社会開発調査部報告書 NSPORT
ALGERIA

No. 12

FINAL REPORT

THE STUDY ON THE DEVELOPMENT OF THE PORTS OF ALGIERS, ORAN AND ANNABA IN ALGERIA

PART Ⅱ SHORT-TERM PLAN

FEBRUARY 1993

JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF TRANSPORT
ALGERIA

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PART II SHORT-TERM PLAN

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ABBREVIATION LIST

A	ASMIDAL	Entreprise Nationale D'Engrais et des Produits Phytosanitaires
B	B/L	Bill of Lading
C	CFS	Container Freight Station
	CFC	Conversion Factor for Consumption
	CIF	Cost, Insurence and Freight
	CLP	Container Load Plan
	CNP	Conseil National de la Planification
	CALTRAM	Compagnie Algero-Libyenne de Transport Maritime
D	DA	Algerian Dinars
	D/R	Dock Receit
	DTM	Direction des Travaux et Maintenance
	DTP	Direction des Travaux Publics
	DWT	Dead Weight Tonnage
E	E/D	Export Declaration
	ENCG	Enterprise Nationale des Corps Gias
	ENTMV	Enterprise Nationale de Transports Maritimes des Voyageurs
	EIRR	Economic Internal Rate of Returns
	EP	Enterprise Portuaire
	E/P	Export Permit
	EPAL	Entreprise Portuaire d'Alger
	EPAN	Entreprise Portuaire d'Annaba
	EPOR	Entreprise Portuaire d'Oran
	E/R	Equipment Receit
	ERCC	Entreprise des Ciments et Dirives Centre
	ERCO	Entreprise des Ciments et Dirives Ouest
	E/S	Engineering Service
F	FCL	Full Container Load Cargo
	FERPHOS	Entreprise Publique Economique du Fer et du Phosphate
	FIG	Figure

F	FIRR	Financial Internal Rate of Returns
	FOB	Free on Board
G	G.C.	General Cargo
	GDP	Gross Domestic Products
	GT	Gross Tonage
H	H	Wave Height
	HA	Hectare(s)
	HR	Hour(s)
I	IMF	International Monetary Funds
J	JY	Japanese Yen
K	KM	Kilometer(s)
	KG	Kilogram
L	LCL	Less than Container Load Cargo
	LPG	Liquefied Petroleum Gas
M	M	Meter(s)
	MARPOL	Final Act of the International on Marine Pollution
	MIN	Minute(s)
	MOE	Ministry of Equipment
	MOT	Ministry of Transport
N	NAFTAL	Entreprise Nationale de Raffinage et de Distribution de Produits Petroliers
	NGA	Niveau General Algerien
	NIES	Newly Industrializing Economies
O	OAIC	Office Algerien De L'Agrculture
	ONAB	Office National des Aliments du Betail
	ONS	Office National Des Statistiques
P	PCB	Polychlorobiphenyl

Q	Q'ty	Quantities
	QX	Quintal
R	R	Correlation Coefficient
	Ro-Ro	Roll on Roll off
S	SCF	Standard Conversion Factor
	SIDER	Enterprise Nationale de Siderurgie
	SNTF	Societe Nationale des Transports Ferroviaires
	SNTM-CNAN	Societe Nationale de Transportes Maritime & Companie Nationale Algerienne de Nav.
	SNTM-HYPROC	Societe Nationale de Transportes Maritimes des Hydrocarbures et des Produits Chimiques
	SPT	Standard Penetrian Test
	SQ.M	Square Meters
	SWL	Safety Weighting Load
T	T	Wave Period
	TEU	Twenty-foot Equivalant Unit
U	U.S.	United States of America
	US$	U.S.Dollars
V	VAT	Taxe sur la Valeur Ajoutee (consumption tax)
Y	Yr	Year
Z	ZH	Hydrographic Zero

Exchange Rate

US$1.00 = DA 21.90 = ¥ 131.25

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PART II

CHAPTER 1 SHORT-TERM PLAN FOR THE PORT OF ALGIERS

1.1 The Basic Concept of the Short-Term Plan

The Short-Term Plan is prepared as a first stage plan with a target year of 1997 for the development of the Port of Algiers. The Short-Term Plan is made within the framework of the Master Plan determined in Chapter 10 of Part I.

1.2 Usage Plan for the Port Facilities by Vessel Type

As mentioned previously in Section 10.2 of Chapter 10 of Part I, vessels calling at the Port of Algiers in the stage of the Master Plan are divided into fifteen categories. In the stage of the Short-Term Plan, the same categories are adopted. The volume of cargoes estimated by the demand forecast(see Chapter 8 of Part I) is distributed to vessels categorized in the above. The usage plan for the 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 vessels of this type through the Port of Algiers is estimated as 880 thousand tons in 1997. In making the plan for berth allocation for the vessels, the following premises are adopted.

- Total volume of cargoes: unloaded: 857 thousand tons
  loaded: 23 thousand tons
- Average cargo-handling volume: 2,000 tons per vessel
- Number of calling vessels: 440 vessels per year
- Cargo-handling productivity: 23 tons per hour
- Average dwelling time: unloaded: 40 days: loaded: 14 days
- Storage: sheds: 82%: open yards: 18%
- Land transport: by trucks: 90%: by railways: 10%

The volume of cargoes to be transported by the general cargo vessels in the year 1997 is expected to stay almost at the same level as at present, since degree of containerization will still be low at that stage. On the other hand,

other cargoes which are unsuitable to be containerized such as cereals, steel products and wood are expected to increase continuously. In order to meet the increasing demand of those cargoes, some of the existing berths which now handle general cargoes are planned to be converted to berths for handling these cargoes exclusively. Moreover, the existing seven berths presently being used for general cargoes will be eliminated after the reclamation to provide space for the yard of Terminal-1. Hence, it will be difficult to allocate enough berths for receiving general cargo vessels following the said reduction. For the general cargo vessels, in addition to the existing 13 berths, two berths are planned to be prepared at Terminal-2 which will be constructed east of the Brise-Lames Est. Taking account of the average vessel size of around 5,000 DWT, the berths with 300 meters long as a total is planned. The length is a half of the length proposed in the Master Plan. The berth allocation plan in 1997 is shown as follows:

Existing facilities

- Quay No.17(1 berth)
- Quay No.21(1 berth)
- Quay No.22(4 berths)
- Quay No.22P/Coupe(1 berth)
- Quay No.23P/Coupe(1 berth)
- Quay No.23(3 berths)
- Quay No.31-2, No.31-3(2 berths)

Terminal 2

- Quay No.1-1(1 berth)
- Quay No.1-2(1 berth)

Total:15 berths

(2) General Cargo Vessel(Cement)

The following premises are adopted:

- Total volume of cargoes unloaded from the vessels: 877 thousand tons
- Average cargo-handling volume: 21,400 tons per vessel
- Number of calling vessels: 41 vessels per year
- Cargo-handling productivity: 183 tons per hour
- Land transport: by trucks: 80%: by railways: 20%

Quay No.34 at the Wharf Skikda is planned to serve the vessels exclusively as it does at present.

(3) General Cargo Vessel(Foodstuffs or agricultural products excluding cereals)

The following premises are adopted:

- Total volume of cargoes unloaded from the vessels: 136 thousand tons
- Average cargo-handling volume: 2,100 tons per vessel
- Number of calling vessels: 65 vessels per year
- Cargo-handling productivity: 17 tons per hour
- Land transport by trucks

The following berths in the North Zone are planned to serve the vessels:

- Quay No.5(1 berth)
- Quay No.6(1 berth)
- Quay No.8(1 berth)
- Quay No.9-1(1 berth)
- Quay No.10(1 berth)
- Quay No.11-1(1 berth)

  Total:6 berths

(4) General Cargo Vessel(Wood)

The following premises are adopted:

- Total volume of cargoes unloaded from the vessels: 267 thousand tons
- Average cargo-handling volume: 5,100 tons per vessel
- Number of calling vessels: 52 vessels per year
- Average dwelling time of unloaded cargoes: 14 days
- Cargo-handling productivity: 61 tons per hour
- Land transport: by trucks: 80%: by railways: 20%

The following berths are allocated:

- Quay No.18-1(1 berth)
- Quay No.19(1 berth)
- Quay No.20-1(1 berth)

- Quay No.33-3(1 berth)

Total:4 berths for exclusive use

Existing sheds behind Quay No.20-1 on the Wharf of Ghara Djebilet need to be demolished to prepare open yards.

(5) General Cargo Vessel(Steel products)

The following premises are adopted:

- Total volume of cargoes: unloaded: 298 thousand tons
  loaded: 40 thousand tons
- Average cargo-handling volume: 4,700 tons per vessel
- Number of calling vessels: 72 vessels per year
- Average dwelling time of unloaded cargoes: 14 days
- Cargo-handling productivity: 97 tons per hour
- Land transport: by trucks: 80%: by railways: 20%

The same berths as listed in Paragraph (4) are allocated.

(6) General Cargo Vessel(Sugar)

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

- Total volume of cargoes unloaded from the vessels: 151 thousand tons
- Average cargo-handling volume: 12,400 tons per vessel
- Number of calling vessels: 12 vessels per year
- Cargo-handling productivity: 33 tons per hour
- Land transport: by trucks: 90%: by railways: 10%

The following berths are allocated:

- Quay No.6(1 berth)
- Quay No.9-1(1 berth)
- Quay No.10(1 berth)
- Quay No.11-1(1 berth)

Total:4 berths

(7) General Cargo Vessel(Animal feed)

The following premises are adopted considering the record of actual operations. Cargo-handling productivity is expected to be improved from the present level, since sheds for storing feed are now under construction just behind the Quay No.26-1 conceded to the ONAB.

- Total volume of cargoes unloaded from the vessels: 151 thousand tons
- Average cargo-handling volume: 15,200 tons per vessel
- Number of calling vessels: 10 vessels per year
- Cargo-handling productivity: 128 tons per hour
- Land transport: by trucks: 30%: by railways: 70%

(8) Ro-Ro Vessel

The total volume of cargoes to be transported by Ro-Ro vessels through the port is estimated as 430 thousand tons in 1997. The following premises are adopted:

- Total volume of cargoes: unloaded: 415 thousand tons
  loaded: 15 thousand tons
- Average cargo-handling volume: 1,100 tons per vessel
- Number of calling vessels: 391 vessels per year
- Cargo-handling productivity: 23 tons per hour
- Average dwelling time: unloaded: 40 days: loaded: 14 days
- Storage: sheds: 84%: open yards: 16%
- Land transport by trucks

The following berths are allocated for Ro-Ro vessels:

- Quay No.7(1 berth)
- Quay No.9-2(1 berth)
- Quay No.18-2(1 berth)
- Quay No.20-2(1 berth)
- Quay No.22-4(1 berth) for priority use
- Quay No.23-3(1 berth) for priority use
- Quay No.24(1 berth)
- Quay No.25(1 berth)

- Quay No.31-3(1 berth) for priority use

Total:9 berths for exclusive use except for Nos.22-4,23-3 and 31-3

(9) Cereal Carrier

The volume of cereals to be unloaded at the port in 1997 is estimated as 2 million tons, 1.5 times greater than the volume in 1990. In order to discharge the forecast volume, the present level of cargo-handling productivity needs to be considerably heightened. For that end, in addition to the existing rail-mounted pneumatic unloaders installed along Quay No.35-2, new unloaders are planned to be installed along Quay No.35-1. A portion of cereals is planned to be unloaded at Quay No.33-1 by using mobile pneumatic unloaders. Three berths are allocated exclusively for cereals, and productivity at each berth is estimated as follows:

Berth	Nominal productivity	Actual productivity
Quay No.33-1	120 tons/hr/unit x 2 units	154 tons/hr/berth
Quay No.35-1	400 tons/hr/unit x 2 units	512 tons/hr/berth
Quay No.35-3	200 tons/hr/unit+300 tons/hr/unit	320 tons/hr/berth

In order to obtain the above productivity, silos with sufficient storage capacities need to be prepared. The following premises are further adopted:

- Average cargo-handling volume: 23,000 tons per vessel
- Number of calling vessels: 87 vessels per year
- Average dwelling time in silos: 18 days
- Land transport: by trucks: 53%: by railways: 47%

(10) Tanker(Butane, diesel oil, gasoline or fuel oil)

The following premises are adopted considering the record of actual operations. The average cargo-handling productivity is expected to be improved to the level of the cases where efficient cargo-handling was actually recorded.

- Total volume of cargoes unloaded from the tankers: 914 thousand tons
- Average cargo-handling volume: 4,600 tons per vessel
- Number of calling vessels: 199 vessels per year
- Cargo-handling productivity: 131 tons per hour

Quay No.37(3 berths) along the Brise Lames Est is planned to serve the tankers as it does at present.

(11) Tanker(Naphtha)

The following premises are adopted:

- Total volume of cargoes loaded into the tankers: 240 thousand tons
- Average cargo-handling volume: 20,000 tons per vessel
- Number of calling vessels: 12 vessels per year
- Cargo-handling productivity: 380 tons per hour

Quay No.37(3 berths) along the Brise Lames Est is also planned to serve the tankers as it does at present.

(12) Tanker(Bitumen)

The following premises are adopted:

- Total volume of cargoes unloaded from the tankers: 79 thousand tons
- Average cargo-handling volume: 2,300 tons per vessel
- Number of calling vessels: 34 vessels per year
- Cargo-handling productivity: 67 tons per hour

Quay No.26-2 is planned to be newly allocated for the tankers.

(13) Tanker(Vegetable oil or animal fat)

The following premises are adopted:

- Total volume of cargoes unloaded from the tankers: 369 thousand tons
- Average cargo-handling volume: 3,100 tons per vessel
- Number of calling vessels: 119 vessels per year
- Cargo-handling productivity: 53 tons per hour

The following berths are allocated for the tankers:

- Quay No.32(1 berth) for exclusive use
- Quay No.36(1 berth) for exclusive use

  Total:2 berths

(14) Car ferry

The volume of cargoes to be transported in 1997 is estimated as 98 thousand tons. Quay No.11-2 is planned to serve the car ferries as it does at present. The following premises are further adopted:

- Total number of passengers: 326 thousand
- Average cargo-handling volume: 420 tons per vessel
- Number of calling vessels: 233 vessels per year
- Average mooring period: 1 day

(15) Container vessel

The number of containers to be handled at the port is estimated as 123 thousand TEUs in 1997. In order to handle the forecast number of containers, two units of gantry cranes for container-handling are planned to be installed at Terminal-1.

In the next step, a computer simulation is conducted on the conditions of the above usage plan for the port facilities. The following operational conditions are used:

- Annual working days: 310 days
- Daily working hours: excluding liquid bulk and cement: 7:00-19:00
  liquid bulk and cement: 24 hours

Results of the simulation are summarized as follows:

- Average ship waiting times:
  1 General cargo vessels(various kinds of cargoes): 13.8 hrs
  2 General cargo vessels(cement): 0 hr
  3 General cargo vessels(foodstuffs or agricultural products): 11.4 hr
  4 General cargo vessels(wood): 3.8 hrs
  5 General cargo vessels(steel products): 2.0 hrs
  6 General cargo vessels(sugar): 20.0 hr
  7 General cargo vessels(animal feed): 0 hrs
  8 Ro-Ro vessels: 12.3 hrs
  9 Cereal carriers: 21.6 hrs

10 Tankers(butane, diesel oil, gasoline or fuel oil): 0 hr
11 Tankers(naphtha): 0 hr
12 Tankers(bitumen): 0 hr
13 Tankers(vegetable oil or animal fat): 3.0 hrs
14 Car ferries: 0 hr
15 Container vessels: 26.7 hrs

- Percentage of berth occupancy:
1 Berths for general cargo vessels(Various Cargoes): 85.2%
2 Berth for general cargo vessels(Cement): 49.5%
3 Berths for general cargo vessels(Foodstuffs): 53.2%
4 Berths for general cargo vessels(Wood): 46.8%
5 Berths for general cargo vessels(Steel products): 46.8%
6 Berths for general cargo vessels(Sugar):49.5%
7 Berth for general cargo vessels(Animal feed): 30.4%
8 Berths for Ro-Ro vessels: 72.8%
9 Berths for cereal carriers: 51.1%
10 Berths for tankers(Butane, diesel oil, etc.): 25.0%
11 Berths for tankers(Naphtha): 25.0%
12 Berth for tankers(Bitumen): 11.6%
13 Berths for tankers(Vegetable oil or animal fat): 44.7%
14 Berth for car ferries: 63.8%
15 Berth for container vessels: 57.3%

The required area for public sheds and open yards occupied by various cargoes excluding containers in 1997 is estimated as 24.3 ha with a peaking factor of 1.28. Regarding the required area of 24.3 ha, 18.9 ha will be available within the existing port limits in the same year, and the remaining 5.4 ha is planned to be prepared in Terminal-2.

The required storage capacity for containers in 1997 is estimated to be 5,800 TEUs. Containers will be stored at Terminal-1 whose planned storage capacity is 5,820 TEUs.

The required capacity of silos for cereals which will be prepared at the Skikda Wharf in the same year is estimated as 130 thousand tons with the same peaking factor of 1.39 used in the Master Plan. Subtracting the existing capacity of 30 thousand tons, silos of a total capacity of 100 thousand tons will be additionally required.

Total ship waiting days in 1997 excluding container vessels are estimated as 576 days, a considerable reduction from that of 1,833 days in 1990. Among the above average ship waiting times, that of cereal carriers is comparatively large. Therefore, in order to reduce the time from the original case (referred to as Case 1), another alternative use plan (referred to as Case 2) for the existing facilities is examined. In Case 2, two rail-mounted pneumatic unloaders with a nominal capacity of 400 tons per hour each are planned to be installed at Quay No.33-1 instead of the existing mobile pneumatic unloaders. The result of the comparison of the two cases is summarized as follows:

- Average ship staying times of cereal carriers at the port including offshore waiting times:

  Case 1: 7.3 days
  Case 2: 5.4 days

The difference in cost between Case 1 and Case 2 is computed and shown as follows:

Comparison between the Two Alternative Cases

Unit: Million DA

	Ship staying cost	Pneumatic unloaders		Grand total
		No. of units	Cost	
Case 1	1,052	2	458	1,510
Case 2	730	4	916	1,646

Note (1) : Cost of an additional silo is excluded in above table.
Note (2) : The costs are discounted to the Present Value through a project life of 30 years.

From the above comparison, Case 1 is considered to be the more economical plan.

At Terminal-1, in the initial stage, containers will be unloaded from or loaded onto container vessels mainly by ship cranes without gantry cranes at quay side. However, it is necessary to install the gantry cranes for containers by 1997 so as to handle the increasing number of containers which is expected

to exceed 100 thousand TEUs by that year. Berthing times in the case where the gantry cranes will not be installed are much longer than those of the original case when two units of the gantry cranes are planned to be prepared due to the difference of crane's cycle times between the two cases. Moreover, longer berthing times of the former case induce longer offshore waiting times (estimated to be 3.7 days per vessel which is much longer than 1.1 days of the original case). Considering costly container vessel cost, it is clear that the capital cost of the gantry cranes will be easily recovered by the saving of ship staying costs at the port.

As for alternative usage plans of Terminal-2, the berths of the terminal will be usable both for general cargo vessels and container vessels. However, if the terminal serves exclusively for container vessels in the year 1997, general cargo vessels will be forced to be served only within the existing berths. In that case, though 13 berths will be allocated for general cargo vessels, only eight berths will be able to provide satisfactory service; three berths, Quays No.22-4, No.23-3 and No.31-3, will be used in priority use for Ro-Ro vessels and another two berths, Quays No.22P/Coupe and No.23P/Coupe, are incomplete berths which do not have sheds or a sufficient backyard, resulting in a very low cargo-handling productivity. As for size of general cargo vessels, around 10% are estimated to be over 15,000 DWT. The berths which can receive the large vessels are limited and when the vessels moor there, two continuous berths are simultaneously occupied. Taking account of those various conditions, a simulation was conducted. According to the results, the average berth occupancy rate is almost 100%, and consequently, the average offshore waiting time is very long, around eight days per vessel, indicating that berth capacity has already been exceeded.

As mentioned previously, in peaking or congested conditions, the required storage area for cargoes unloaded from or loaded onto the vessels is expected to exceed the capacity of the existing storage areas. Not only the lack of the number of berths but also the shortage of the required storage areas will cause long ship waiting times offshore as they do at present.

On the other hand, in the case where Terminal-2 is used for general cargo vessels, an average berth occupancy rate is reduced to the level of 85.2% and an average ship waiting time is also reduced to only 13.8 hours by preparation of a berth of 300 meters long and open storage yards and one warehouse of 5.4 ha at

the terminal. Thus, it is necessary to prepare Terminal-2 for general cargo vessels in the stage of the Short-Term Plan. The resulting berth throughput excluding the berths for priority use for Ro-Ro vessels, Quay No.17 used mainly for handling marble, and Quays No.22 P/Coupe and No.23P/Coupe is 770 tons per meter on an average, which is within the standard used internationally in the range of 700-1,000 tons per meter. The present throughput at the same berths is 370 tons per meter, showing approximately half of the above throughput.

Conversely, in the same year, Terminal-1 will still be able to receive most of the container vessels if container gantry cranes are newly installed there. Thus, in 1997, Terminal-2 must be used mainly to receive the general cargo vessels and store their cargoes.

The capacity of Terminal-1, which is the number of containers handled per annum is estimated as 169 thousand TEUs. According to the forecast demand, the capacity of Terminal-1 will be insufficient a few years after 1997. After the saturation of Terminal-1, Terminal-2 will also be usable together with terminal-1 to receive increasing number of container vessels, since the number of general cargo vessels will conversely be decreasing along with the progress of containerization. Thus, in the stage of the Short-Term Plan, Terminal-2 is planned to be a multipurpose terminal. The multipurpose terminal will serve mainly for general cargo vessels in the initial stage. Then, the terminal will gradually be converted to an all container terminal as called for in the Master Plan. Thus, in the stage of the Short-Term Plan, the multipurpose terminal, namely Terminal-2, is indispensable in handling the increasing volume of general cargoes whether they will be transported by conventional vessels or modernized fully-cellular container vessels.

As for the handling of steel products, an alternative plan, Case 2, in which a crane specialized for handling heavy and bulky steel products is introduced at the Wharf of Ghara Djebilet is compared with the original plan, namely Case 1. The following premises are assumed in Case 2:

- Average weight lifted by a crane: 10 tons
- Cycle time: 3 minutes
- Number of cranes: 1 unit
- Cargo-handling efficiency: 0.8
- Operational ratio: 0.8

(10 tons/cycle/crane x 60min/hr/(3min/cycle) x 0.64= 128 tons/hr)

- Average mooring time per vessel: 3.6 days
- Number of vessels received per berth and year: 72 vessels

Since, in Case 1, an average mooring time is estimated as 4.8 days, 2.2 days are saved by the introduction of the specialized quay crane. The result of the comparison between the two cases is summarized as follows:

Comparison between the Two Alternative Cases

Unit: Million DA

	Ship staying cost	Specialized quay crane		Grand total
		No. of units	Cost	
Case 1	329	-	-	329
Case 2	247	1	134	381

Note (1) : Ship staying costs are counted for the 72 vessels.

Note (2) : The costs are discounted to the Present Value through a project life of 30 years.

From the above comparison, the introduction of the specialized quay crane cannot recover the capital investment cost.

1.3 Modernization Plan of the Existing Facilities

1.3.1 Modernization of the Cereal Terminal

Modernization of the cereal terminal at the Wharf of Skikda is planned for in the target year 1997. An outline of the terminal is summarized as follows:

- Volume of cereals to be unloaded: 2 million tons
- Number of berths specialized for cereal carriers: 3
- Maximum vessel size under full draft: 28,000 DWT
- Type of unloaders: rail-mounted and tire-mounted pneumatic unloaders
- Number of required units of rail-mounted unloader: 4 units (2 units presently exist and 2 units will be additionally purchased)
- Nominal capacity of new unloader per unit: 400 tons per hour

- Nominal capacity of belt conveyor per unit: 400 tons per hour
- Capacity of silos: 130 thousand tons (100 thousand tons will be additionally required)
- Access road
- Siding railway
- Building
- Other facilities: dust collector, electric equipment

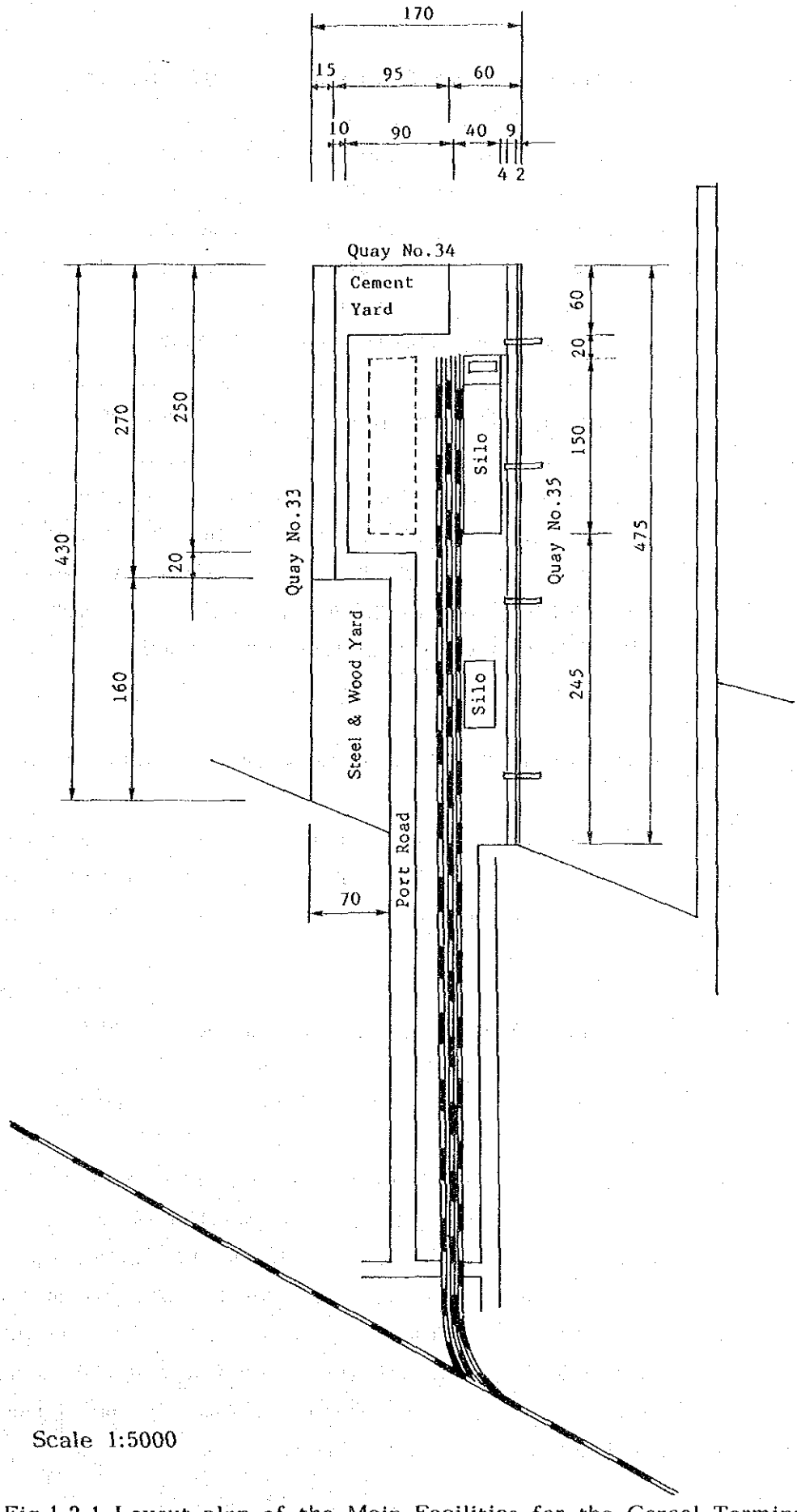

Fig.1.3.1 Layout plan of the Main Facilities for the Cereal Terminal

1.3.2 Installation of Gantry Cranes for Containers at Terminal-1

In order to handle the forecast number of containers, two units of rail-mounted gantry cranes for container-handling are planned to be installed at Terminal-1 by the year 1997.

1.3.3 Preparation of Open yards for Steel Products and Wood

The area of the open yards required for storing steel products and wood in 1997 is estimated to be 5.2 ha in total. Out of this area, 3.9 ha is allocated at the open yards on the Wharf of Ghara Djebilet and yards near the wharf. The remaining 1.3 ha is allocated at the open yard just behind the Quay No.33-3 on the Wharf of Skikda and the yards near the wharf. The existing shed behind the Quay No.20-1 on the Wharf of Ghara Djebilet is planned to be demolished to prepare an additional open yard to store steel products or wood.

1.3.4 Preparation of a Berth for Bitumen and Bunker Fuel

The berth for handling bitumen and bunker fuel, which currently exists at Quay No.27, is planned to be transferred to Quay No.26-2 which is presently used for buoy stocking.

1.4 Establishment of Terminal-2 as a Multipurpose Terminal

1.4.1 General

In order to handle increasing volume of general cargoes which are transported by conventional vessels, fully-cellular container vessels, or part container vessels through the Port of Algiers, Terminal-2 as a multipurpose terminal is planned to be established in the stage of the Short-Term Plan. As mentioned previously, the multipurpose terminal will serve mainly for conventional vessels in the initial stage upto 2000. Then beyond 2000 along with the progress of containerization, the multipurpose terminal will be converted to an all container terminal as mentioned in the Master Plan.

1.4.2 Phase Plans of Terminal-2

After the start of operations in Terminal-2 in 1997, cargoes handled at the terminal are expected to increase continuously. Therefore, additional investment will be needed at some stage. The timing of the investment must be determined taking account of a saturated condition of the first phase project. The saturated condition is defined to be the point when the savings of transportation costs induced by the next phase project come to exceed the additional investment costs. The timing is examined to make phase plans between 1997 and 2010. The resulting phase plans of Terminal-2 are as follows:

	Year	Contents of project
Phase I-1 (Short-Term Plan)	1997	No.1 berth (300 m)
Phase I-2	2000	2 units of gantry cranes
Phase II	2006	No.2 berth (300 m) with 2 units of gantry cranes

1.4.3 Volume of Cargoes Handled at Terminal-2

General cargoes or containers handled at the Port of Algiers will be allocated to the existing berths, Terminal-1, and Terminal-2. The cargoes allocated to the two terminals by the above phase plans are shown as follows:

(Phase I-1)

	Terminal-1	Terminal-2 Berth No.1
	Containers (TEUs)	General cargoes (Tons)
1997	123,000	264,000
1998	145,000	263,000
1999	169,000	261,000

(Phase I-2)

	Terminal-1	Terminal-2 Berth No.1
	Containers (TEUs)	Containers (TEUs)
2000	98,000	98,000
2001	112,000	112,000
2002	127,000	127,000
2003	143,000	143,000
2004	160,000	160,000
2005	177,000	177,000

(Phase II)

	Terminal-1	Terminal-2	
		Berth No.1	Berth No.2
	Containers (TEUs)	Containers (TEUs)	Containers (TEUs)
2006	129,000	129,000	129,000
2007	141,000	141,000	141,000
2008	153,000	153,000	153,000
2009	164,000	164,000	164,000
2010	177,000	177,000	177,000

1.4.4 Scale of the Main Facilities of Terminal-2

(1) Berths

As mentioned previously, the berth is planned to receive general cargo vessels in the initial stage. In the initial stage, a berth of 300 meters long is required in order to receive simultaneously two general cargo vessels of around 5,000 DWT which is average size of the vessels. A water depth of 13 meters is planned, the same as proposed in the Master Plan, since the berth will be used beyond the target year of the Master Plan.

In the next stage, the berth will serve container vessels. In this stage, the maximum size of the vessels to be received by the berth is 35,000 DWT with a capacity of 2,000 TEUs. The berth will be able to receive simultaneously

two container vessels of 6,500 DWT-12,000 DWT with capacities of 400-500 TEUs which are expected to ply between the Port of Algiers and the West European ports.

In the initial stage, the allocated volume of general cargoes is 264,000 tons in 1997.

In the next stage, container-handling will start in 2,000. The allocated number of containers in the year is 98,000 TEUs which is sufficient to convert Terminal-2 from the multipurpose terminal to the all container terminal.

(2) Open Storage Yard

The open storage yard is planned considering future conversion of the multipurpose terminal to the all container terminal. The container marshaling yard of Terminal-2 proposed in the Master Plan (see Fig 10.4.5 of Part I) is usable for the above open storage yard for general cargoes in the initial operational stage. The required area in 1997 is 5.4 ha as mentioned in section 1.2. Hence, half of the yard proposed in the Master Plan will be prepared in the Short-Term Plan.

(3) Warehouse

One of three CFSs proposed in the Master Plan will be prepared for a warehouse in the stage of the Short-Term Plan. The warehouse will be converted to a CFS beyond the year 2000.

(4) Terminal Office

The head office of Terminal-2 is planned as follows:

- Stories: 3
- Site area for building: 30 m x 25 m = 750 sq.m
- Floor space: 2,250 sq.m.

1.4.5 Layout of the Main Facilities of Terminal-2

The main facilities of Terminal-2, of which the required sizes are shown in the previous section, are arranged(see Fig 1.4.1).

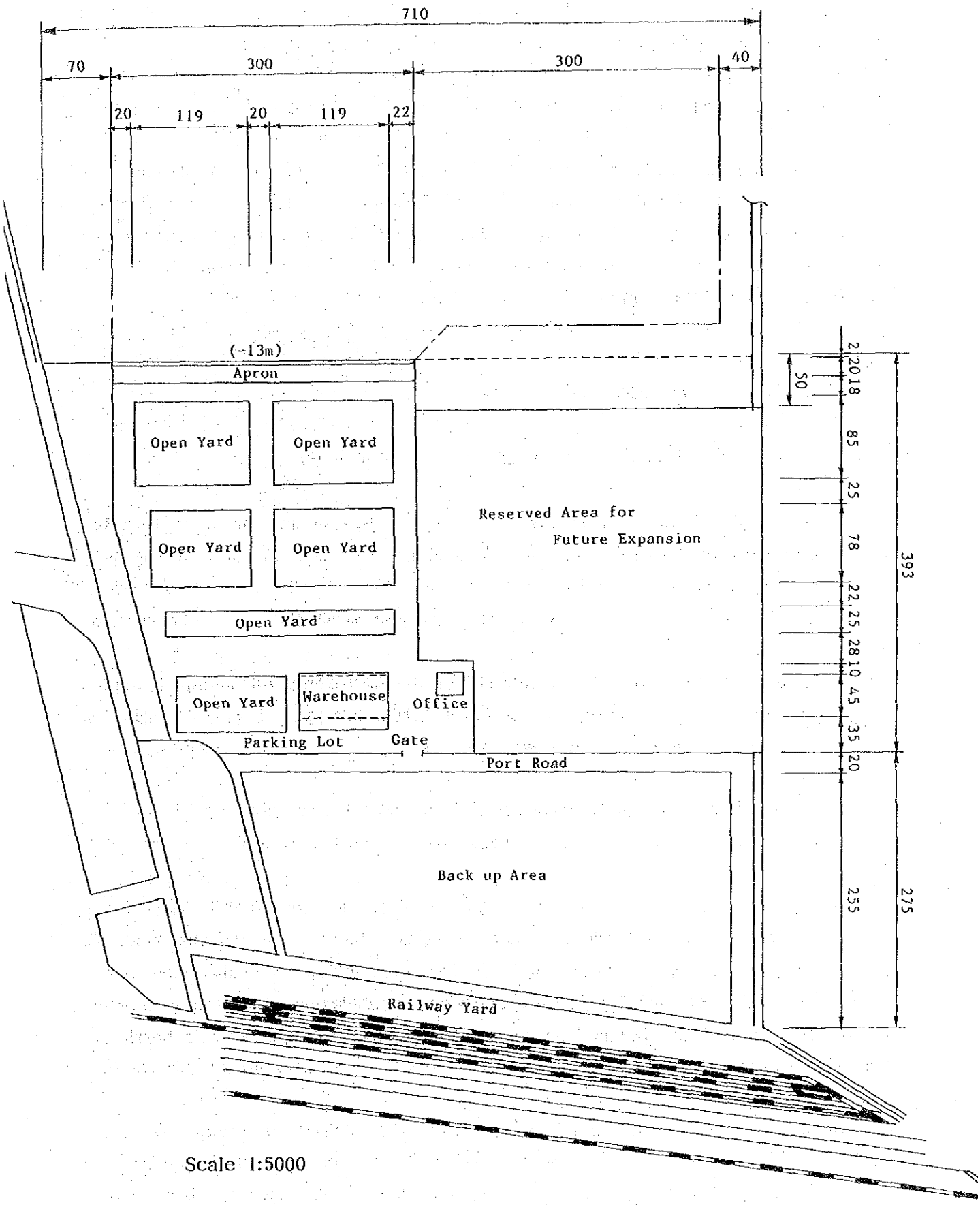

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Fig.1.4.1 Layout Plan of the Main Facilities of Terminal-2

1.5 Cargo Handling System

1.5.1 Steel Products and Timber

Marshaling of steel products and timber in the Port will be basically carried out in the manner mentioned in section 10.5.1, (3)-4) in Part I. However, given the forecast handling volume of steel products and timber for the target year 1997, unloading of cargoes will be carried out by ship's cranes/gear or mobile cranes owned by EPAL.

1.5.2 Multipurpose Terminal (Terminal-2)

The proposed situation at this terminal in the port is follows:

- to change from multipurpose terminal to full scale container terminal equipped with gantry cranes as containerized cargo handled at the port increases in future,
- to handle fully cellular container vessels at terminal - 1 in the existing port district,
- to be able to moor two vessels simultaneously along the berth, to handle sacked cargo in loose, foodstuff, steel goods and timber which are carried by vessels laden with one kind cargo at the existing port district,
- to separated the berth from the existing port district,
- to establish a large space for open storage yard and CFS,

Given the above, it seems that the berth is to be mainly used for handling of modern geared general cargo vessels laden with various kinds of general cargoes, and is fit for handling a large amount of bulky and heavy cargoes such as plant cargo in boxes, and containers, because there is a large open spaces behind the berth. So the cargo handling systems at this berth are planned as follows.

(1) Utilization of open yard and CFS

- Open yard

The Open yard should be used for transit and sorting of cargoes for short

periods and should not be used for storage for long periods. To facilitate smooth handling at the time of marshaling and delivery of cargo and to properly administer stored cargoes, the open yard should be divided with line into sections marked with numerals or letters. Zoning should make allowances for handling spaces beside the sections and for traffic routes for marshaling and delivery of the cargoes. Cargoes should be stacked in blocks per type and lot of cargo with proper clearances between piles.

The open yard should be roughly zoned on the basis of the layout plan of the container stacking yards in the container terminal established for the target year 2010, in order to switch over smoothly to full scale container terminal at the later stage. Utilization and the layout and size of each zone should be determined in accordance with the categories of cargoes and handling volume per category. The allocated areas can be flexibly changed according to the situation.

The cargoes should be categorized into five categories, "container", "bulky boxed cargo and/or plant cargo", "palletized cargo", "vehicle and trailer" and "others to be stored in shed".

Fig.1.5.1 is an example layout plan of zoning and allocation of storage cargoes per zone.

- CFS

As a general rule, the CFS should be used only as temporary storage for a short period,

(2) Loading and unloading to and from vessels

Loading and unloading of cargoes is basically carried out by means of ship's cranes and/or gear because no quay cranes are equipped at the terminal.

(3) Marshaling of cargoes in the open yard and CFS

The standard method of transfer of cargoes from apron to storage areas is by horizontal handling equipment combinations, using forklifts, trailers, chassis, trucks, and tractors. The loading/unloading onto/from transferring equipment is carried out by forklifts and/or mobile cranes. Using the example zoning plan in

the open yard, the standard method of handling each category of cargoes is basically as follows.

- Container

The storage area for containers is allocated near the berths, therefore all of the container handling, forwarding from/to apron to storage area and lift on/off chassis, is carried out by forklifts.

- Bulky boxed cargoes

The storage area for these cargoes is also allocated near the berths, therefore forwarding from the apron to storage area is also carried out in a similar way to the container handling by forklifts. Loading onto trucks/trailers for inland transport is done by forklifts and/or by mobile cranes.

- Palletized cargo

These cargoes are allocated the middle areas in the open yard, so forwarding is carried out by forklifts and trucks in combination. Loading onto trucks for delivery is done by forklifts.

- Vehicle and trailer

After landing on the apron, the vehicles are forwarded to the storage area under their own power and the trailers are forwarded to the storage area by trailer trucks.

- Others to be stored in the shed (CFS)

The cargoes are forwarded by trucks from the apron to the CFS.

(4) Horizontal handling equipment

According to the area of the terminal, when the terminal is fully used for handling, a large quantity and various types of handling equipment is necessary in order to facilitate smooth handling. However, according to the situation of the terminal and the expected cargo handling volume in the berths, at the first stage, 4 units of heavy forklifts of lifting capacity of 35 tons are allotted to the containers, and bulky boxed cargo handling, and in addition to that 8 units of forklifts with capacity of 3 tons for operation in CFS, and other operation is to be carried out by the existing equipment owned by the EPAL.

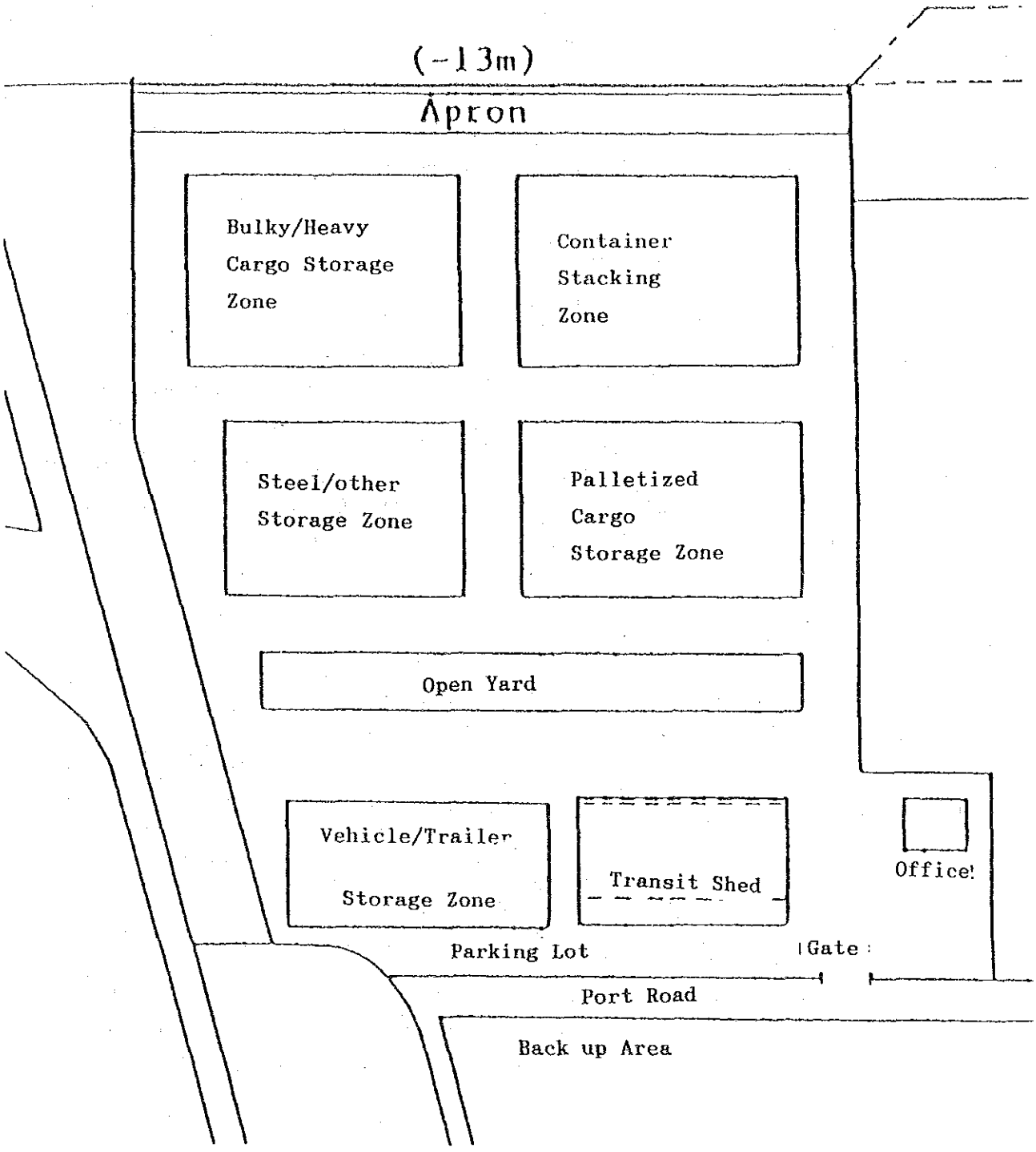

Fig. 1.5.1 Example Layout Plan of Allocation of Storage Cargo

1.5.3 Bulk Cereals

For the target year 1997, it is planned to handle bulk cereals at the berths Nos. 1 and 2 in Quay No. 35 and the berth No.1 in Quay No.33. The cargo handling system at each berth is planned as follows.

- Quay No.35 - 2

The cargo is to be handled using the existing facilities; "two units of pneumatic unloaders" and "the storage silos behind the berth".

Basically, all the cargo is first stored in the silos and then evacuated, so some cargo discharged at the berth will have to be directly transferred through conveyor systems between the existing silos and the new silos to be constructed behind the berth No.1 in this quay, because the capacity of the existing silos is small compared to the expected handling volume at this berth.

- Quay No.35 - 1

The cargo handling is to be handled using two units of rail-mounted pneumatic unloaders with an unloading capacity of 400 tone/hour, and the storage silos which are to be newly established at this berth. The cargo is to be first stored in the silos and then evacuated to trucks and/or rail wagons.

- Quay No.33 - 1

At this berth, cargo is to be unloaded using the existing tiremounted pneumatic unloaders, owned by the EPAL, and transferred to the new silos by shuttle trucks for storage. Direct delivery by trucks is advised only for short distance transportation of cargo from the port.

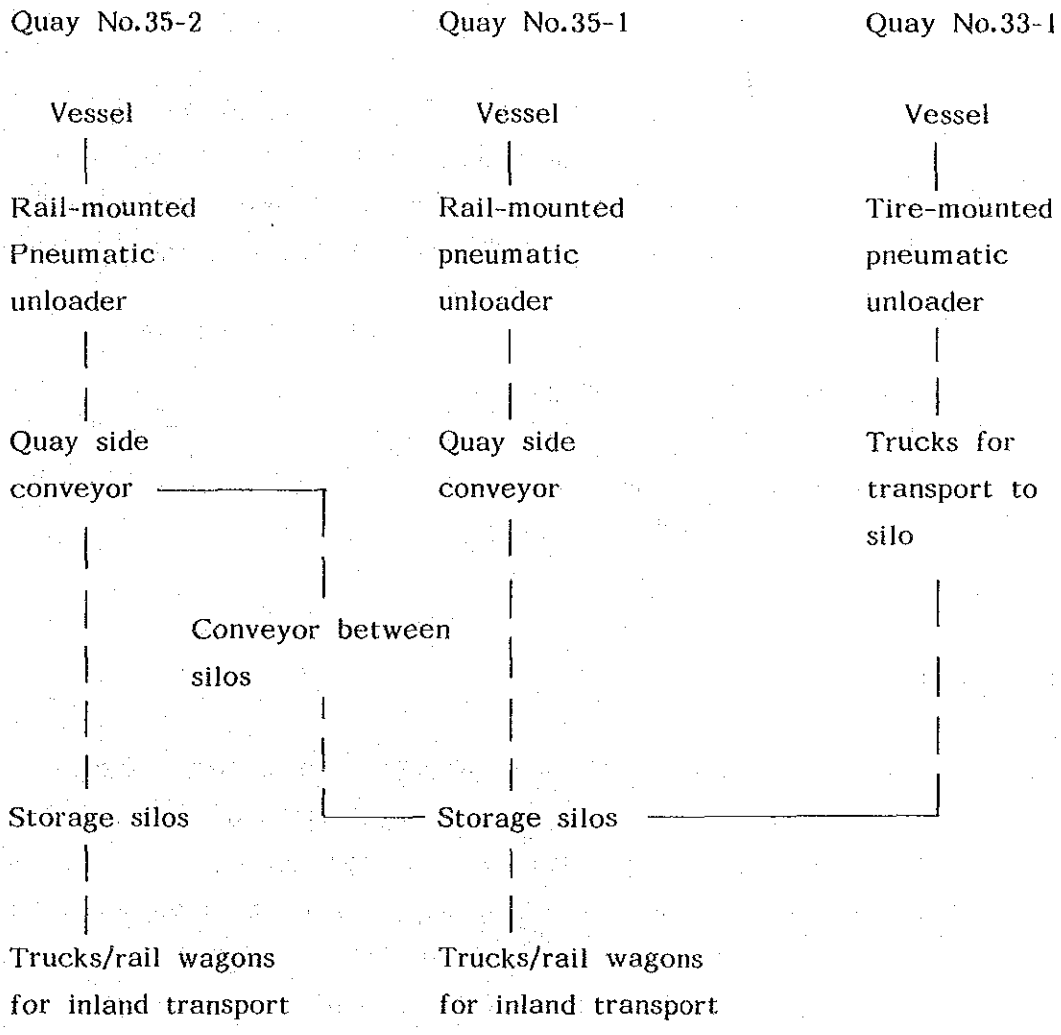

Fig. 1.5.2 Cargo Flow in the Terminal

1.6 Access Channel and Basins

It is necessary to plan an access channel and basins so as to receive container vessels of the maximum size mentioned in Section 1.4.4 to approach Terminal-2. As the size of the vessels is the same as proposed in the Master Plan, the same dimensions of the access channel and basins as those in the plan are proposed as follows:

- Access channel: Breadth: 260 meters
  Water depth: 13 to 14 meters
- Basins (including a turning basin with a diameter of 520 meters):
  Water depth: 13 meters

1.7 Breakwaters

It is necessary to prepare new breakwaters to protect vessels to be maneuvered at the above basins or to moor at the berths of Terminal-2 in the stage of the Short-Term Plan. In planning the breakwaters, the same critical wave height of 0.5 meters for cargo-handling which must be maintained 95% of the time is adopted, the same as proposed in the Master Plan (see Section 10.7 of Chapter 10 of Part I). As for the critical conditions for vessels anchoring in the basins in a storm, a critical wave height of 1.5 m is adopted. In order to reduce investment cost of breakwaters, the return period of 10 years is adopted considering the interval between the initial construction of the breakwaters and the next. Thus, the main breakwater of 480 meters long and the sub-breakwater of 320 meters long are planned to be newly constructed in the Short-Term Plan (see Fig.1.7.1).

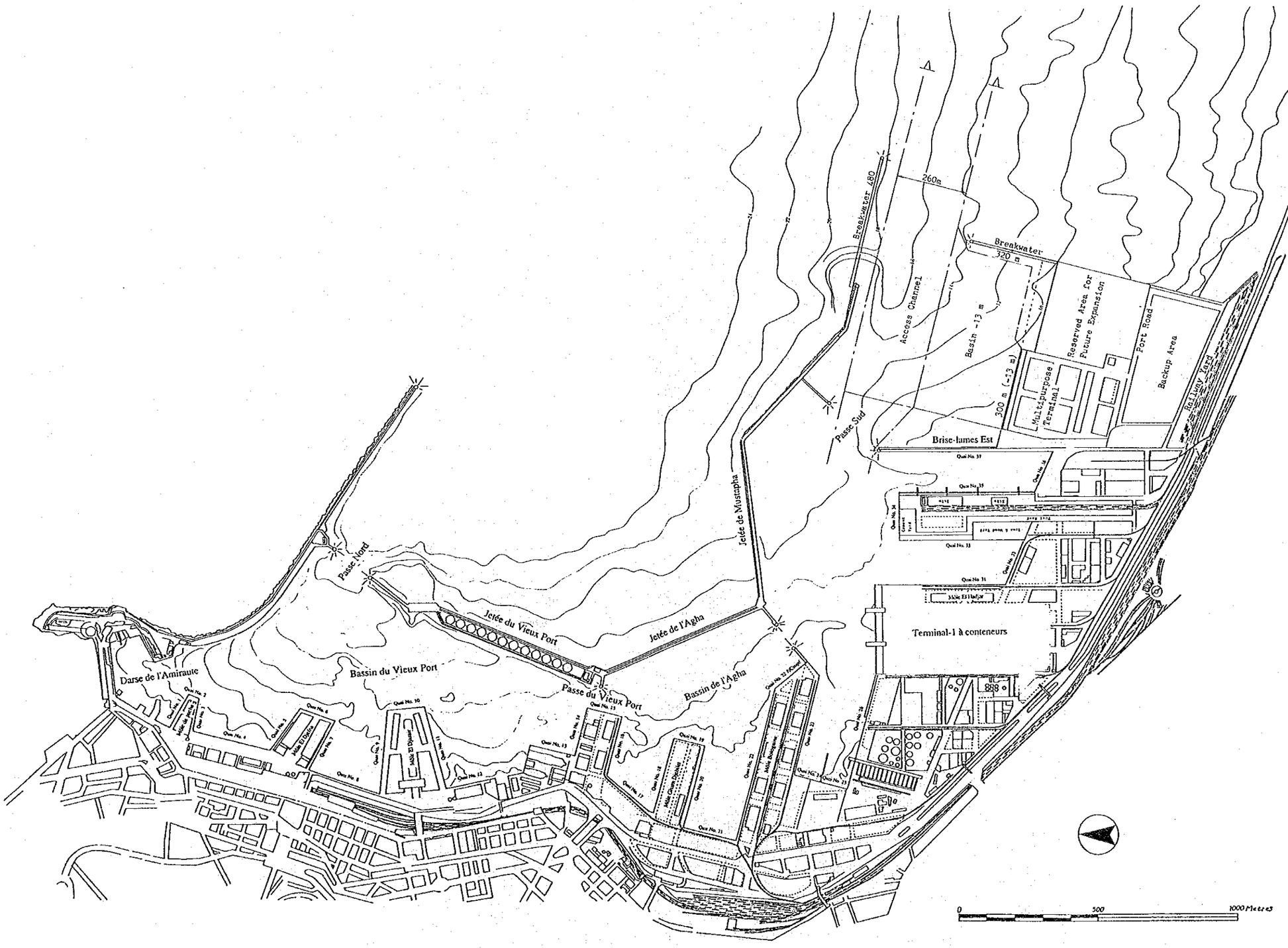

Fig.1.7.1 Development Plan of Terminal-2

1.8 Access Roads and Railways

The traffic volume of vehicles originating from or destined to the port in the year 1997 during peak time with a peaking factor of 2.2 is estimated to be 4,540 vehicles per day each way in total. The hourly traffic corresponding to that daily traffic is also estimated to be 681 vehicles each way. Traffic volume by type of cargo is shown as follows:

Kind of cargo	Daily traffic	Hourly traffic
General cargoes including Ro-Ro cargoes	958	144
Cereals	831	125
Cement	550	82
Containers	477	72
Steel products and wood	379	57
Foodstuffs and agricultural products	213	32
Animal feed	35	5
Car ferry	1,097	165
Total:	4,540	681

In the stage of the Short-Term Plan, the Port of Algiers is divided into four zones; the North, Central and South zones, and Terminal-2. In addition to the existing access roads and gates located in each zone, a new access road and a gate is planned to be prepared in the Short-Term Plan for smooth delivery and receiving of cargoes through the port. Taking account of the locations of those gates, the above estimated traffic volumes each way are distributed through those gates in the following manner:

Zone	Hourly traffic each way
North Zone	207
Central Zone	139
South Zone	307
Terminal-2	28
Total:	681

As hourly capacity of traffic volume per road lane is estimated as 600 vehicles, one lane each way needs to be shared for the entire above traffic.
As for railway wagons, daily traffic is estimated as follows:

Kind of cargo	Daily traffic
Cereals	52
Cement	10
Others	26
Total:	88

As for siding railway providing access to Terminal-2, a single track is planned to be newly installed. In a marshaling yard of the railway, three tracks with an effective length of 500 meters each are planned. At the cereal terminal, it is necessary to install additional tracks to transport the forecast volume. When installing the siding railway, the existing express way running along the port will be modified to overpass the siding railway in order to avoid plane intersection.

1.9 Environmental Consideration in the Port Activities

1.9.1 Environmental Impacts Induced by the Development of Terminal-2

It is also necessary to consider the possibility of pollution induced by the development of Terminal-2 in the stage of the Short-Term Plan. In the Master Plan, the environmental impacts on the surrounding districts were examined in details and are considered to be very small (see Section 10.10 of Chapter 10 of Part I). Since the scale of the development in the Short-Term Plan is approximately half of the Master Plan, the environmental impacts induced by the project of the Short-Term Plan is considered to be very small. When constructing required infrastructures, the proposed countermeasures in the Master Plan must be taken so as to minimize the environmental impacts.

1.9.2 Improvement of Environment Within the Existing Port District

As mentioned in Section 10.10.2 of Chapter 10 of Part I, polluted water presently discharged from the city or industries needs to be treated before being discharged into the basins of the port regardless of the cost.

1.9.3 Provision of Facilities for Reception of Waste Water from Vessels

As mentioned in Section 10.10.3 of Chapter 10 of Part I, according to the MARPOL Convention, it is necessary to provide facilities to receive waste such as ballast, bilge and tank cleaning waters from vessels at ports of the countries that ratified the convention. Presently, a simple oil and water separator exists at the port to receive petroleum tankers only. Therefore, it is advisable to provide full-scale facilities to receive the waste from not only petroleum tankers but also other vessels as required in the stage of the Short-Term Plan. A site near the existing separator is proposed for installation of the above reception facilities. Quay No.36 is also proposed as a barge site to receive the waste water from vessels on route to the reception facilities.

1.10 Contents of the Project of the Short-Term Plan

The contents of the project of the Short-Term Plan are summarized as follows:

- Terminal-2

  - Project site: East of the Brise-Lames Est

  - Dimensions: Terminal area: 11.6 hectares
    Berth: Length: 300 meter
    Water depth: 13 meters
    Main breakwaters: length: 480 meters
    Sub-breakwaters: Length: 320 meters
    Access channel: Breadth: 260 meters
    Basin: Area: 18.9 hectares
    Water depth: 13 meters
  - Cargo-handling facilities: 4 Forklifts of 35 ton capacity
    8 Forklifts of 3 ton capacity
  - Other main facilities: Transit shed
    Terminal office
    Access road: 1.8 km
  - Required areas: Terminal area: 11.6 hectares
    (Open yard and warehouse: 5.4 hectares)

Access road: 2.6 hectares
Backup area: 10.0 hectares
Area reserved for the next stage: 11.1 hectares
Others: 1.5 hectares
Railway yard: 3.6 hectares

Total: 40.4 hectares

- Terminal-1

  - Cargo-handling facilities: 2 Units of gantry cranes of 40 ton capacity for containers

- Open Yard for Steel Products and Wood

  - Project site: Wharf of Ghara Djebilet
  - Demolishing the warehouse behind Quay No.20-1 to prepare an open yard

- Cereal Terminal

  - Project site: Wharf of Skikda
  - Cargo-handling facilities: 2 Units of rail-mounted pneumatic unloaders: nominal capacity of 400 tons per hour each
  - Silos of 100,000 ton capacity
  - Other main facilities: belt conveyors
    siding railway
    loaders for railway wagons

- Facilities for Reception of Waste Water from Vessels

  - Project site: near the existing facilities

- Siding railway overpassed by the existing express way

1.11 Design of Major Structures

1.11.1 Basic Design Principles

In developing designs of the major facilities of the project ports, efforts will be made to comply with local technical standards or codes of practice if these are in force and applicable or relevant to the designs of any part thereof.

The "Technical Standards for Port Facilities and Commentary", published by the Japan Port and Harbor Association, will be used as the primary source of guidance in design methods, procedures and calculations.

1.11.2 Selection of Structural Types

As in other port development projects, the proposed port facilities in the present project may be grouped into broad categories: harbor facilities, protective facilities, mooring facilities, and shore facilities. Selection of appropriate structural types for these facilities of the project port will be based on an in depth and overall evaluation of relevant factors, such as local construction methods and practices in general, availability of local construction materials, plants and equipment, and contractor capability and experience.

Specifically, the following factors demand greater attention in order to enable the project construction to be completed within a relatively short time frame:

(1) Relative ease of obtaining local construction materials;

(2) Relative ease of procuring construction equipment form local or overseas sources;

(3) Availability of local contractor with sufficient experience, and reliability of works performed by local contractors and

(4) Economic considerations.

Tables 1.11.1 and 1.11.2 present the outcome of analyses and evaluations of the structural types of the breakwater, seawall, and quay wall which will constitute the major structures of the project.

Table 1.11.1 Structural Types Evaluated for Major Project Facilities

Facilities / Structural Type	Protective Facilities		Mooring Facilities
	Breakwater	Sea Wall	Quay Wall
(1) Gravity type	o	o	o
(2) Pier type	x	x	o
(3) Sheet pile type	x	x	o
(4) Rubble mound type	o	o	x

Note: o : Applicable
x : not applicable

Table 1.11.2 Structures and Factors Analyzed for Selection of Structural Types

Facilities / Factor analyzed (Structural)	Gravity type	Pier type	Sheet Pile type	Rubble mound type
	Breakwater Sea Wall quay Wall	Quay Wall	Quay Wall	Breakwater Sea Wall
Relative ease of obtaining construction materials	o	*	*	o
Relative ease of procuring construction equipment and facilities	o	*	*	o
Availability of sufficient construction experience and reliability of work performed	o	* (x if batter piles used)	*	o

Note: o : Suitable
* : Common
x : Not common

Detailed discussions of the selection of structural types for the major facilities will be found later in this report.

1.11.3 Design Conditions

(1) Datum Level

The datum level used for structural designs, soil investigations, tide observations and hydrographical surveys shall be ZH(NGA -0.34 m).

(2) Characteristics of Mooring Facilities

1) Design Ship Size, Berth Length and Water Depth

Based on the determination of the design ship size, Table 1.11.3 gives the length and water depth of the proposed quay wall and the ship characteristics.

Table 1.11.3 Berth & Ship Characteristics

Unit: M

Design Ship Size	Berth Characteristics		Ship Characteristics			
	Length	Water depth	Length	Width	Molded depth	Full-Load draft
35,000 DWT	300	-13	260	32.2	21.0	12.0

2) Crown Height

The crown height of the quay wall shall be ZH + 2.50 m on the basis of an analysis of such relevant factors as the crown height of the existing quay wall, tidal fluctuation, and the frequency of wave attack.

3) Berthing Speed

The berthing speed for design purposes shall be 0.10 m/sec.

(3) Superimposed Loads

1) Uniformly Distributed Load

Loading on the proposed container terminal is assumed as follows with the straddle carrier system considered for container handling.

(a) Container terminal
apron : W1 = 2 tons/m^2

(b) Container stacking
yard : W2 = 3 tons/m^2

2) Live Load

The following live loads are assumed on the basis of the estimated requirements for container handling equipment.

(a) Crane Load
Rated Load : 40.0 tons
(Container grantry cranes)
Rail Span : 19.6 m
Wheel Base : 16.9 m
No.of wheels : Sea side : 8 wheels x 2
= 16 wheels
Land side : 8 wheels x 2
= 16 wheels

Wheel Load :
(per wheel) During Operation
Sea side : 38 tons/wheel
Land side : 26 tons/wheel
During Earthquake
Sea side : 47 tons/wheel
Land side : 50 tons/wheel

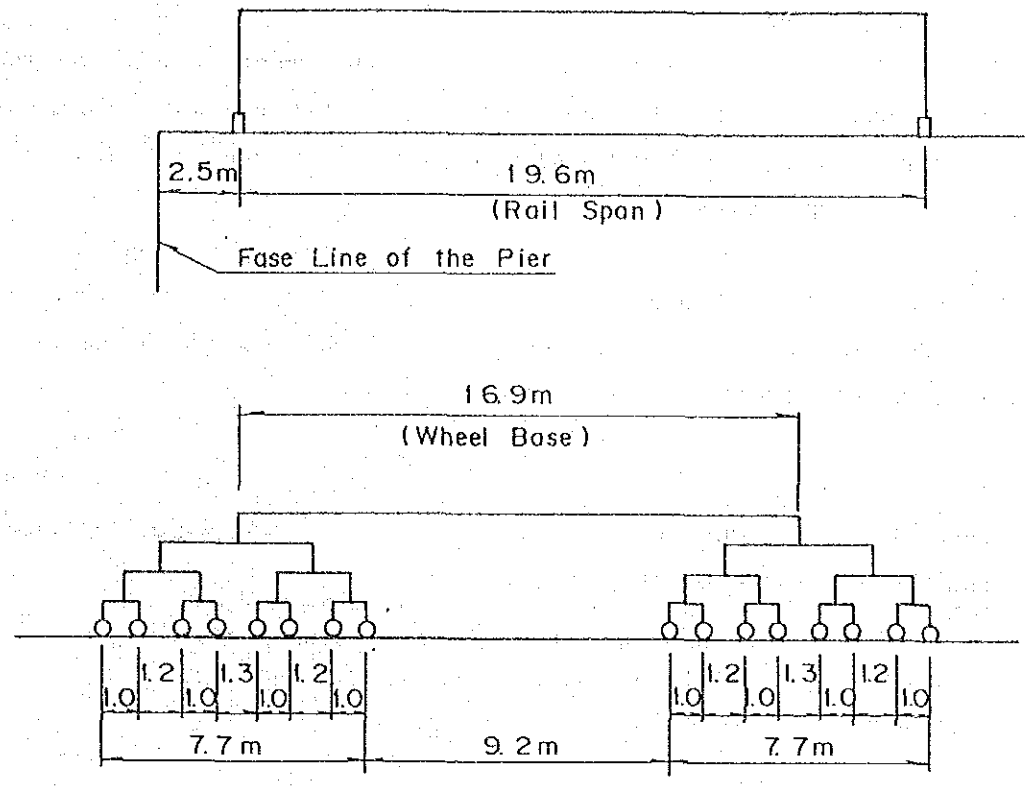

Fig. 1.11.1 Arrangement of Container Crane

(4) *Natural Conditions*

1) Design Tide Level

The design tide levels shall be determined as follows from an analysis of available tide observation data and the tide level used for the design of the existing Ro-Ro quay wall in the Port of Oran.

HWL = ZH + 1.00m

LWL = ZH + 0.60m

2) Design Wave Height

The height of deep water waves with a 50-year return period shall be taken for the design of the quay wall, breakwaters and seawall. Determination of the specific design wave heights shall take into account the shallow water deformations of these waves.

3) Assumption of Natural Ground

The soil conditions of the natural ground will be treated in the respective sections dealing with the design of the various structures.

4) Seismic Coefficient

The following seismic coefficients based on the technical standards of Algeria shall be taken for design purposes,

Horizontal : Kh = 0.1
Vertical : Kv = 0

(5) Characterisitics of Major Construction Materials

1) Earth and Stone

The design parameters for characteristics of earth and stones for use in the construction works shall be as tabulated below.

Table 1.11.4 Design Parameters for Earth and Stone

Item	ϕ	Angle of friction with wall	Unit weight	Submerged unit weight
Backfilling stones	40^{o}	$+15^{o}$	1.8 tons/m^3	1.0 ton/m^3
Foundation rubble	40^{o}	-	1.8	1.0
Filling material	30^{o}	$+15^{o}$	1.8	1.0

2) Unit Weight of Concrete and Steel

Plain concrete : 2.3 tons/m^3
Reinforced concrete : 2.45 tons/m^3
Steel : 7.85 tons/m^3

3) Allowable Stresses

The strength requirements of concrete, reinforcing bars and steel pipes shall be as indicated in Table 1.11.5.

Table 1.11.5 Allowable Stresses of Materials

(kg/cm^2)

Item	Design Strength	Bending Stress	Tensile Stress
Concrete	210	70	
Reinforcing bar(SR 24)			1,400
Reinforcing bar(SR 30)			1,800
Steel pipe		1,400	1,400

Note: The values required during earthquakes shall be 1.5 times higher than those listed in the table.

4) Coefficient of Friction

Between concrete and rubble : 0.6
Between concrete units : 0.5
Between rubble : 0.8

(6) Safety Factors

The safety factors required for structures shall be as noted in Table 1.11.6.

Table 1.11.6 Safety Factors

Item	Normal Situation	During Earthquake
Overturning of structure	1.2	1.1
Sliding of structure	1.2	1.0
Circular failure	1.3	-
Linear failure	1.2	-
Bearing capacity of foundation	2.5	1.5
Allowable pressure of foundation rubble	50 tons/m^2	50 tons/m^2

1.11.4 Port Facilities to be Designed

The facilities to be designed for the Port of Algiers under the project are as illustrated in Fig. 1.11.2.

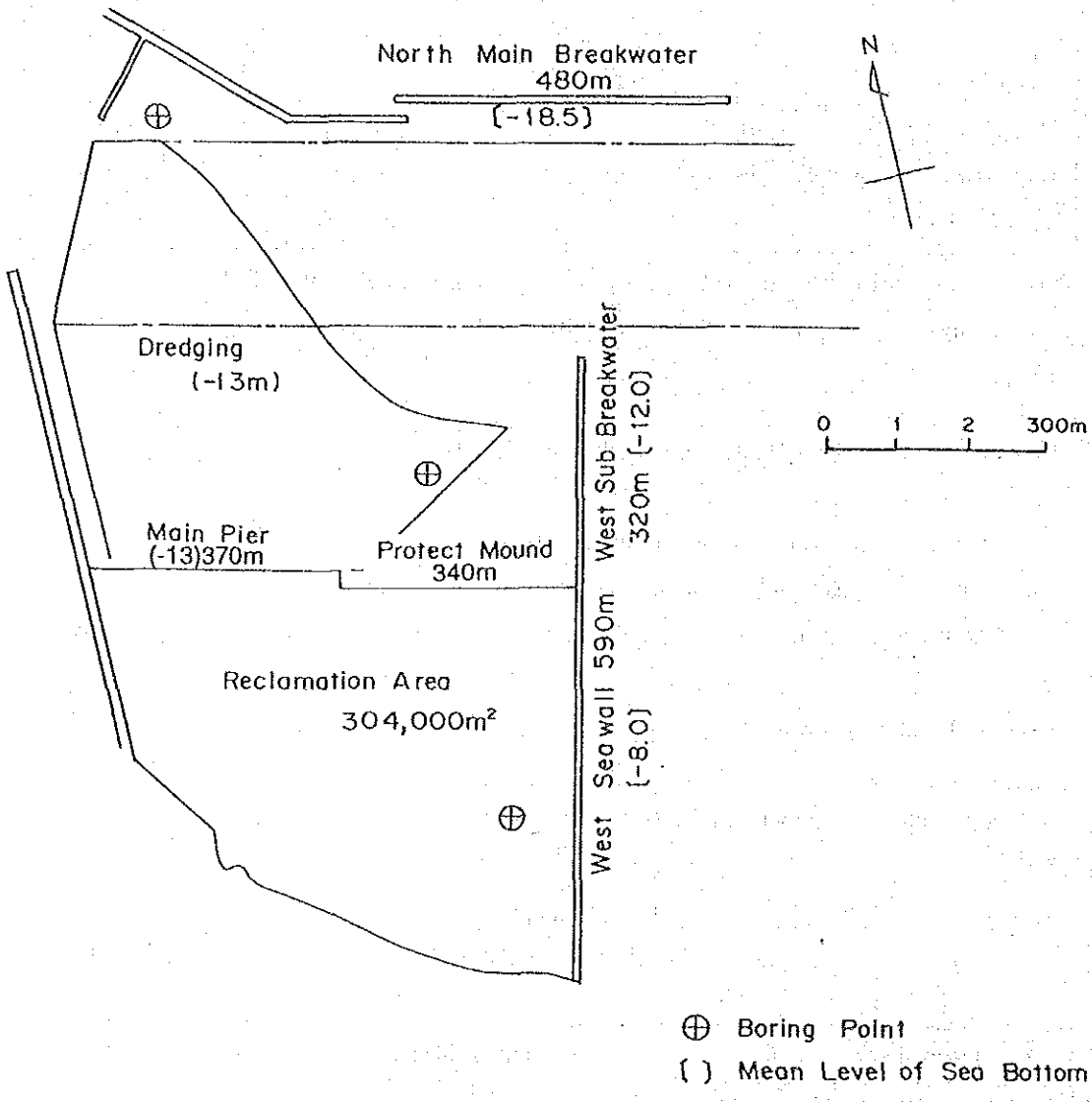

Fig. 1.11.2 General Plan of Design Facilities

1.11.5 Design of Breakwater

(1) Design wave Height

The maximum wave height and corresponding wave period used for structural design of the proposed breakwaters is determined by taking account of wave transformation from offshore to breakwaters. As for wave transformation, refraction, shoaling transformation, diffraction, etc. were considered. The resulting figures are shown as follows:

1) North Breakwater

Wave height $H_{1/3}$ = 7.3 m

Wave period $H_{1/3}$ = 11.8 sec.

Angle of incidence β = 11.5°

(Prevailing direction of advance: N40°E)

2) West Breakwater

Wave height $H_{1/3}$ = 5.5 m

Wave period $T_{1/3}$ = 11.8 sec.

Angle of incidence β = 68.5°

(Prevailing direction of advance: N20°E)

(2) Natural Ground

According to analyses of soil data obtained from this study and previous studies, meter the foundation soil layer under the proposed breakwaters consists of about a 10-meter-deep upper layer of silty clay and a lower layer of sandy silt (see Fig.1.11.3).

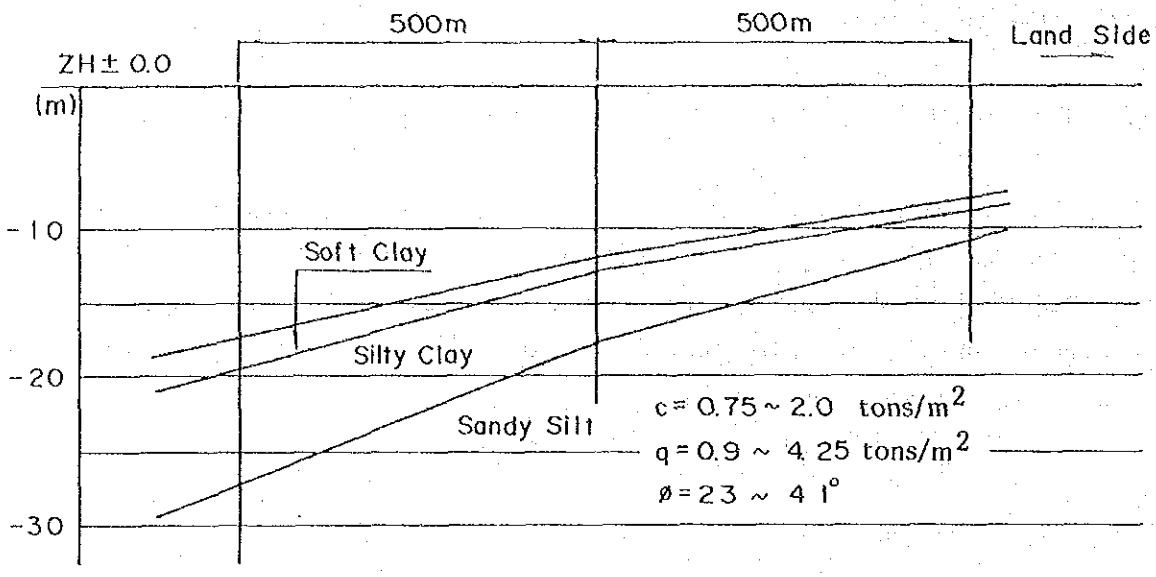

Fig. 1.11.3 Geological Profile

(3) Structural Type and Standard Section of Breakwaters

Common types of breakwater structures include composite breakwaters having caissons, cellular blocks, concrete blocks,etc. as the main body, and rubble mound breakwaters incorporating large quantities of stones.

In Algeria, the existing breakwaters are mostly rubble mound type structures due primarily to the abundant availability of locally produced stones at low cost. For the purpose of this project, the rubble mound type will be selected for the proposed breakwaters, seawall and revetment for similar reasons.

The standard sections of the North and West Breakwaters, seawall and revetment have been determined as illustrated in Fig.1.11.4 to 1.11.7 as a result of an in-depth study of the structural stability requirements.

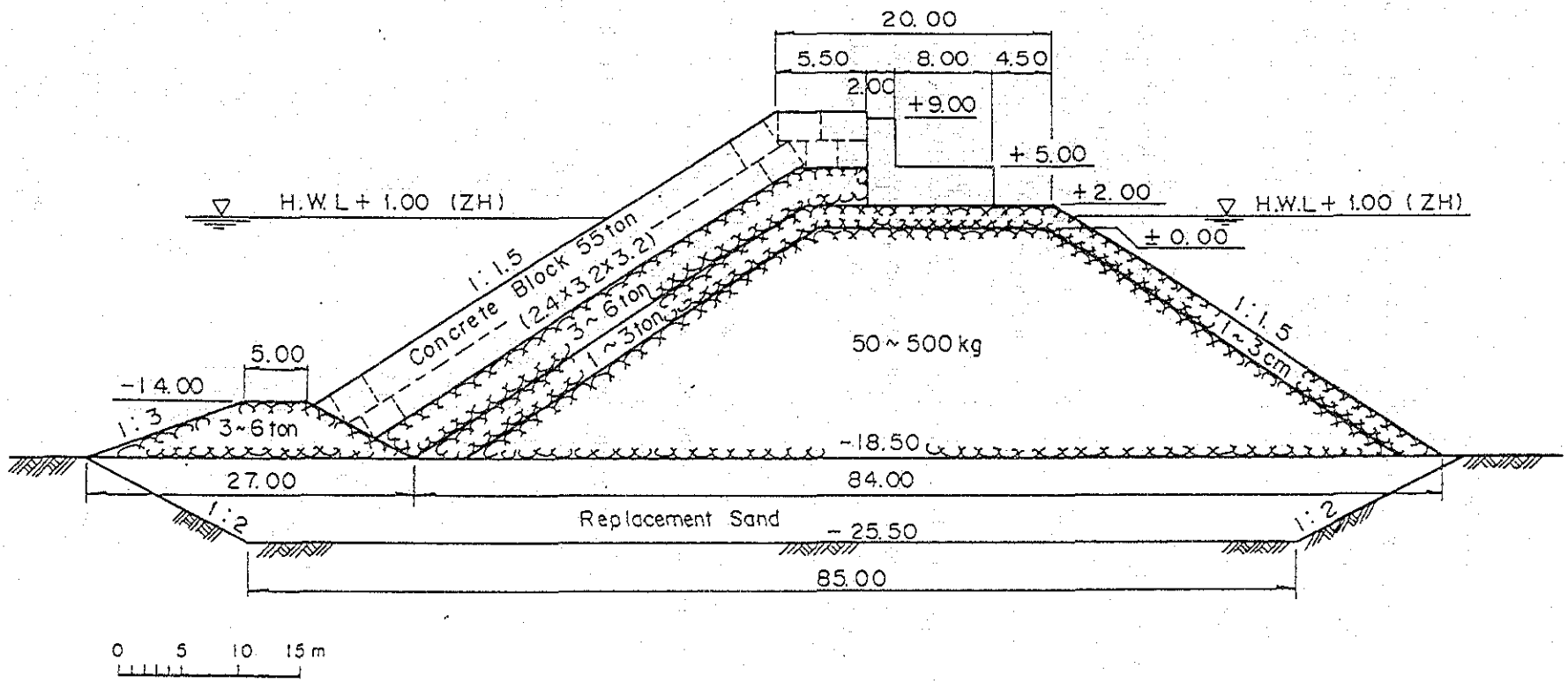

Fig. 1.11.4 Typical Cross Section of North Main Breakwatter

1.11.6 Design of Quay Wall

(1) Structural Type and Standard Section

The common structural types of quay walls catering to large ocean-going vessels include the gravity wall type, concrete block type, caisson type, steel pipe sheet wall type, cellular type, and pier type. The concrete block type, caisson type and steel pipe sheet wall type are often preferred for locations with relatively favorable soil conditions.

In Algeria, many of the existing quay walls for large ocean-going vessels are the concrete block type, presumably because of the relatively favorable soil conditions, ease of obtaining cement, stones and other necessary construction materials, and the availability of pertiment technology.

For the proposed quay wall in this Project, the block type or the caisson type seems to be the right choice in view of the previous constructions and the soil conditions of the proposed site. However, the final choice will have to be made after an in-depth economic study.

For the time being, however, the concrete block type is considered because of the local experience with this type of quay structure.

Fig.1.11.8 illustrates the standard section of the concrete block type of quay wall.

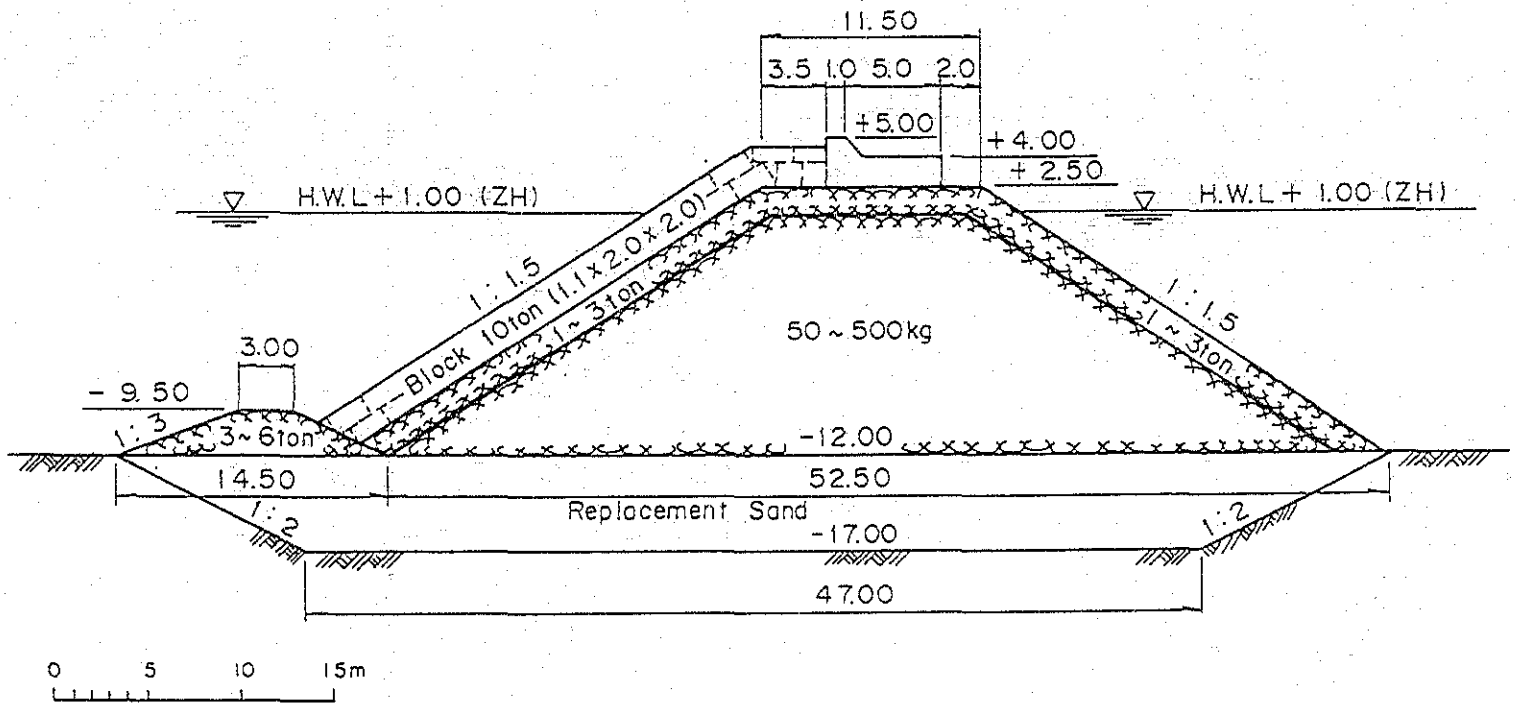

Fig. 1.11.5 Typical Cross Section of West Sub Breakwater

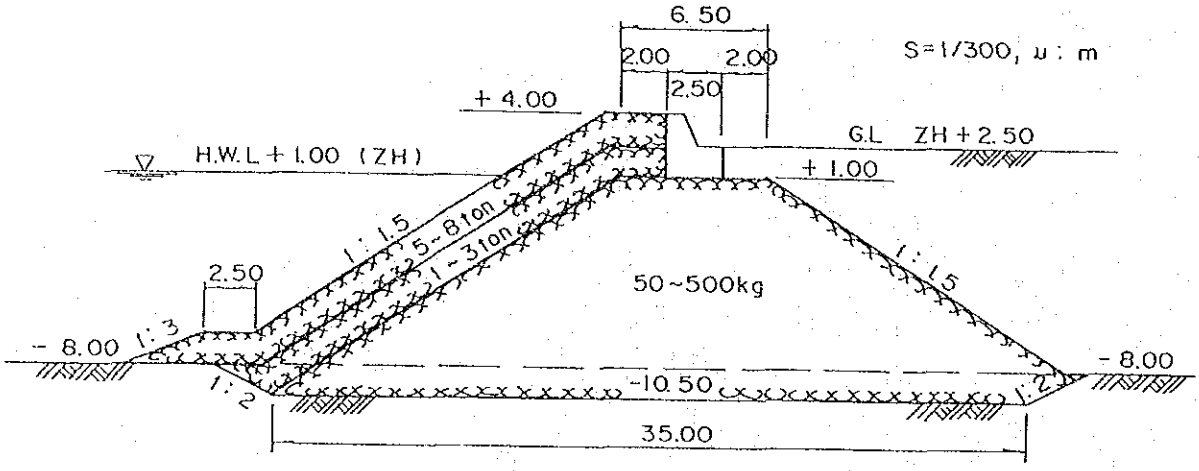

Fig. 1.11.6 Typical Cross Section of Seawall

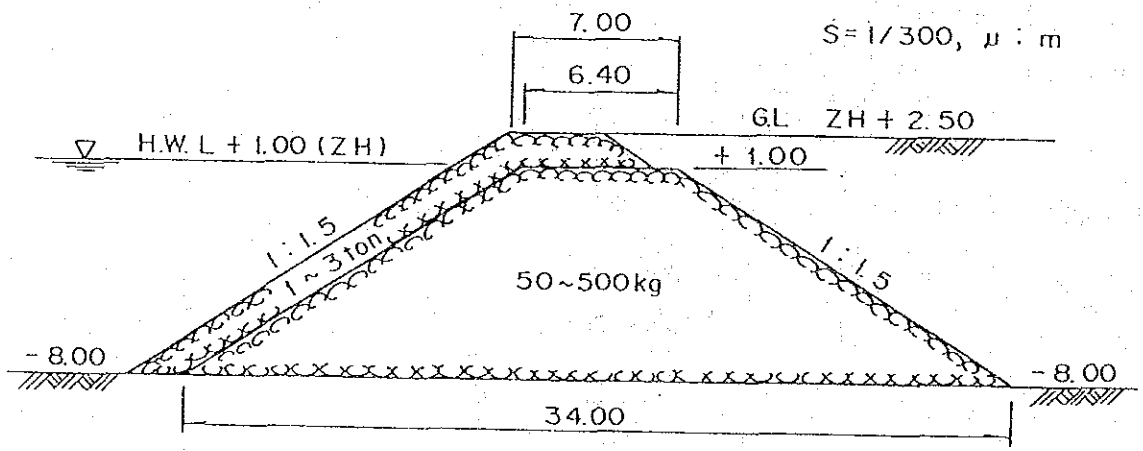

Fig. 1.11.7 Typical Cross Section of Protective Mound

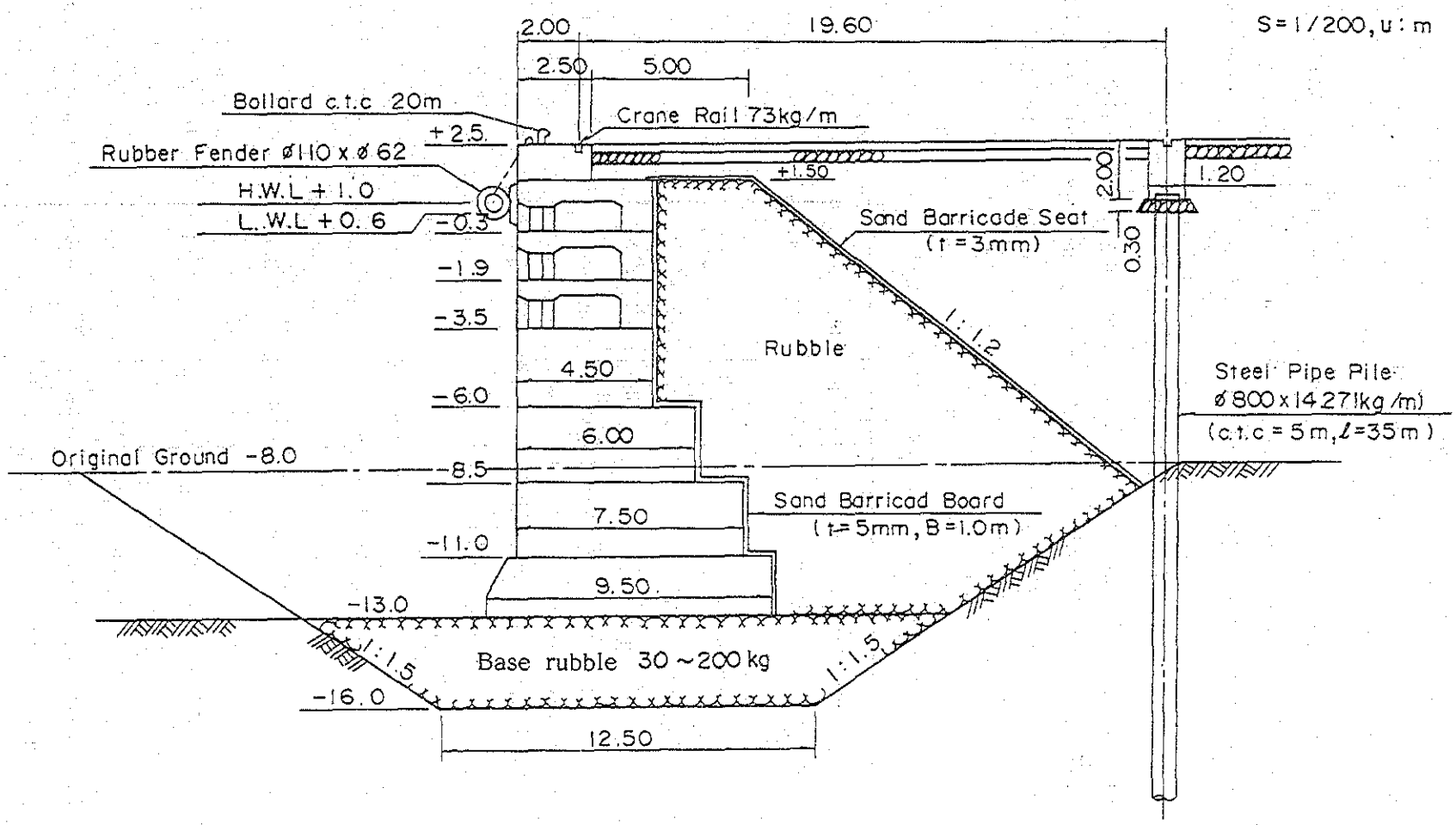

Fig. 1.11.8 Typical Section of Concrete Block Type Quay

1.12 Construction Planning for the Port of Algiers

1.12.1 General

The construction quantities for each facility in the Short-Term Plan for the Port of Algiers are shown in Table 1.12.1. The main construction materials which have been estimated based upon the foregoing preliminary design are listed in Table 1.12.2.

An economical construction plan shall be developed marking full use of local equipment. To complete the project within four years, the implementation of the construction and the supply of construction equipment and materials should be carefully planned.

Table 1.12.1 Construction Quantities

Description	Unit	Quantities
Dredging		
Channel & basin	m^3	950,000
Main Breakwater	m^3	382,000
Other Dredging	m^3	224,000
Breakwater		
Main Breakwater(-18.5m)	m	480
Sub Breakwater(-12.0m)	m	320
Seawall(-8.0m)	m	590
Reclamation of Land	m^2	304,000
Quay(-13.0m)	m	300
Cereal Silos 100,000t	No.	1
Cargo Handling Equipment		
Container Crane 40t	Nos.	2
Pneumatic Unloader 400t/hr	Nos.	2
Forklift 3t ~ 35t	Nos.	12

Table 1.12.2 Main Materials

Material		Unit	Breakwater	Quay	Yard	Total
Concrete Block	55T	Nos.	5,590	-	-	5,590
Concrete Block	10T	Nos.	5,900	-	-	5,900
Concrete Block	65T-35T	Nos.	-	1,400	-	5,900
Concrete		m^3	23,000	14,900	1,500	39,400
Steel Bar		Ton	4,400	1,290	160	5,850
Steel Pipe Pile		Ton	-	31	30	61
Rubble Stone		m^3	873,000	66,000	80,000	1,019,000
Rock Riprap	1.0T-3.0T	m^3	175,000	-	15,000	190,000
Armor Stone	3.0T-8.0T	m^3	179,000	-	-	179,000
Filling Sand		m^3	603,000	-	2,370,000	2,973,000

Note: The estimated quantities do not include any construction materials for silos.

1.12.2 Preliminary Study on Construction Procedure

The construction method of major works is briefly described below:

(1) Dredging and Reclamation

The required dredging and removal of seabed foundation volume is estimated to be 1,500,000 m^3. Dredging work will be conducted by a 2,000 - 3,000 HP pump dredger with a monthly output of around 100,000 m^3 and the dredged material will be dumped into the reclamation area.

The balance of reclamation work will be conducted by borrow materials to be obtained from the borrow pit in the suburbs of Algiers. The top 1.2 m of the land reclamation fill will be sufficiently compacted to provide sufficient bearing capacity for heavy traffic load of cargo handling equipment.

(2) Breakwater

Since the required volume of rubble and armored stones is almost 620,000 m^3 for the north main breakwater, 205,000 m^3 for the west sub-breakwater and 414,000 m^3 for the yard area, the construction work is divided into two sections. Construction of the north main breakwater will be done in the sea using barges. The west sub breakwater and yard area will be carried out on land.

The stones, sorted into sizes and stockpiled at the quarry site, will be directly hauled to each section and dumped by dump trucks and barges.

The securing of rubble at the start of construction is indispensable in generating a smooth supply of materials during the construction period.

On the other hand, the required number of concrete blocks (55.0 ton and 10.0 ton) is estimated to be 11,500 and a total area of about 6,000 m^2 will be required for manufacturing and temporarily stockpiling them.

(3) Quay (-13.0m)

After finishing the dredging work of the foundation, installation of base rubble and concrete blocks should begin.

After that, backfilling, placing of coping concrete and pavement should be carried out.

Finally, a steel pipe piling and a concrete beam will be constructed as the base of the container crane.

1.12.3 Construction Schedule

In considering the construction schedule, working days and productivity have been set as follows:

(1) Assessment of Working Days

The annual working days for the onshore and off-shore work at the site have been estimated based on the following considerations All the data relevant to construction planning have been collected from the Central Meteorological Observatory and wave records from US Naval data. An average wind speed of 10 m/sec and significant wave height of 1.0 m have been assessed as critical for the carrying out of the off-shore work.

As for holidays, non-working Fridays and public holidays, a total of 65 non-operational days have been considered, but in the case of off-shore work the number of non-working days has been reduced to 50 days annually.

The working days used for construction planning are shown below.

Table 1.12.3 Estimated Annual Working Days

Description	On-shore Work (days)	Off-shore Work (days)
Windy Days(non-working)	6	*(12)
Rough Sea Day(non-working)		44
Rainy Days(non-working)	3	*(3)
Holidays(non-working)	65	50
Total of Non-working Days	74	94
Annual Working Days	291	271
Monthly Average Working Days	24	22

* Windy days & rainy days are included in the rough sea days.

(2) Productivity

The targeted productivity of major works in the Project has been compiled as follows:

Dredging (3,000 HP)	5,000 m^3/day
Dissposal of rubble and armored stone	1,500 m^3/day
Installation of concrete block for Main Breakwater	10 Units/day
Installation of concrete block for Subbreakwater & Quay	20 units/day
Reclamation by Borrow Materials	3,000 m^3/day

(3) Construction Schedule

The construction schedule of the Project is shown in Fig.1.12.1.

Fig 1.12.1 Construction Schedule of Main Facilities

Work Item	Unit	Q'ty	1st Year	2nd Year	3rd Yea	4th Year	5th Year
1. Design & Tendering	L.S						
2. Mobilization	L.S						
3. Dredging Works							
(1) Main Breakwater	m3	382,000					
(2) Channel&Basin	m3	950,000					
(3) Other Dredging	m3	224,000					
4. Breakwater							
(1) Main Breakwater	m	480					
(2) Sub Breakwater	m	320					
(3) Seawall	m	590					
5. Reclamation of Land							
(1) Dredging Material	m3	1,248,000					
(2) Borrow Material	m3	2,319,000					
6. Quay							
(1) Concrete Block Quay	m	330					
(2) protect Mound	m	365					
7. Preparation of Yard							
(1) Dressing of Yard	m2	216,000					
(2) Pavement of Yard	m2	133,700					

1.13 Cost Estimation

1.13.1 Basic Conditions for Cost Estimation

The main conditions for the cost estimation are as follows:

(1) Construction costs have been estimated in principle using the prices and rates obtained in October 1991.

(2) The inflation factor has been excluded from estimation.

(3) The exchange rates of the U.S.$ against the Algerian Dinar (DA) and the Japanese Yen (JY) are as follows:

U.S.$1 = DA 21.90 = JY131.25

(4) Rents or compensation for land and fishing activities have been excluded from the estimation.

(5) In general, the costs of the foreign portion of the operation include the following:

i) Foreign currency portion of equipment (depreciation cost for imported equipment)
ii) Imported materials and products
iii) Foreign currency portion of indirect cost
iv) Cost of engineering services by foreign consultants

(6) The construction costs of water and electricity supply, drainage and communication facilities are included in the yard preparation works.

(7) Customs duties on imported materials are included in the direct cost.

(8) Physical contingencies are as follows;

0% Cargo - handling equipment
5% Dredging, road, pavement and land preparation cost.
10% Constructions of breakwaters, quays and buildings.

(9) The consultation and technical cooperation fee is 8 %.

1.13.2 Results of Estimation

A summary of the estimation results is presented in Table 1.13.1 and the result for each item is presented in Table 1.13.2.

Table 1.13.1 Summary of Construction Cost

Unit: Million DA

No.		Construction cost		
		Foreign Portion	Local Portion	Total
1.	Container Terminal 2	1,652.6	853.0	2,505.6
2.	Cereal Terminal	804.8	367.9	1,172.7
3.	Container Terminal	11.3	7.2	18.5
4.	Metalic Material Berth	0.3	0.1	0.4
5.	Railway Siding	25.5	23.2	48.7
	Sub Total	2,494.5	1,251.4	3,745.9
6.	Cargo Handling Equipment	673.4	79.9	753.3
	Direct Cost Total	3,167.9	1,331.3	4,499.2
7.	Physical Contingency	26.3	113.3	339.6
8.	Engineering Service	199.6	100.1	299.7
	Indirect Cost Total	425.9	213.4	639.3
9.	Total Cost	3,593.8	1,544.8	5,138.6
10.	Tax(VAT)	251.6	108.1	359.7
11.	Project Cost	3,845.4	1,652.9	5,498.3

On the basis of the construction schedule shown in Fig. 1.12.1, the yearly disbursement schedule has been estimated as shown in Table 1.13.3.

Table 1.13.2 Construction Cost

Unit: 1,000DA

Facilities		Consturuction Cost		
Item	Sub Item	Foreign Portion	Local Portion	Total
1. Terminal 2. excluding a railway yard	(1)Direct Cost of Civil & Building	1,652,614	853,067	2,505,681
	*Main Breakwater	687,785	342,886	1,030,671
	*Sub Breakwater	224,949	102,616	327,565
	*Seawall	169,559	68,876	238,435
	*Dredging of Basin & Channel	19,950	117,800	137,750
	*Reclamation of Land	198,291	68,874	267,165
	*Quay	126,467	80,814	207,281
	*Preparation & Pavement of Yard	36,855	29,954	66,809
	*Terminal Buildings	20,513	12,859	33,372
	*Miscellaneous	4,472	3,542	8,014
	*Mobilization Cost	163,773	24,846	188,619
	(2)Indirect Cost	277,153	144,118	421,271
	*physical Contingency	144,944	75,873	220,817
	*Engineering Services	132,209	68,245	200,454
	(3)Cargo Handling Equipment	41,256	2,544	43,800
	(4)Construction Cost	1,971,023	999,729	2,970,752
2. Cereal Terminal	(1)Direct Cost Civil & BUilding	804,840	367,904	1,172,744
	*Foundation of Unloader	5,831	5,128	10,959
	*Service Railway Line	12,000	11,760	23,760
	*Cereal Silos	707,250	340,300	1,047,550
	*Mobilization Cost	79,759	10,716	90,475
	(2)Indirect Cost	143,882	65,353	209,235
	*Physical Contingency	79,495	35,921	115,416
	*Engineering Services	64,387	29,432	93,819
	(3)Pneumatic Unloader 400T x 2	309,140	28,104	337,244
	(4)Construction Cost	1,257,862	461,361	1,719,223
3. Terminal 1.	(1)Direct Cost of Civil Work	11,290	7,144	18,434
	*Foundation of Crane	9,875	6,734	16,609
	*Miscellaneous	296	202	498
	*Mobilization	1,119	208	1,327
	(2)Indirect Cost	1,468	929	2,397
	*Physical Contingency	565	357	922
	*Engineering Services	903	572	1,475
	(3)Contalner Crane 40.5 T x 2	323,038	49,246	372,284
	(4)Construction Cost	335,796	57,319	393,115
4. Metalic Material Berth	(1)Direct Cost of Civil Works	302	105	407
	*Demolish of Existing Sheds	272	102	374
	*Miscellaneous	30	3	33
	(2)Indirect Cost	39	13	52
	*Physical Contingency	15	5	20
	*Engineering Services	24	8	32
	(3)Construction Cost	341	118	459
5. Railway Yard at Terminal 2	(1)Direct Cost	25,530	23,216	48,746
	*Railway Construction	23,000	22,540	45,540
	*Miscellaneous	2,530	676	3,206
	(2)Indirect Cost	3,319	3,018	6,337
	*Physical Contingency	1,277	1,161	3,438
	*Engineering Services	2,042	1,857	3,899
	(3)Construction Cost	28,849	26,234	55,083
6. Total Cost		3,593,871	1,544,761	5,138,632
7. Tax(VAT)	6 x 7 %	251,571	5,138,632	359,704
8. Project Cost		3,845,442	1,652,894	5,498,336

Table 1.13.3 Yearly Disbursament Schedule

Unit: 1,000 DA

Facilities		total Construction Cost			1st/2nd Year			3rd Year			4th Year			5th Year		
Item	Sub Item	F/P	L/P	Total	F/P	L/P	Total	F/P	L/P	Total	F/P	L/P	Total	F/P	L/P	Total
1. Terminal 2 (excluding railway yard)	1)Main Breakwater	687,785	342,886	1,030,671	143,159	127,162	270,321	180,987	68,521	249,508	177,248	65,553	242,801	186,391	81,650	268,041
	2)Sub Breakwater	224,949	102,616	327,565	11,655	16,170	27,825			0	91,379	37,074	128,453	121,915	49,372	171,287
	3)Seawall	169,559	68,876	238,435	21,086	15,566	36,652	78,645	28,997	107,642	40,694	14,602	55,296	29,134	9,711	38,845
	4)Dredging of Basin & Channel	19,950	117,800	137,750	19,950	117,800	137,750			0			0			0
	5)Reclamation of Land	198,291	68,874	267,165	66,860	23,761	90,621	65,716	22,557	88,273	65,715	22,556	88,271			0
	6)Quay	126,467	80,814	207,281			0	16,450	11,637	28,087	36,675	23,113	59,788	73,342	46,064	119,406
	7)Preparation & Pavement of Yard	36,855	29,954	66,809			0			0			0	36,855	29,954	66,809
	8)Terminal Buildings	20,513	12,859	33,372			0			0			0	20,513	12,859	33,372
	9)Miscellaneous	4,472	3,542	8,014			0	98	103	201	3,975	3,138	7,113	399	301	700
	10)Mobilization Cost	163,773	24,846	188,619	163,773	24,846	188,619			0			0			0
	11)Phisical contigency	144,944	75,873	220,817	37,396	28,908	66,304	30,003	11,684	41,687	36,526	14,795	51,321	41,019	20,486	61,505
	12)Engineering Services	132,209	68,245	200,454	70,236	34,006	104,242	20,657	11,413	32,070	20,658	11,413	32,071	20,658	11,413	32,071
	13)Cargo Handling Equipment	41,256	2,544	43,800			0			0			0	41,256	2,544	43,800
	14)Tax	137,972	69,981	207,953	37,388	27,175	64,563	27,479	10,844	38,323	33,101	13,457	46,558	40,004	18,505	58,509
	Total Construction Cost	2,108,995	1,069,710	3,178,705	571,503	415,394	986,897	420,035	165,756	585,791	505,971	205,701	711,672	611,486	282,859	894,345
2. Terminal 1	1)Foundation of crane	9,875	6,734	16,609							9,875	6,734	16,609			
	2)Miscellaneous	296	202	498							296	202	498			
	3)Mobilization	1,119	208	1,327							1,119	208	1,327			
	4)Phisical contigency	565	357	922							565	357	922			
	5)Engineering Services	903	572	1,475				338	215	553	565	357	922			
	6)Container Crane 30.5T x 2	323,038	49,246	372,284									0	323,038	49,246	372,284
	7)Tax	23,506	4,012	27,518				24	15	39	869	550	1,419	22,613	3,447	26,060
	Total Construction Cost	359,302	61,331	420,633				362	230	592	13,289	8,408	21,697	345,651	52,693	398,344
3. Railway Yard at Terminal 2	1)Railway Construction	23,000	22,540	45,540				17,250	16,905	34,155	5,750	5,635	11,385			
	2)Miscellaneous	2,530	676	3,206							2,530	676	3,206			
	3)Phisical contigency	1,277	1,161	2,438				895	813	1,708	382	348	730			
	4)Engineering Services	2,042	1,857	3,899	757	696	1,453	964	871	1,835	321	290	611			
	5)Tax	2,019	1,836	3,856	53	49	102	1,338	1,301	2,639	628	486	1,114			
	Total Construction Cost	30,868	28,070	58,939	810	745	1,555	20,447	19,890	40,337	9,611	7,435	17,046			
	Total	2,499,165	1,159,112	3,658,277	572,313	416,139	988,452	440,844	185,876	626,720	528,871	221,544	750,415	957,137	335,552	1,292,689
4. Cereal Terminal	1)Foundation of unloader	5,831	5,128	10,959							3,499	3,077	6,576	2,332	2,051	4,383
	2)Service Railway line	12,000	11,760	23,760							8,400	8,232	16,632	3,600	3,528	7,128
	3)Cereal Silos	707,250	340,300	1,047,550				192,886	92,809	285,695	608,618	148,495	457,113	205,746	98,996	304,742
	4)Mobilization	79,759	10,716	90,475				79,759	10,716	90,475						
	5)Physical contigency	79,495	35,921	115,416				25,583	11,521	37,104	32,666	14,675	47,341	21,246	9,725	30,971
	6)Engineering Services	64,387	29,432	93,819	24,145	11,037	35,182	13,414	6,132	19,546	13,414	6,132	19,546	13,414	6,131	19,545
	7)Pneumatic Unloader 400T x 2	309,140	28,104	337,244							154,570	14,052	168,622	154,570	14,052	168,622
	8)Tax	88,050	32,295	120,346	1,690	773	2,463	21,815	8,482	30,297	36,482	13,626	50,108	28,063	9,414	37,477
	Total Construction Cost	1,345,912	493,656	1,839,569	25,835	11,810	37,645	333,457	129,660	463,117	557,649	208,289	765,938	428,971	143,897	572,868

Note: the cost of a minimum capacity 40T/h Oil Separator System is 32.7 million DA.

CHAPTER 2 SHORT-TERM PLAN FOR THE PORT OF ORAN

2.1 Target of Short-Term Plan

The major goals for the port of Oran by 1997 include augmentation of facilities and improvement of operations.

The redevelopment of cereals berth and completion of container berth financed by the World Bank is indispensable under the short-term plan. The location of container terminal is planned at existing Quays Nos. 21-23, where reconstruction has already started.

The annual handling volume of cereals at the port of Oran in 1990 was about 1.2 million tons, and the volume handled at Quay No.12 was about 600 thousand tons, the remaining was almost entirely handled at Quays Nos. 21-23.

As a result of reconstruction of the container terminal, the total handling capacity of cereals will be decreased. Therefore, it is necessary to acquire facilities including silos to adequately handle the increased volume of cereals.

Since installation of additional facilities can not be quickly expected, operational improvements should be promoted including the use of transit sheds and introduction of measures, for the time being, to prevent cargo damage during loading, unloading and storage.

A short-term policy aimed at increasing the actual handling productivity of certain key facilities will ensure smooth implementation of the master plan.

2.2 Study Concerning Required Berths

2.2.1 Determination of Number of Berths

The proposed scale of the short-term plan must be in accordance with the volume of cargoes to be handled. In Chapter 8, the volume of cargoes that will be handled at the port of Oran in 1997 is shown in Table 2.2.1.

Table 2.2.1 Volume of Cargoes Handled in 1997

Commodities	Volume of Cargoes (tons)		
	Import	Export	Total
(General Cargoes)			
Timber	94,000		94,000
Sugar	115,000		115,000
Other Agricultural Prod.	25,000		25,000
Other Foodstuff	68,000		68,000
Fertilizer	17,000		17,000
Chemical P.,Manufactrd G.	247,000	23,000	270,000
Sub-total	566,000	23,000	589,000
(Bulk Cargoes)			
Cereals	1,300,000		1,300,000
Vegetable Oil	113,000		113,000
Animalfeed	125,000		125,000
Petroleum Prod.	726,000		726,000
Metallic Prod.	217,000		217,000
Cement	357,000		357,000
Costrution Materials	63,000		63,000
Metallurgical Scrap		11,000	11,000
Sub-total	2,901,000	11,000	2,912,000
(Container Cargoes)	245,000		245,000
		3,000	3,000
Sub-total	245,000	3,000	248,000
Grand Total	3,712,000	37,000	3,749,000

2.2.2 General Cargo and Ro-Ro Vessel Wharf

General cargo volume will be 880 thousand tons in 1997. However, since 150 thousand tons transported by Ro-Ro vessels is planned to be handled at Berth No.10 and No.25, the volume to be handled at 14 general cargo berths is assumed at 730 thousand tons.

(1) Number of berths

1) In planning for general cargo, the following conditions are set:

a. The volume of general cargoes handled in 1997 is 730 thousand tons.

b. The cargo handling capacity of 30.8 tons/hour is used for calculation.

c. The average per-ship loading/unloading volume is 2,400 tons.

d. Average time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).

e. Necessary processing time for entry and departure is 2 hours per ship.

f. The size of ships is considered to be 7,000 DWT class.

2) In planning for Ro-Ro vessel, the following conditions are set:

a. The volume handled in 1997 is 150 thousand tons.
b. The cargo handling capacity of 18.8 tons/hour is used for calculation.
c. The average per-ship loading/unloading volume is 760 tons.
d. Average time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours pership.
f. The size of ships is considered to be 6,000 DWT.

The required number of berths in 1997 is determined as follows: The total annual ship calls for these vessels at this port is 457, the total berthing time is 31,544 hours. Since the available time for using berths is 3,720 hours, the berth occupancy ratio is 53.0 % for sixteen berths.

Based on these results, the existing berths should be sufficient in the short term.

(2) Planning of cargo handling and storage facilities

In 1997, the volumes of cargoes through transit shed and open storage yard areas are estimated as shown in Table 2.2.2.

The required area of the storage facilities is determined by the formula as mentioned in Part I, Section 11.3.

Table 2.2.2 Volume of Cargoes Passing through Transit Shed and Open Storage Yard in 1997

Commodities	Volume of Cargo (tons)	Direct Cargo (tons)	(tons)		
			Open Storage	Transit Shed	Sub-total
Timber	94,000		94,000		94,000
Sugar	115,000	57,500		57,500	57,500
Other Agricultural Prod.	25,000	12,500		12,500	12,500
Other Foodstuff	68,000	34,000		34,000	34,000
Fertilizer	17,000	8,500		8,500	8,500
Chemical, Manufacture Prod.	270,000	135,000		135,000	135,000
Metallic Prod.	217,000		217,000		217,000
Construction Materials	63,000		63,000		63,000
Metallurgical Scrap	11,000		11,000		11,000
Total	880,000	247,500	385,000	247,500	632,500

1) Transit shed

The required size of the transit shed is shown as Table 2.2.3.

Table 2.2.3 Required Area of Transit Shed

Volume of Cargo Handled N		Annual Storage Volume R x a x W (tons/m2)			Required Area (N x P / R x a x W) /B (m2)
Sugar	57,500	122	0.5	2.5	654
Other Agricultural Prod.	12,500	122	0.5	2.5	142
Other Foodstuff	34,000	122	0.5	2.5	386
Fertilizer	8,500	122	0.5	2.5	97
Chemical, Manufacture Pro	135,000	37	0.5	2.5	5,059
Total					6,300

2) Open storage yard

The necessary size of open storage yard is shown in Table 2.2.4.

Table 2.2.4 Required Size of Open Storage Yard

Volume of Cargo Handled N		Annual Storage Volume R x a x W (tons/m2)			Required Area (N x P / R x a x W) /B (m2)
Timber	94,000	37	0.5	1.2	7,339
Metallic Prod.	217,000	37	0.5	2.0	10,166
Construction Materials	63,000	24	0.5	2.0	4,550
Metallurgical Scrap	11,000	24	0.5	2.0	794
Total					22,900

Then the existing storage facilities should be sufficient in the short term.

2.2.3 Cereals Wharf

The present cereals wharf at Quay No.12 is equipped with three units of unloading equipment (nominal capacity 400 t/hour x 1, 200 t/hour x 2), and two units (400 t/hour x 1, 200 t/hour x 1) are connected with a silo (30,000 tons).

The volume of cereals in 1997 is estimated at 1.3 million tons, which can not be adequately handled at the Quay No.12. Therefore, it is necessary to study the feasibility of handling this total volume at two wharves, since three of the existing quays will be out of use, due to reconstruction of Quays Nos. 21-23.

Hence it will be assumed that the volume of cereals handled at Quay

No.12 will be 600 thousand tons, the remaining is planned to be temporarily handled at the new container berth planned in the Master Plan, which will be completed by the year 2010.

The facilities required to handle these volumes are examined as follows;

(1) Number of berths

1) In planning for Quay No.12, the following conditions are set:
   a. The volume of cereals handled is 600 thousand tons.
   b. The cargo handling equipment consists of two unloaders (400 t/hour x 1,200 t/hour x 1) for this berth. he work efficiency is 0.64.
   c. The per-ship unloading volume is 25,000 tons and 7,000 tons. The 7,000 tons of cereals will be unloaded at the port of Oran from the vessels which will leave for the port of Ghazaouet in order to lessen this draft as they do at present.
   d. The number of ship is 19 x 25,000 tons and 17 x 7,000 tons.
   e. The per-berth available time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
   f. Necessary processing time for entry and departure is 2 hours per ship.
   g. The size of ships is considered to be 32,000 DWT.

2) In planning for an additional new berth, the following conditions are set:
   a. The volume of cereals handled is 700 thousand tons.
   b. The cargo handling equipment consists of three unloaders (200 t / hour x 3) for this berth. The work efficiency is 0.64.
   c. The average per-ship unloading volume is 35,000 tons.
   d. The per-berth available time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
   e. Necessary processing time for entry and departure is 2 hours per ship.
   f. The size of ships is considered to be 40,000 DWT.

The result of calculations are as follows;

As for 1); The total number of ship calls is 36, and the total berthing time is 1,635 hours. Since the per-berth annual hours available for use are 3,720 hours per year, the berth occupancy ratio is 44.0 %. As for 2); The total ship calls is 20, and the total berthing time is 1,863. Since the per-berth annual

hours available for use are 3,720 hours per year, the berth occupancy ratio is 50.1 %.

The result of the simulation indicates an average berth occupancy ratio of 46.1 % and a waiting time of 100 hours.

Based on these estimations, it appears that existing berth No.12, and an additional new berth will be sufficient for the short-term.

As for the additional new berth, since the standard dimensions for 40,000 DWT has a length of 190 m, width of 28.5 m and maximum draft of 12 m, then the length and water depth of this berth is made to 200 m and -13.0 m; neighboring quay (Quay No.22) is available to facilitate mooring.

As for the silo, a silo with a holding capacity of 30,000 tons is already in place immediately behind Quay No.12. Since the annual volume to pass through the silo will be 600 thousand tons and an annual turnover of 20 times/yr, then existing silo will be sufficient to meet Quay No.12's short-term requirements.

As for the cereals handled at the new berth, 700 thousand tons are planned to be handled there; therefore an additional silo with a holding capacity of 35,000 tons will be required and will be constructed immediately behind the new berth. Also, two new tire-mount pneumatic unloaders (nominal capacity; 200 t/hour x 2) will be installed, and one of the existing unloaders (nominal capacity; 200 t/hour) at Quay No.12 will be shifted to this berth. A new belt conveyor between the quay and silo will be constructed for temporary use until completion of the new cereals berth planned in the Master Plan.

2.2.4 Vegetable Oil Wharf

At present, vegetable oil is handled at Berth No.27. The volume of vegetable oil to be handled in 1997 will be 113 thousand tons.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of vegetable oil in 1997 is 113 thousand tons.

b. The cargo handling capacity of 65 tons/hour is used for calculation.

c. The average per-ship unloading volume is 2,500 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 6,000 DWT.

The number of berths required in 1997 is calculated as follows: The annual number of ships calling at port is 45. Since the per-ship berthing time is 40 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 1,800 hours. Since the per-berth available time for use is 7,440 hours per year, the berth occupancy ratio is 24.2 % for one berth.

Based on these estimations, the capacity of existing berth should be sufficient in the short term.

2.2.5 Animal Feed Wharf

The animal feed berth is planned at the head of Quay No.15. The volume of animal feed to be handled in 1997 will be 125 thousand tons.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of animal feed in 1997 is 125 thousand tons
b. A cargo handling capacity of 80 tons/hour is used for calculation.
c. The average per-ship unloading volume is 15,000 tons.
d. The per-berth available time for using berths is 3,720 hours per year (12.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 20,000 DWT.

The number of animal feed berths required in 1997 is calculated as follows: The annual number of ships calling at the port is 8. Since the per-ship berthing time is 190 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 1,520 hours. Since the per-berth available time for use is 3,720 hours per year, the berth occupancy ratio is 40.9.% for one berth.

Based on these estimations, the capacity of the existing berth should be sufficient in the short term.

2.2.6 Petroleum Products Wharf

Quay No.17, is consisting of Berth No.20 and No.21, is equipped to handle petroleum products. At present, Berth No.21 is mainly used for handling petroleum products.

The volume of petroleum products to be handled in 1997 will be 726 thousand tons.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of petroleum products handled in 1997 is 726 thousand tons.
b. A cargo handling capacity of 83 tons/hour is used for calculation.
c. The average per-ship unloading volume is 5,000 tons.
d. The per-berth available time for using berths is 7,440 hours per year (24 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 6,000 DWT.

The number of petroleum products berths required in 1997 is calculated as follows: The annual number of ships calling at the port is 145. Since the per-ship berthing time is 62 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 8,990 hours. Since the per-berth available time for use is 7,440 hours per year, the berth occupancy ratio is 60.4 % for two berths.

Based on these estimations, the capacity of the existing two berths should be sufficient in the short term.

2.2.7 Cement Wharf

At present, cement is handled at the head of Quay No.19 through the cement plant ship.

The volume of cement to be handled at Berth No.19 in 1997 will be 357 thousand tons.

(1) Number of berths

In planning, the following conditions are set:

a. The volume of cement handled in 1997 is 357 thousand tons.
b. A cargo handling capacity of 200 tons/hour is used for calculation.
c. The average per-ship unloading volume is 20,000 tons.
d. The per-berth available time for using berths is 5,580 hours per year (18.0 hours/days x 310 days).
e. Necessary processing time for entry and departure is 2 hours per ship.
f. The size of ships is considered to be 28,000 DWT.

The number of cement berths required in 1997 is calculated as follows: The annual number of ships calling at the port is 18. Since the per-ship berthing time is 102 hours based on the volume of unloading and the cargo handling capacity, the total berthing time is 1,836 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy ratio is 32.9 % for one berth.

Based on these estimations, the capacity of the existing berth should be sufficient in the short term.

2.2.8 Car Ferry Wharf

At present, ferry services at the port of Oran are provided at Quay No.9, which consists of two berths (Berth No.6 and No.7), and the ferry terminal is in place immediately behind.

The total number of passengers in 1997 will be 228 thousand.

(1) Number of berths

In planning, the following conditions are set:

a. The number of passengers in 1997 is 228,000.
b. The average number of passengers per ship is 1,300.
c. The average mooring time per ship is 36 hours.
d. The annual available hours for using berth is 5,580 hours. (18 hours/days x 310 days)
e. The size of ships is considered to be the 10,000 DWT class.

The number of car ferry berths required in 1997 is calculated as follows: The annual number of ships calling at the port is 175. Since the per-ship berthing time is 36 hours, the total berthing time is 6,300 hours. Since the per-berth available time for use is 5,580 hours per year, the berth occupancy ratio is 56.5 % for two berths.

Based on these estimations, the capacity of the existing two berths should be sufficient in the short term.

2.2.9 Container Wharf

The reconstruction of the container terminal financed by the World Bank is planned at existing Quays Nos.21-23.

Volume of container cargoes handled in 1997 will be 248 thousand tons.

(1) Number of berths

1) In planning, the following conditions are set:

a. The volume of container cargoes handled in 1997 is 248 thousand tons.
b. Based on 1990 results, 10.2 tons is used as per-container cargo volume.
c. The average handling volume per hour is 30 TEU/hour.
d. It is assumed that the per-ship number of loaded containers that are loaded or unloaded is 500 TEU. Since the import/export ratio in 1997 is 98 % for import and 2 % for export, the ratio of empty containers to loaded container is 96 %. So, the per-ship number of containers handled is 1000 TEU.
e. The per-berth annual hours available for use are 3,720 hours (12

f. The necessary processing time for entry and departure is 2 hours per ship.

g. The size of ships is considered to be 19,000 DWT.

The necessary number of berths in 1997 is calculated as follows: Since the total number of containers in 1997 is 47.7 thousand TEU, the total annual ship calls for container vessels is 48. The total berthing time is 1,680. Since the per-berth annual hours available for use are 3,720 hours per year, the berth occupancy ratio is 45.2 % for one berth.

Based on these estimation, the capacity of the planned berth should be sufficient in the short term.

(2) Required scale of storage facilities

The required area of the storage facilities is determined by the formula as mentioned in Part I, Section 11.3.

1) Container yard

The required storage number of containers is shown in Table 2.2.5.

Table 2.2.5 Results of Required Storage Capacity in Container Yard

Items	Unit	Loaded Containers		Empty Containers	Total
		Import	Export		
Container Handling Volume	tons	245,000	3,000	-	248,000
Tons per-container	tons	10.2	10.2		
Annual Container Throughput (My)	TEUs	24,020	294	23,340	47,654
My / Dy x Dw x P	TEUs	1,007	9	979	1,995
Stacking Height	Layers	2.2	2.2	3.0	-
Required Number of Ground Slots	Slots	458	4	326	788
Slot area	m2				28,921

2) Container freight station (CFS)

The required size of the CFS is 2,200 m^2.

As mentioned previously in Section 11.2 of Part I, it appears that there will be a shortage of storage capacity, therefore, the site of the new container yard, which is not due for completion until 2010 as part of the Master Plan, will serve as a temporary container yard to handle the demand in the short term.

2.3 Other Port Facilities

(1) Breakwater

The expansion of the northern breakwater is not proposed for the additional new berth in view of the marine conditions in the vicinity of the port of Oran. During monsoons or the rainy season, formidable waves may develop in the harbor. When the marine conditions are unfavorable, cargo handling work at the port is sometimes stopped, depending on the severity of the rain or wind. Though expansion of the breakwater is desirable for the safety and efficiency of the new berth, the investment for the expansion of breakwater is not warranted in the period of the short-term plan, in the light of its construction cost and the number of calling vessels. The detailed analysis concerned can be found in following A.6.

(2) Road

The volume of traffic generated at the port is determined by the formula as mentioned in Part I, Section 11,3.

Table 2.3.1 shows generated traffic volume by wharf.

Table 2.3.1 Generated Traffic Volume in 1997

Type	Cargo Volume ('000t)	Cargo weight of loaded (t/car)	Hourly generated traffic volume (car/hour)
Genral Cargo	880	8	138
Container Cargo	248	8.1	38
Cereals	702	12.0	73
Other Bulk	482	10.5	57
Total	2,312		310

Daily port generated traffic volume is about 3,100 cars.

Access roads and an inner port road that connect with the national road are proposed to smoothly distribute port traffic generated at the wharves

(3) Railway

The volume of railway cargoes at the port of Oran in 1990 was about 690 thousand tons or 24 % of port-handled cargo.

The total volume of railway cargoes at the port of Oran in 1997 is assumed to be about 1.44 million tons.

The average number of arrival trains per day is calculated by the formula as mentioned in Part I, Section 11.3.

The average number of arrival trains in 1997 is 4.8 trains.

(4) Consideration of the high cliff

Just behind the proposed new development area in the short term, there is a high cliff at a height of about 70 m. In order to avoid possible risk of slop failure of the cliff, the related new port facilities will be constructed about 50 m from the end of the slope.

2.4 Cargo Handling System

2.4.1 Animal feed in Bulk

In section 11.6.2 in Part I, two cargo handling systems for handling of animal feed are examined for target year 2010. However, considering the handling volume of the cargo forecast for target year 1997, and necessary investment for handling equipment such as quay cranes and mobile tower cranes as shown in table 2.6.1, the recommended handling system is that the unloading is carried out by means of ship's gear/cranes with grab buckets and transferring from berth to the shed is carried out by shuttle trucks from a economical point of view. Besides, this system does not require a specialized berth, and the handling rate can be attained by arrangement of a adequate number of shuttle trucks, because the attainable handling rate depends on the turn-around rate of the trucks between the apron and the shed.

Table 2.4.1. The comparison in necessary investment by type of handling equipment

Handling System	Total Cost (Unit ; 1,000 DA)
Case 1 : By 2 quay cranes (20 tons) and movable hoppers	: 95,878
Case 2 : By 2 tower cranes (20 tons) and movable hoppers	: 20,542
Case 3 : By ship's cranes and movable hoppers	: 1,708

The complex handling facility, e.g. consisting of two exclusive unloaders, each lifting capacity 20 tons, and one belt conveyor line connecting berth and warehouse, transferring capacity some 300 tons, is also examined for handling, however, it is not feasible for the period of short term of before 1997. According to the demand forecast, it is considered that the feasible year for installment of the complex handling facility is on and /or after 2011 year.

2.4.2 Bulk Cereals

(1) Handling at quay No.12

For the target year 1997, the cargo handling system for bulk cereals at the berth is similar to the present handling system, using the existing handling facilities. All the cargo unloaded at the berth is first stored through the existing conveyor system into the existing silos.

(2) Handling at new berth

The cargo is to be unloaded by the existing tire-mounted pneumatic unloader which is now used at quay No.12 and two units of new tire-mounted pneumatic unloaders with an unloading capacity of 200 tone/hour. Transferring from berth to newly constructed silos is carried out conveyor system.

2.5 Consideration of Environmental Aspects

2.5.1 Environmental Impacts of the Port Development

The main components of environment to be affected by the port development are as mentioned in Part I, Section 11.3.

Especially, at the time of construction, to prevent water pollution, dredged materials will be dumped into an enclosed embankment which will be built at the new construction site.

2.5.2 Measures in the Future

1) Monitoring system

The water in the port basins will be further polluted by the water through discharge of ballast water, bilge, sewage, and waste water from the wharves and other port facilities.

In order to minimize water pollution at the port, a standard for discharged water will have to be established and a monitoring system arranged in advance.

2) Facilities for reception of ballast and bilge from vessels

In conformity with MARPOL convention, it is necessary to provide facilities to receive waste such as ballast, bilge and etc. from vessels at the port. The construction of facilities for reception of ballast and bilge from vessels is proposed in the area behind Quay No.7.

3) Consideration of sewage and waste water from the wharves

Sewage and waste water from the wharves need to be treated before being discharged into the basins of the port at earliest possible time.

2.6 Proposed Scale Under the Short-Term Plan

The port facilities necessary to handle cargoes in 1997 are summarized as follows:

(1) New Berth

Location: new container berth planned in the Master Plan

Total area: 14.1 hectares

Berth: length: 200 m, water depth:-13 m

Cargo storage facilities: one (1) new silo (holding capacity of 35,000 tons)

Cargo handling facilities: 1) two (2) new tire-mount pneumatic unloader (200 tons/hour each) and one (1) existing tire-mount pneumatic unloader (200 tons/hour)

2) belt conveyor system (600 tons/hour) between quay and new silo

Access road: 2.3 hectares

Railway yard: 1.4 hectares

(2) Container Freight Station (CFS)

Location: immediately behind Quay No.21

Total area: 2000 m^2 (50 m x 40 m)

(3) Facilities for Reception of Ballast and Bilge from Vessels

Location: behind Quay No.7

The layout of the new berth in the short-term plan is shown in Fig. 2.6.1.

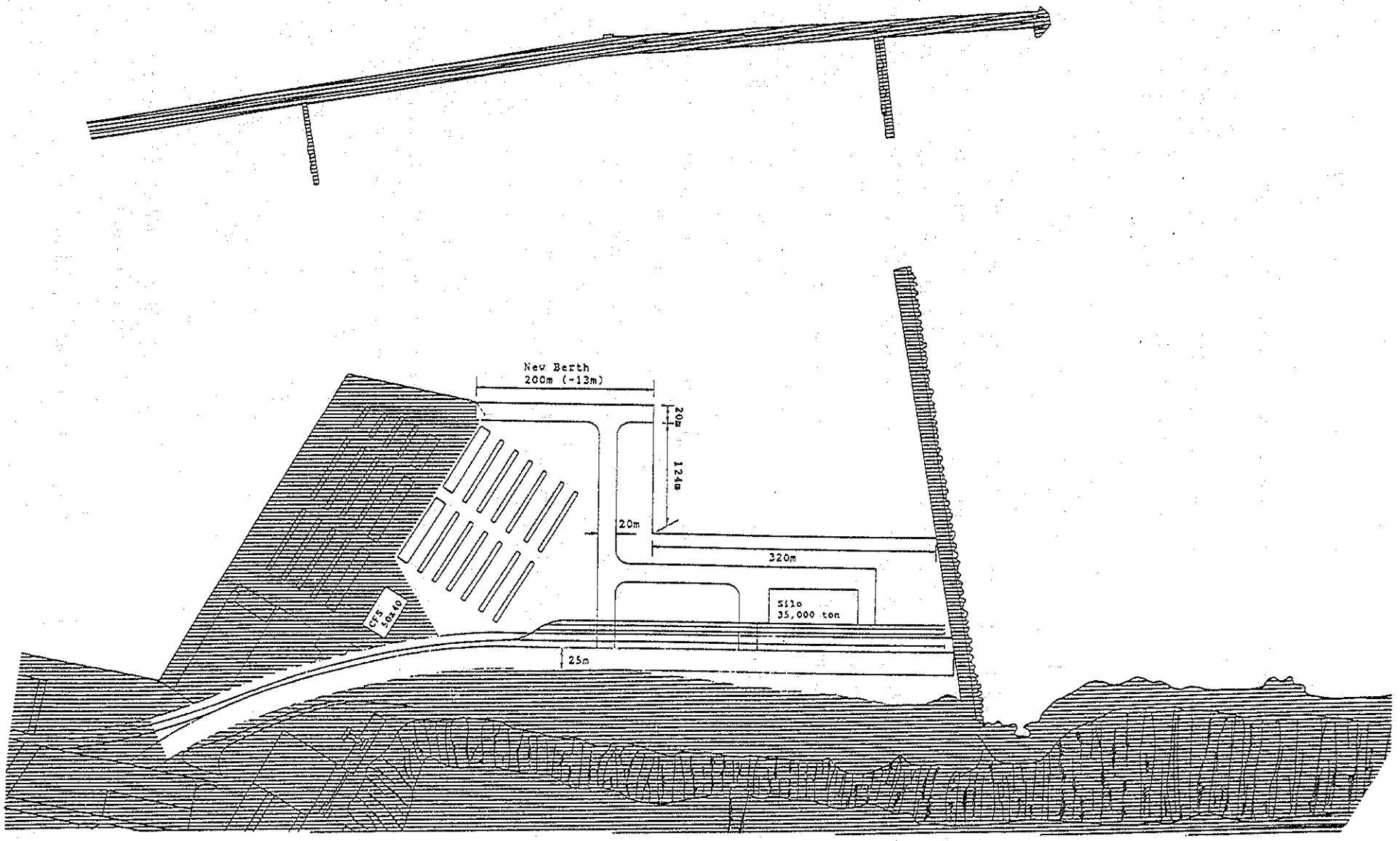

Fig. 2.6.1 The Layout of the New Facilities in the Short-Term Plan

2.7 Design of Major Structures

2.7.1 Basic Design Principles and Conditions

The basic principles and conditions for the design are substantially the same as for the Port of Algiers. Thus previously detailed descriptions are omitted.

However, a brief description of the soil conditions may be necessary.

Judging from the soil data obtained during the feasibility study, the natural ground of the proposed port development has favorable soil conditions, characterized by the occurrence of a soft mud layer about 2 m thick at the surface, which is underlain by a sand layer with N-values of 50 to 84 itself underlain by an over consolidated sandy marl.

2.7.2 Port Facilities to be Designed

Fig.2.7.1 is the layout plan of the new port facilities of the Port of Oran.

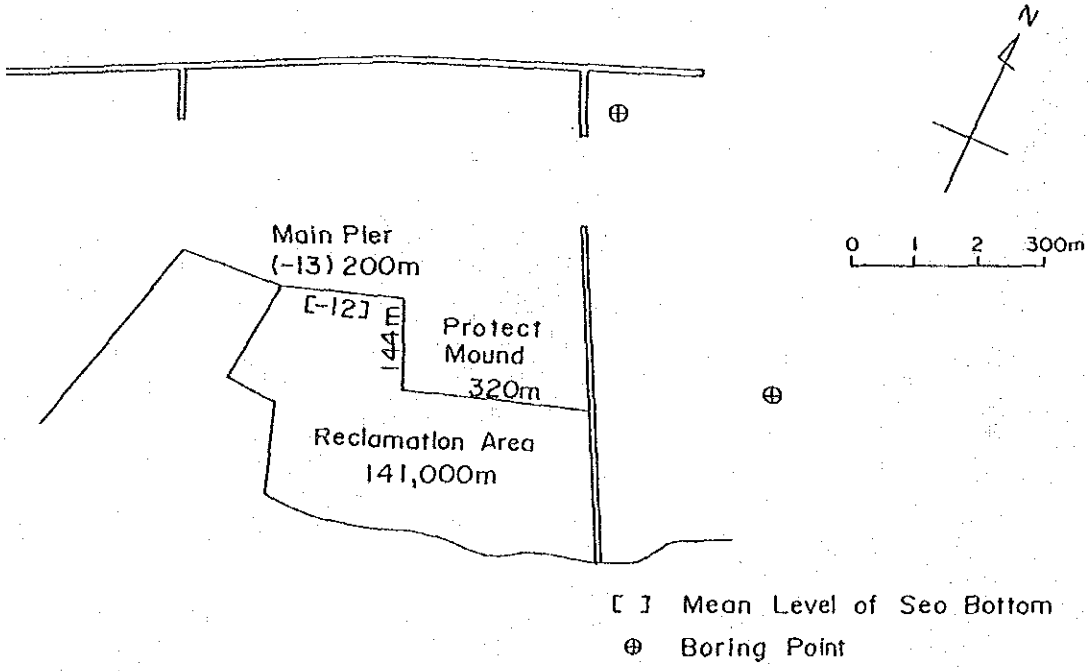

Fig. 2.7.1 General Plan of Design Facilities

2.7.3 Design of Quay Wall

(1) Structural type and Standard Section

Since the natural ground of the proposed site is considered to be favorable, the structure will be the block type for the same reasons as noted in the case of the Port of Algiers.

The standard section of the selected structural type is illustrated in Fig.2.7.2.

2.7.4 Consideration of Degree of Calmness in Short Term Plan

In the Short Term Plan, the advisability of building a certain extension of the existing breakwater for ensuring the required degree of basin calmness has been much discussed. In the present study, a comparison was made between the degree of basin calmness in the case of the existing breakwater length and in the case of a 100 m extension.

The wave height under the existing sheltering conditions is 1.2 m at point A, 1.5 m at point B and 1.3 m at point C (Appendix), while a 100 m extension of the breakwater length will change the wave heights only marginally, from 6.1 % to 8.5 %. This tendency is not presumed to change appreciably even when the wave parameters are changed to improve the sheltering effects of the breakwater.

Judging from the actual utilization of the harbor basin by vessels and the critical wave height that defines the limit beyond which safe loading and unloading of large vessels is impossible, any extension of the existing breakwaters with a view to improve the degree of basin calmness by about 8 % would not be necessary.

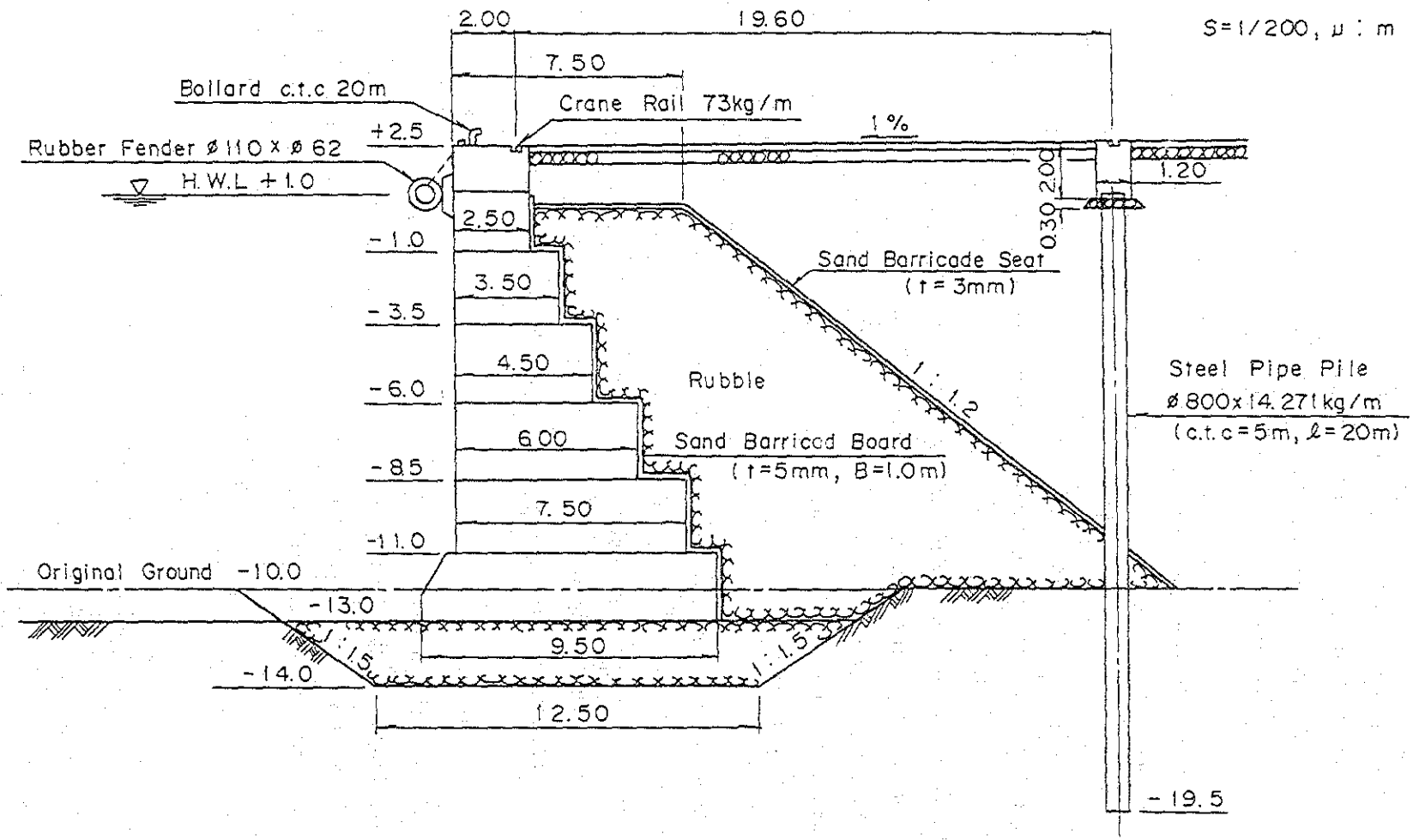

Fig. 2.7.2 Typical Section of Concrete Block Type Quay

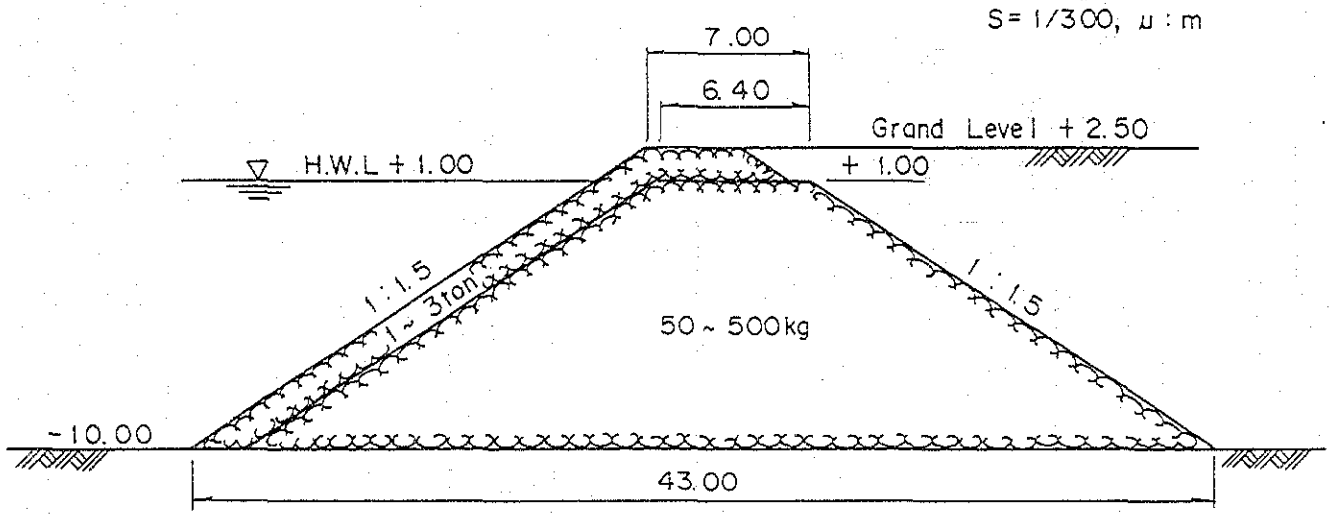

Fig. 2.7.3 Typical Section of Protective Mound for Reclaimed Land

2.8 Construction Planning for the Port of Oran

2.8.1 General

The construction quantities for each facility in the Short Term Plan for the Port of Oran are shown in Table 2.8.1 and main construction materials which have been estimated based upon the foregoing preliminary design are listed in Table 2.8.2.

Table 2.8.1 Construction Quantities

Description	Unit	Quantities
Reclamation of Land	m^2	141,000
Quay (-13.0 m)	m	200
Cereal Silos 35,000 t	No.	1
Cargo Handling Equipment Tire Mound Pneumatic Unloader 200 T/hr	No.	1

Table 2.8.2 Main Material

Material	Unit	Quay	Yard	Total
Concrete Block 65T - 35T	No.	800	-	800
Concrete	m^3	1,300	-	1,300
Steel Bar	Ton	422	-	422
Steel Pipe Pile	Ton	13		
Rubble Stone	m^3	30,200	57,200	87,400
Rock Riprap	m^3	-	8,450	8,450
Filling Sand	m^3	-	1,588,000	1,588,000

Note : The estimate quantities do not include any construction material for silos.

2.8.2 Preliminary Study on Construction Procedure

The construction method of major works is briefly described below;

(1) Reclamation

The reclamation fill will be borrowed materials to be obtained from the borrow pit.

The top 1.2 m of the land reclamation fill will be compacted to provide enough bearing capacity for heavy traffic load of cargo handling equipment.

(2) Quay (-13.0m)

On completion of excavation work, the emplacement of base rubble and concrete blocks should begin.

After that, backfilling, placing of coping concrete and pavement should be carried out.

Lastly, steel pipes and concrete beams as the base of container cranes will be installed.

2.8.3 Construction Schedule

In considering the construction schedule, working days and productivity have been set as follows:

(1) Working Days

The working days used for construction planning are shown below.

Table 2.8.3 Estimated Annual Working Days

Description	Onshore Work (days)	Offshore Work (days)
Windy Days (non-working)	12	*(23)
Rough Sea Days (non-working)		42
Rainy Days (non-working)	3	*(3)
Holiday (non-working)	65	50
Total Non-Working Days	80	92
Annual Working Days	285	273
Monthly Average Working Days	23	22

* Windy days & rainy days are included in rough sea days.

(2) Productivity

The targeted productivity capacities of major works in the Project have been compiled as follows;

Implacement of rubble and armored stones 1,000 m^3/day
Installation of concrete blocks for the quay 20 units/day
Reclamation with borrow material 2,000 m^3/day

(3) Construction Schedule

The construction schedule of the Project is shown in Fig 2.8.1.

Work Item	Unit	Q'ty.	1st Year	2nd Year	3rd Year	4th Year
1. Design & Tendering	L.S	1				
2. Mobilization	L.S	1				
3. Reclamation of Land	m^3	1.588.000				
4. Quay and Protective Mound						
(1) COncrete Block Quay	m	200				
(2) Protective Mound	m	300				
5. Preparation of Yard						
(1) Dressing Yard	m^2	110,000				
(2) Pavement of Yard	m^2	66,000				

Fig. 2.8.1 Construction Schedule of Major Facilities

2.9 Cost Estimation

2.9.1 Basic Conditions for Cost Estimatiton

The main conditons for the cost estimation are as shown in Article 1.13 of the Short Term Plan of the Port of Algiers.

2.9.2 Results of Estimation

A summary of the estimation results is presented in Table 2.8.1 and the result for each item is presented in Table 2.9.2.

Table 2.9.1 Summary of Constction Cost

Unit: Million DA

No.	Item	Construction Cost		
		Foreign Portion	Local Portion	Total
1.	New Cereal Berth	524.9	259.2	784.1
2.	Cargo Handling Equipment	143.6	9.6	153.2
	Direct Cost total	668.5	268.8	937.3
3.	Physical Contingency	43.1	20.8	63.9
4.	Engineering Service	42.0	20.7	62.7
	Indirect Cost Total	85.1	41.5	126.6
5.	Total Cost	753.6	310.3	1,063.9
6.	Tax (TVA)	52.8	21.7	74.5
7.	Project Cost	806.4	332.0	1,138.4

On the basis of the construction schedule drawn up in Fig.2.8.1, the yearly disbursement schedule has been estimated as shown in Table 2.9.3. In addition, the Study Team has proposed installing a minimun capacity 20 T/hr oils separator system at an estimated cost of 18.7 million DA.

Table 2.9.2 Construction Cost

Unit: 1,000DA

Facilities		Construction Cost		
Item	Sub Item	Foreign Portion	Local Portion	Total
1. New Cereal Berth	(1)Direct Cost	524,877	259,222	784,099
	*Protective Mound	30,293	10,137	40,430
	*Dredging of Basin	186	1,134	1,320
	*Reclamation of Land	107,182	36,809	143,991
	*Construction of Quay	48,845	29,263	78,108
	*Preparation of Land	17,809	14,340	32,149
	*CFS for Container	18,150	14,850	33,000
	*Silos & Buildings	127,350	78,080	205,430
	*Accompany Mechinnary	129,471	45,487	174,958
	*Miscellaneous	15,775	14,198	29,973
	*Mobilization	29,816	14,924	44,740
	(2)Indirect Cost	85,132	41,489	126,621
	*Physical Contingency	43,142	20,751	63,893
	*Engineering Services	41,990	20,738	62,728
	(3)Pneumatic Unloader 200T/H x 2	143,638	9,636	153,274
	(4)Construction Cost	753,647	310,347	1,063,994
2. Tax(VAT)	1 x 7 %	52,755	21,724	74,479
3. Project Cost		806,402	332,071	1,138,473

Table 2.9.3 Yearly Disbursement Schedule

Unit: 1,000 DA

Facilities		Total Construction Cost			1st Year			2nd Year			3rd Year			4th Year		
Item	Sub Item	F/P	L/P	Total	F/P	L/P	Total	F/P	L/P	Total	F/P	L/P	Total	F/P	L/P	Total
New Berth	1) Protective Mound	30,293	10,137	40,430							6,658	2,228	8,886	23,635	7,909	31,544
	2) Dredging of Basin	186	1,134	1,320							186	1,134	1,320			
	3) Reclamation of Land	107,182	36,809	143,991				29,231	10,039	39,270	38,975	13,385	52,360	38,976	13,385	52,361
	4) Quay	48,845	29,263	78,108							8,290	5,181	13,471	40,555	24,082	64,637
	5) CFS for Container	18,150	14,850	33,000							18,150	14,850	33,000			
	6) Preparation of Land	17,809	14,340	32,149							7,124	5,436	12,560	10,685	8,904	19,589
	7) Silo & Buildings	127,350	78,080	205,430							89,145	54,656	143,801	38,205	23,424	61,629
	8) Accompanying Machinery	129,471	45,487	174,958							38,841	13,646	52,487	90,630	31,841	122,471
	9) Miscellaneous	15,775	14,198	29,973				1,578	1,420	2,998	6,310	5,679	11,989	7,887	7,099	14,986
	10) Mobilization Cost	29,816	14,924	44,740				29,816	14,924	44,740						
	11) Phisical contigency	43,142	20,751	63,893				4,580	1,818	6,398	17,966	9,596	27,562	20,596	9,337	29,933
	12) Engineering Services	41,990	20,738	62,728	16,374	8,264	24,638	7,234	3,119	10,353	9,634	5,035	14,669	8,748	4,320	13,068
	13) Pneumatic Unloader 200T/H x 2	143,638	9,636	153,274										143,638	9,636	153,274
	14) Tax	52,755	21,724	74,479	1,146	578	1,724	5,071	2,192	7,263	16,891	9,158	26,049	29,647	9,796	39,443
	Total Construction Cost	806,402	332,071	1,138,473	17,520	8,842	26,362	77,510	33,512	111,022	258,170	139,984	398,154	453,202	149,733	602,935