsw)	workers/gang	-	-	-	About 16
Average number of required gangs(Gnc)	gangs/day	2.50	1.65	5.25	-
Number of required workers per day(Nwc)	workers/day	About 40	About 27	About 84	About 150

Table A.17-10 Number of Required Shifts for each Commodity at Latakia Port in Short-term Plan

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total
Cargo volume(Vp)	tons/year	394,000	246,000	264,000	221,000	120,000	961,000	2,206,000
Cargo-handling productivity per gang(Pv)	tons/hour	50	60	60	75	35	41	-
Working hours per shift(Tws)	hours	8	8	8	8	8	8	-
Number of gangs per ship(Ngc)	gangs/shift	3	5	2	1	4	3	-
Number of shifts(Scy)	shifts/year	328	103	275	368	107	977	2,158
Ratio of number of required shifts(Rsy)	-	0.15	0.05	0.13	0.17	0.05	0.45	1.00

Table A.17-11 Average Number of Required Shifts per Day for each Commodity Group at Latakia Port in Short-term Plan

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of berths at Latakia Port(Bn)	berths	-	-	-	-	-	-	14
Average number of shifts per ship(Nsa)	shifts/day	3	3	3	3	3	3	3
Average berth occupancy rate in 2010(Rb)	%	-	-	-	-	-	-	78
Ratio of number of required shifts(Rsy)	-	0.15	0.05	0.13	0.17	0.05	0.45	1.00
Average number of required shifts(Nsc)	shifts/day	4.91	1.63	4.26	5.57	1.64	14.74	32.75
Number of required gangs per vessel(Ngc)	gangs/shift	About 3	About 5	About 2	About 1	About 4	About 3	About 18
Average number of required gangs(Gnc)	gangs/day	14.70	8.15	8.52	5.57	6.56	42.72	-

Table A.17-12 Number of Required Workers per Day at Latakia Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of required gangs per vessel(Ngc)	gangs/shift	About 3	About 5	About 2	About 1	About 4	About 3	About 18
Number of shifts per day(Nsv)	shifts/ship	3	3	3	3	3	3	-
Annual number of ships(Nv)	ships/year	203	131	193	651	48	692	1,918
Total number of gangs per day(Ngy)	gangs/year	About 1,827	About 1,965	About 1,158	About 1,953	About 576	About 6,228	About 13,707
Number of workers per gang(Nwg)	workers/gang	About 12	About 21	About 19	About 1	About 15	About 15	-
Total number of workers in a year(Nwy)	workers/year	About 21,924	About 41,265	About22,002	About 33,201	About 8,640	About 93,420	About220,452
Number of standard workers per gang(Nsw)	workers/gang	-	-	-	-	-	-	About 16.1
Average number of required gangs(Gnc)	gangs/day	14.7	8.15	8.52	5.57	6.56	42.72	-
Number of required workers per day(Nwc)	workers/day	About 240	About 125	About 130	About 90	About 105	About 710	About 1,400

Table A.17-13 Number of Required Shifts for each Commodity at Tartous Port in Short-term Plan

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total
Cargo volume(Vp)	tons/year	497,000	546,000	351,000	289,000	290,000	961,000	2,934,000
Cargo-handling productivity per gang(Pv)	tons/hour	50	60	60	85	35	41	-
Working hours per shift(Tws)	hours	8	8	8	8	8	8	-
Number of gangs per ship(Ngc)	gangs/shift	3	5	2	1	4	3	-
Number of shifts(Scy)	shifts/year	414	228	366	425	259	977	2,669
Ratio of number of required shifts(Rsy)	-	0.15	0.08	0.14	0.16	0.10	0.37	1.00

Table A.17-14 Average Number of Required Shifts per Day for each Commodity Group at Tartous Port in Short-term Plan

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of berths at Latakia Port(Bn)	berths	-	-	-	-	-	-	14
Average number of shifts per ship(Nsa)	shifts/day	3	3	3	3	3	3	3
Average berth occupancy rate in 2010(Rb)	%	-	-	-	-	-	-	60
Ratio of number of required shifts(Rsy)	-	0.15	0.08	0.14	0.16	0.10	0.37	1.00
Average number of required shifts(Nsc)	shifts/day	3.80	2.00	3.50	4.00	2.50	9.30	25.10
Number of required gangs per vessel(Ngc)	gangs/shift	11.4	About 5	About 2	About 1	About 4	About 3	About 18
Average number of required gangs(Gnc)	gangs/day	14.70	10.00	7.00	4.00	10.00	27.90	-

Table A.17-15 Number of Required Workers per Day at Tartous Port

Item	Unit	Foodstuffs and Agriculture products	Steel & Steel products	Wood & Wood products	Car, Machine and Equipment	Chemical products	Others (Various)	Total (or Average)
Number of required gangs per vessel(Ngc)	gangs/shift	About 3	About 5	About 2	About 1	About 4	About 3	About 18
Number of shifts per day(Nsv)	shifts/ship	3	3	3	3	3	3	-
Annual number of ships(Nv)	ships/year	140	244	253	558	274	531	2,000
Total number of gangs per day(Ngy)	gangs/year	About 1,260	About 3,660	About 1,518	About 1,674	About 3,288	About 4,779	About 16,179
Number of workers per gang(Nwg)	workers/gang	About 12	About 21	About 19	About 17	About 15	About 15	-
Total number of workers in a year(Nwy)	workers/year	About 15,120	About 76,860	About28,842	About 28,458	About 49,320	About 71,685	About270,285
Number of standard workers per gang(Nsw)	workers/gang	-	-	-	-	-	-	About 17
Average number of required gangs(Gnc)	gangs/day	11.4	10.00	7	4	10	27.9	-
Number of required workers per day(Nwc)	workers/day	About 195	About 170	About 120	About 70	About 170	About 475	About 1,200

Table A. 17-16 Number of Required Workers per Day at New Port

Item	Unit	Fire Brick and Related produc of steel Ind.	Oil Coak and Others	Firtilizer and Others	Total
Number of required gangs per vessel(Ngc)	gangs/shift	About 3	About 5	About 5	About 13
Number of workers per gang(Nwg)	workers/gang	About 16	About 15	About 17	-
Number of required workers per day(Nwc)	workers/day	About 47	About 73	About 90	About 210

II. Number of Cargo-handling Workers at Exclusive Terminal in New Port

1. Iron Terminal

1.1 Scrap

Ship/Apron
Number of cranes:3 Number of gangs:3, 33 workers
For 1 gang
Crane driver 2, Watcher(foreman) 1,
Worker in the hold 4
Worker on apron 4

Transportation(Apron/yard) 9 drivers
3 trucks/crane
Number of drivers 3

Yard 2 cranes/berth 8 workers + 1 Watcher = 9 Workers
For 1 crane
Number of crane drivers: 2
Number of workers: 2,

Trucks/Train 2 cranes/train 14 workers
For 1 crane
Number of crane drivers: 2
Number of workers: on truck 2 on the yard 2
Watcher(worker) 1

Transportation(Yard/train station) 2 truck/crane, 2 drivers
Number of drivers of truck per crane: 1

Shift
Ship/Apron: 1 shift/ship/day
Yard/trucks (land side): 1 shift/day

Total per terminal
33+9+9+14+2=67 Workers

1.2 Pellet

Ship/Apron 6 workers x 2 unloader = 12 workers/shift
2 unloader, 1 shovel loader/unloader (in the hold)
For 1 unloader
Driver of unloader: 2
Worker in the hold; 2(including shovel loader driver)
on the apron(dust man): 1
Watcher(foreman): 1

At yard
3 stacker cum reclaimers 9 workers/shift
For 1 stacker cum reclaimers
Driver of stacker cum reclaimer: 2 drivers/stacker
Worker: 1 workers/stacker

At Loading Facility to train 8 workers/shift
2 loader at loading facility
For 1 loader
Driver of loader: 2 driver/loader
Worker(dust man): 1 worker/loader
Watcher(foreman): 1 worker/loader

Operation of Belt Conveyor 3 workers/shift
Operator: 2 operator/shift
Watcher: 1 worker/shift

Shift
Cargo handling at apron: 1 shift/ship/day
Cargo handling at loading facility (land side): 3 shift/day

Total
12+{6+(3x3)}+(8x3)+(2x3)=57 workers

2. Fertilizer Terminal(Export Fertilizer)

[Apron/Ship] Number of Loaders: 3(3 gangs) 15 Workers
For 1 gang
Crane driver 2,
Worker at apron: 2
Watcher(foreman): 1

[Transportation] 3 trucks per loader, total 9 tucks, 9 drivers
For 1 loader
Truck driver: 1 driver x 3 trucks = 3 drivers

[Shed] Number of loaders: 3 3 gangs per shift 6 Workers
For 1 gang (with 1 shovel loader)
Driver of shovel loader: 1
Worker on truck:1

[Belt conveyor] 5 Workers
Driver of belt conveyor: 2
Watcher at shed: 3 (1 Watcher per shed)

[Reciving Facility] 1 facility per terminal 3 Workers
Worker: 2
Watcher(signal man): 1 Signal to locomotion

[Total]
Ship/Apron: 15 workers
Transportation: 9 drivers
Shed: 6 workers
Belt conveyor: 5 workers/shift x 3 shift = 15 workers
Reciving facility: 3 workers/shift x 3 shifts = 9 workers
Total : 54 Workers

3. Cement Clinker Terminal(Export)

[Apron/Ship] Number of Loaders: 2(2 gangs) 8 Workers
For 1 gang
Crane driver 2,
Watcher on board(foreman): 1
Worker at Apron(dust man): 1

[Shed] Number of sheds: 2 6 Workers: 1 shift
4 Workers: 3 shifts
Sea side work 2 gangs per shift 6 Workers/shift
For 1 gang (with 1 shovel loader)
Driver of shovel loader: 1
Worker on yard: 2

Land side work 2 gangs per shift 4 Workers/shift
For 1 gang (1 gang: 1 shed)
Watcher: 2

[Belt conveyor] 4 workers: 1 shift, 2 workers: 3 shifts
Operation for loading to ship: 4
Operation for unloading from train: 2

[Reciving Facility] 1 facility per terminal 3 Workers
Worker: 2
Watcher(signal man): 1 Signal to locomotion

[Total]
Ship/Apron: 8 workers
Shed: (6 workers/shift X 1 shift) + (4 workers/shift X 3 shifts) = 18
Belt conveyor: (4 workers x 1 shift) + (2 workers x 3 shifts)= 10 workers
Reciving facility: 3 workers/shift x 3 shifts = 9 workers
Total : 45 Workers

4 Sulphur

[Apron/Ship] Number of loaders: 3 units (3 gangs) 18 Workers
For 1 gangs
Driver of loader: 2
Watcher on the board(foreman): 1
Watcher at the apron: 1
Worker at apron: 2 (dust man: 1, for mist water: 1)

[Transportation, Shed/Apron] 3 loaders 9 drivers
For 1 loader 3 trucks per loader
Number of drivers: 3 drivers

[Shed] with 3 shovel loaders 11 workers for 3 shifts, 8 workers for 1 shift
For 1 terminal
Driver of belt conveyor: 2
Driver of shovel loader: 3 (3 driver: 1 shift)
Worker for loading to truck: 5
Watcher for dunping from belt conveyor: 9 (1 watcher per shed)

[Reciving Facility] 4 workers
For 1 terminal
Worker: 3 (assistant for unloading: 2, for mist water: 1)
Watcher(Signal man): 1

[total]
Apron/Ship: 18
Transportation(Shed/Apron): 9
Shed: (11 workers x 3 shifts) + (8 workers x 1 shift) = 41
Raciving facility: 4 workers x 3 shifts = 12
Total : 80 Workers

APPENDIX-18

Breakdown of the handling equipment cost at new grain terminal of the Latakia Port

Unit:1000 us$

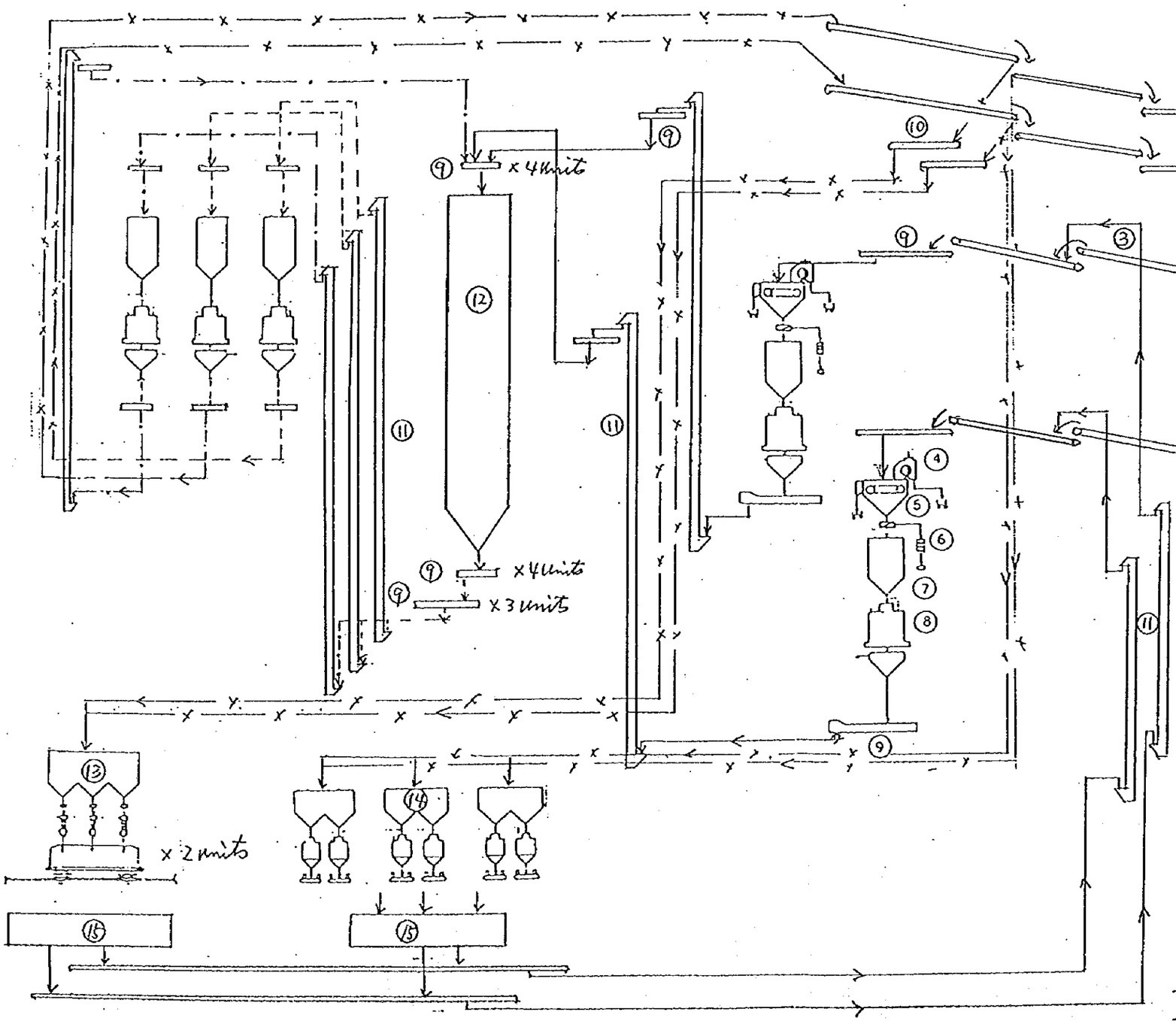
		Capacity	Length	No of line	Unit Price	Cost	Remarks
1	Belt conveyor						
a	Receiving	440	45	2	170	340	U.G
b	Berth	440	190	4	500	2000	
c	No 1 Incl	440	90	4	270	1080	
d	No 2 Incl	440	110	4	320	1280	
f	Loading	440	45	2	170	340	Wagon
2	Chain conveyors						
a	Dis	440	55	2	245	490	Top
b	Dis	440	55	2	245	490	Bot
c	Dis	440	55	2	245	490	Top
d	Take in	440	110	4	390	1560	Top
e	Take out	440	110	4	390	1560	Bot
f	Dis	440	55	3	245	735	Bot
g	Dis	440	55	3	245	735	Top
h	Dis	440	55	3	245	735	Bot
3	Bucker elevators						
a	Receiving	440	25	2	200	400	
a	Recycle	440	30	1	220	220	
b	Take in	440	40	3	280	840	
c	Take out	440	30	2	220	440	
4	Gate &Chute	LS			200	200	
5	Loading device	LS			500	500	
6	Foreign material removal	LS			200	200	
7	Fumigation	LS			400	400	
8	Dust collection	LS			1000	1000	
9	Weighing	LS			500	500	
10	Conveyor Support	LS			300	300	
11	Electric	LS			2000	2000	
12	Otheres	LS			165	165	
	Total					19000	

Breakdown of the handling equipment cost at existing grain terminal of the Latakia Port

Unit:1000 us$

	Capacity	Length	No of line	Unit Price	Cost	Remarks
1 Belt conveyor						
a Receiving	440	55	2	200	400	UG
b Berth	440	185	2	490	980	
c	220	185	2	390	780	
d	440	90	2	270	540	
e	220	90	2	215	430	
f loading	440	30	2	150	300	
g loading	440	15	2	90	180	
2 Chain conveyors						
a Dis	440	35	2	200	400	top
b Dis	440	35	2	200	400	bot
c Dis	440	35	2	200	400	top
d Take in	440	65	4	290	1160	top
e Take out	440	65	4	290	1160	bot
Dis	440	35	3	210	630	bot
Dis	440	35	3	210	630	top
Dis	440	35	3	210	630	bot
3 Bucket elevators						
a Receiving	440	40	2	290	580	
b Recycle	440	30	1	250	250	
c Recycle	440	40	1	290	290	
d Take in	440	30	2	250	500	
e Take out	440	25	2	220	440	
4 Gate and Chute	LS			180	180	
5 Receiving & Loading				450	450	
6 Foreign material removal				180	180	
7 Fumigation				360	360	
8 Dust collection				900	900	
9 Weighing				450	450	
10 Conveyor Support				150	150	
11 Electric				1900	1900	
12 Otheres				350	350	
Total					16000	

Fig Grain Conveying Lines at New Grain Terminal of the Latakia Port



① Loader cum unloaders
② Berth Belt Conveyors
③ Inclined Belt Conveyors
④ Magnetic Separators
⑤ Net Separators
⑥ Auto Sampler
⑦ Supply Hopers
⑧ Hopper Scales
⑨ Chain Conveyors
⑩ Belt Conveyors
⑪ Bucket Elevators
⑫ Silo
⑬ Supply Hopper for Wagon
⑭ Supply Hopper for Truck
⑮ Receiving Under Ground Hopper

——— Receiving lines or unloading lines
—x—Discharge lines or loading lines
—.—Recycle line