1.2 Natural Conditions

(1) Terrestrial Conditions

Topography

Algeria's coastlines are largely a result of the surroundings landform, since the Atlas mountains that run east to west and are parallel to the coast dip into the Mediterranean. Oran, Algiers and Annaba, the proposed sites of port expansion, are Algeria's major seaports located at the western edge of an alluvial plain formed by rivers emptying into the Mediterranean. The coastlines of these ports extend 15 to 30 km and form sand beaches in the pattern of an arc.

Earthquake

During the last 100 years, Algeria has experienced 70 earthquakes, most of which measured about 5 in magnitude. The maximum magnitude ever observed was 7.7 in October 1980, in the region of Chlef. Different design seismic coefficients are established for different regions and classified by zone. All of the proposed project sites are classified under Zone II and the seismic coefficients are classified from 0.15 to 0.35 according to the importance of structures to be designed.

(2) Meteorology

Climate

Algeria's coastal areas are located in the Mediterranean climatic zone which is characterized by mild weather and low rainfall. There exists a clear seasonal distinction: wet and dry seasons. The average temperature of the three proposed project sites is substantially equal, about $15^{o}C$ during the wet season from October to March and about $24^{o}C$ during the dry season from June to September. Rainfall averages 330 mm annually and 50 mm per month during the wet season and 10 mm per month during the dry season in the Oran area closer to Morocco, while in Algiers and Annaba the average annual rainfall is 680 mm and the monthly rainfall during the wet season and the dry season in 90 mm and 10 mm, respectively.

Wind

Winds vary more or less from region to region, but generally the

prevailing winds blow almost parallel to the coast line. Winds primarily from WSW prevail during the wet season and northerly winds during the dry season. In the Algiers area winds occur with a 65% frequency and WSW and ENE winds prevail during the wet season and the dry season, respectively. The frequency of occurrence of strong winds is 1.8% with winds mainly from W direction predominant. In the Oran area, winds occur with a 95% frequency with WSW and N winds prevailing. The frequency of occurrence of strong winds is 3.7% with W to WSW being predominant. In the Annaba area, winds blow with a 74 % frequency with WSW and NNE winds prevailing. The frequency of occurrence of strong winds in 3.4% with N to NNE being predominant.

Rainfall Intensity

The intensity of rainfall with a 50-year return period is 26 mm in Algiers, 22 mm in Oran and 9 mm in Annaba.

(3) Marine Conditions

Tide

In the Algerian waters, the tidal range is generally about 0.30 m. The average high water level is +0.34NGA and the average low water level -0.34NG. The working datum level of NGA = +0.34ZH for port and harbor structures has been taken for the three project sites.

Tidal Currents

In Algeria's coastal waters, tidal currents flowing eastward prevail with a velocity ranging from 1/4 to 3/4 knots. Currents off-shore the Port of Arzew flow at an average velocity of 3 knots. In the vicinity of the harbor entrance there flows a counter current with a velocity equivalent to nearly one-fifth of that of the off-shore currents.

Waves

Waves attacking the three project ports vary in characteristics due to differences in the topographical features of the surrounding seas. At a point about 50 km off-shore the Port of Algiers waves with a height of 0.5 m or more occur with a 58% frequency and they are mostly 7 sec in period. Waves 0.5 m or more in height from N to E directions reaching the area in front of the harbor entrance occur with a 61% frequency. The ENE waves prevail. The design deepwater wave with a 50-year return period is estimated to have Ho =

8.9 m and To = 11.8 sec.

In the area of Oran waves 0.5 m or more in height at a point about 50 Km off-shore occur with a 61% frequency. They are largely 7 sec in period. Those waves from N to E directions reaching the area in front of the harbor entrance occur with a 11.3% frequency and the N waves prevail. The design deepwater wave with a 50-years return period is estimated to have Ho = 9.3 and To = 12.3 sec.

In the area of Annaba, waves 0.5 m or more in height at a point about 50 km off-shore occur with a 61% frequency. They are also largely 7 sec in period. Those waves affecting the harbor basin come from N to E directions with a height of 0.5 m or more reaching the Port of Annaba occur with a 17.5% frequency. Although NNE waves are slightly predominant, wave directions from N to ENE distribute almost evenly. The design deepwater wave with a 50-years return period is estimated to have Ho = 9.0 m and To = 11.6 sec.

Littoral Drift

There are no available data to determine the extent of the littoral drift in the three project ports. However, judging from the topographical features of the neighboring sea areas and wave and current conditions, which are major factors contributing to the littoral drift, the three project ports are not considered to suffer seriously from the littoral drift.

(4) Geological Investigation

In every project port three boreholes have been drilled with length between 13.5 and 46 m. Standard Penetration Tests (SPT) have been done and samples have been taken from the boreholes.

[The Port of Algiers]

Three drillings between 18 and 24 m deep have been done in the area to the east of the eastern breakwater.

a) Geology of the sea bottom

The sea bottom consists of a Recent to Pleistocene sedimentary cover and a Pliocene basement.

Sedimentary cover:

- its thickness increases form 5.5 m close to the coast to 10 m at the jetty;
- its composition is:
  - black, organic "mud",
  - fine sand containing a variable percentage of clay
  - gravel and conglomerate
  - clay (only along the Mustapha jetty)
  - shell-rich limestone;
- the layers named above have variable thickness and are not always continuous.

The basement in the study area (just outside the port zone) consists of an alternation of two formations:

- "Molasse" -type formation - carbonaceous sandstone and sand
- Marl formation.

Under the port area itself, the basement consists only of marl.

b) Geotechnical conditions

SPT tests in the sedimentary cover indicates 8 to 12 blows in the fine sand layer (SC-CL) and 17 blows in the conglomerate. The latter is not a continuous layer.

The unconfined compressive strength on the molassic-sandstone of the basement gives a value of 102 ton/m^2.

The marl indicates cohesion values around 1 kg/cm^2 and internal friction angles between 35^o and 40^o. The consolidation tests indicate a consolidated to over consolidated rock. The pre-consolidation stresses range between 26 and 60 ton/m^2.

[The Port of Oran]

Three shallow holes, 13-15 m deep, have been drilled, one in the basin of Machreck and the other two just outside of the eastern breakwater.

a) Geology of the sea bottom

The Recent to Pliocene sedimentary cover, about 6-7 m thick, consists of:

- black "mud";
- clean, medium sand;
- shell-rich limestone.

The basement consists of Miocene gray marl of unknown thickness.

b) Geotechnical Conditions

The sand bed, a component of the sedimentary cover is a good foundation bed, encountered at shallow depth under the sea floor (1-2 m). The SPT tests conducted in this bed show N-values more than 50.

The marl basement is encountered at 6 to 7 m under the sea floor.

The laboratory tests indicate 0.4-2 kg/cm^2 for the cohesion and internal friction angles of $28\text{-}45^o$.

The marl seems to be over-consolidated and the pre-consolidation stresses range between 25 and 70 t/m^2 for the depth range 7.5-12.5 m.

[The Port of Annaba]

The Port of Annaba is located against and on the Paleozoic schist and gneiss formation.

In order to locate the depth of the basement, three deep holes (depth between 31.5 and 46 m) have been drilled outside of the port zone, along the breakwater.

a) Geology of the sea bottom

The weak Quaternary sedimentary cover of the sea bottom in Annaba is 20-30 m thick at the jetty and more than 60 m thick in the shallow water zone (close to the coast).

The cover consists of:

- black, organic "mud";
- clayey or gravely sand;
- clay with sand lenses;
- sand with iron nodules;
- boulders, gravel and sand (river deposits), only locally present.

The basement has been encounterd only in one of the drill holes, S3.

It consists of a thin marble bed with gneiss underneath. The depth of the basement under the port zone is varies.

b) Geotechnical conditions

While a tectonic lineament has been noticed in this region, no sign of a significant fault which may possibly affect the foundation of the port structures has been found.

The sediments analyzed in the laboratory have been classified as MH or ML soil, till ± 11 m depth and as CH or CL soils further downward.

The N-values from the SPT tests range between 4 and more than 29 blows.

The shear tests indicate a cohesion value between 0.05 and 0.55 kg/cm^2 and a small friction angle 1.5^o (only in one case 22.5^o)

The estimated allowable bearing strength ranges from 5 t/m^2 to 12 t/m^2 in the stronger beds.

From the consolidation tests, the soil in Annaba appears to be unconsolidated.

Compared to Alger and Oran, in Annala there is no overconsidated soil, the pre-consolidation pressure ranges between 10 and 20 ton/m^2 and the compression index of 0.2 - 0.4 is higher than in the two former sites.

The pre-consolidation pressure has a mean value of 1 kg/cm^2; the value of 0.7 kg/cm^2 has been measured at 15 m depth. The compression index of 0.2-0.4 is higher than in the two former sites.

(5) Bathymetric survey

In all the three project ports the water depth has been measured on a moving boat, equipped with an echo-sounder. The water depth was recorded in a grid of 100 m x 25 m or 50 m x 25 m. The results have been represented on bathymetric maps, on the scale of 1:2000.

1.3 Present Situation of Algerian Maritime Transportation

(1) Algerian Flag Merchant Fleet

The number of Algerian Flag Merchant Vessels in 1989 is 76 ships with 1,094,619 DWT which are categorized into 5 types, "Ro-Ro Vessel", "Cargo Vessel", "Bulk Carrier" "Tanker" and "Car Ferry". The average age of the fleet is 13.9 years.

(2) Maritime Enterprise

There are four maritime enterprises in Algeria

SNTM-CNAN owns a fleet consisting of 50 vessels with 588,719 DWT.

SNTM-HYPROC owns a fleet consisting of 15 tankers with 460,359 DWT.

ENTMV carry out the regular ferry service with 5 car ferries.

CALTRAM is joint venture company of Algeria and Lybia with 5 vessels.

(3) Liner Service

Twelve shipping companies including CNAN and CALTRM carry out liner services with Ro-Ro vessels and semi-container vessels between Algerian ports and other countries ports.

(4) Tramper Service

Since the limitation of port facilities, except coal in bulk discharged at Annaba port, solid cargoes in bulk are transported by smaller sized vessels than panamax bulk carrier.

1.4 Outline of the Algerian Principal Ports

(1) Typical Cargo Flow through the Algerian Principal Ports

In Algeria, there are 13 commercial ports located along the Mediterranean coast stretching about 1.2 thousand km. These ports are administrated and operated by ten port enterprises. In 1990, the total volume of cargo handled at these ports amounted to about 83 million tons consisting of loaded cargoes of about 66 million tons and unloaded cargoes of about 17 million tons.

Major cargo flows by commodity through the Algerian principal ports are shown as follows:

- Cereals, other agricultural products, livestock, foodstuffs and feed: Imported through the most of principal ports,
- Solid combustible mineral: Imported through the Annaba port,
- Crude petroleum: Exported through the ports of Arzew/Bethioua and Bejaia,
- Hydrocarbon gas: Exported through the ports of Arzew/Bethioua and Skikda,
- Refined petroleum: Mainly exported through the ports of Arzew/Bethioua and Skikda, and partly transshipped to the ports of Algiers, Oran, Annaba and Bejaia,
- Metallurgic products: Imported through the most of principal ports,
- Cement: Imported through the floating cement plants at the ports of Algiers, Oran and Bejaia,
- Manufactures including machinery, vehicles, etc.: Three fourths of the total is imported through the Algiers Port.

Out of the above Algerian principal commercial ports, the ports of Algiers, Annaba, Oran, Arzew/Bethioua, Skikda, Bejaia and Mostaganem accounted for 94.8% of the total cargoes discharged in 1990, and 99.9% of the total loaded cargoes. In addition to these ports, a new deep-sea port Djen Djen which was planned to serve a steel making factory to be established in Belara, though not yet materialized, is ready to be in operation.

(2) Port Administration System in Algeria

In Algeria, port construction and administration are conducted by different organizations. The Ministry of Transport regulates the port enterprises responsible for port administration and operation. The Port Enterprises provide the cargo handling equipment, warehouses, transit sheds and tugs necessary for profitable port operations. On the other hand, the Ministry of Equipment is in charge of construction and maintenance of port infrastructures, such as breakwaters, quays and passages, through the civil works department of the 'wilaya', a local office of the national government.

(3) Environment Aspects

Since the Mediterranean sea is closed except at the strait of Gibraltar, water pollution is more sensitive compared to the ocean.

Water quality at a port is particularly vulnerable because the major ports are located at the coast of densely populated areas, where volume of waste water of various sources is large.

The major commercial ports in Algeria, namely, Algiers, Oran and Annaba are no exception to above mentioned condition. All these three ports have well protected basins where ships can berth safely. Consequently, the water in the harbor is comparatively stagnant and vulnerable to contamination.

The major source of water pollution in the Algerian ports at present seems to come from sewage water from cities and discharge from industries.

Discharge and drainage from the quay area is normally not observed unless it is raining. Surface of the quay in these three major ports in Algeria are heavily polluted and stained by various oil, chemicals and foodstuffs spilled from cargoes as well as cargo handling equipment. There is no treatment facility for the surface drainage water from the quay. Consequently, when rain falls, rainwater over the quay area washes all the polluted substances on the surface of the quay into the harbor thus damages to the water quality of the harbor.

Degree of water pollution inside the harbor at the port of Algiers is so bad that ships mates refuse to take ballast water from the harbor after

emptying their cargo.

Discharge from ships in the harbor is not noticed due to the introduction of MARPOL convention.

Since introduction and ratification of the MARPOL Convention and other related protocol by the Algerian Government, water quality control within the port limit is normally observed by vessels.

Needs for such facilities are well recognized among the ports in Algeria and installation of oil-water separating plants are planned but not yet fully accommodated.

Sedimentation in the harbor is another factor of pollution. With accumulation of sediment caused by drainage from various sources, sediment material in the harbor is seriously contaminated in Algerian ports.

Particularly, in the Port of Algiers, the bottom soil in the harbor is reportedly contaminated by various toxic materials including mercury, PCB as well as hydrocarbons. The degree of contamination is exceeding beyond the level of acceptable limit for ocean disposal and dredged soils must be placed to the specially prepared filling site along the coast.

A dumping sites fro such dredged material are planned along the coast near the entrance of the Port of Algiers. The dike to enclose these area will be built by rock mound with impermeable filter layer at the back of the dike so that the contaminated materials should not escape to the environment.

1.5 The Port of Algiers

(1) Port Facilities

Breakwaters with a total length of more than 4,000 m protect the basins from violent waves attacking the port in the winter season. The basins have a total area of 184 ha, and are composed of the following three basins: Bassin Du Vieux Port, Bassin Du Agha Port and Bassin Du Mustapha Port. There are two access channels; Passe Nord and Passe Sud, at the Port of Algiers.

The total quay length of the Port of Algiers is 9,734 m. Out of the total length, a length of around 7,500 m are used for loading and unloading of port cargoes. There are 23 transit sheds with a total floor area of around 73,000 sq. m within the port limits enclosed with fences. Open storage yards with a total area of around 274,000 sq. m are also allocated within the limits. There is a yard specialized for stacking containers behind the wharves of El Hadjar and Skikda managed by the container section of the EPAL.

As presently, however, vessels specialized for containers are not yet calling at the port, containers are discharged or loaded from Ro-Ro or general cargo vessels along with other cargoes at many berths. As mentioned previously, the OAIC has silos of capacity of 30,000 tons behind No.3 berth of No.35 Quay.

(2) Port-Related Industries

Over 20 enterprises were conceded sites within the port limits. The major concessionaires are the OAIC, NAFTAL, ENCG, ONAB, SONELGAZ, ERENAV and SONATRAM.

(3) Cargo Traffic through the Port

The port of Algiers acts as a pivotal cargo distribution terminal, serving the central region of Algeria, including the Algiers metropolitan area.

Port traffic in 1990 was 6.37 million tons with 5.48 million tons of unloading and 0.88 million tons of loading. The share of domestic traffic is very small with 12% in unloading and 15% in loading.

The port of Algiers is the largest commercial port in the country with

general cargo traffic of 3.33 million tons, accounting for 41% of the total general cargo traffic of the nation.

Apart from general cargo traffic, the traffic of liquid bulk and solid bulk cargoes amounted to 1.71 million tons and 1.33 million tons respectively. Liquid bulk cargo comprises liquefied hydrocarbon gas and refined petroleum products (loading and unloading), and solid bulk cargo consists mainly of cereals (unloading).

(4) Port Activities

According to the EPAL's classification, vessels calling at the Port of Algiers are divided into five types; general cargo vessel, Ro-Ro vessel, cereal carrier, tanker and car ferry. The general cargo vessels are further divided into two categories. One is vessel laden with various kinds of cargoes and the other is vessel laden with one kind of commodity.

According to the actual record in 1990, around 1,800 vessels called at the port. Almost a half of vessels that called at the port are general cargo vessels accounting for 45.7% of the total number. Almost half of them are the vessels laden with one kind of commodity. Ro-Ro vessels, tankers, car ferries, cereal carriers followed the general cargo vessels, accounting for 21.6%, 16.8%, 12.6%, 3.3% of the total.

The vessels laden with one kind of cargo such as sacked foodstuffs are mainly allocated to berths in the northern zone. All of the cargoes are directly landed onto trucks and brought out from the port. The vessels co-stowed with various kinds of general cargoes, including containers, are mostly handled at berths in the central and southern zone. Discharge is done by ship's gears together with quay cranes and mobile cranes. Almost all of the discharged cargoes are forwarded and stacked in open yard. Only perishable and valuable cargoes are stored in sheds. Besides, there is nine designated berths in the port for accommodating Ro-Ro vessels and cargoes are discharged and transferred to open yards near berths by forklifts of various capacities. Almost all of cargo to be loaded are brought into open yards by trucks and rail wagons and loaded onto vessels.

Bulk cereals is discharged by means of 3 types of handling equipment, "Traveling rail-mounted pneumatic unloader", "Tire-mounted pneumatic unloader"

and "Grab bucket" at quay Nos.35 and 33. Animal Feed in Bulk is discharged by means of 2 units of traveling transfer cranes with grab buckets at No.26 Quay, and directly landed onto trucks. Marble Gravel is handled at a berth in No. 17 Quay and directly discharged to the storage yard behind the berth by means of quay cranes with grab buckets. Bulk cement is discharged into the cement plant barge moored at No.34 quay and packed in bags on board the cement plant barge.

LPG, Gas oil, Naphtha, Fuel Oil, Crude Oil,etc. are handled at special berths in No.37 quay by piping systems which are leading from berths to inland storage tanks. The loading/discharging of fuel and gas oil is done with rubber hoses connected between vessel's pipeline and the mouths of shore pipelines at Nos.26 and 27 quays. Bitumen is also discharged at No. 27 quay with rubber hose connected between vessel's pipeline and the mouth of shore pipeline. Vegetable oil is discharged with rubber hoses connecting between vessel's pipelines and mouth of shore pipelines at Nos.32 and 36 quay.

In this study, cargo-handling productivity at the port was computed based on the actual record of the operation in 1990. The productivity was computed by each vessel that called in the year, totaling to around 1,800 vessels, and then sorted and averaged by vessel type and berth.

The cargo-handling productivity of the general cargo vessels laden with various kinds of cargoes was 9.7 tons per hour on an average. The productivity of the general cargo vessels laden with monocommodity was 24.1 tons per hour.

As for cereals' discharging, the average productivity was 52.6 tons per hour. Considering that the capacity of existing unloaders, the actual productivity seems to be very low. The fact causes long mooring days over two weeks on an average, and subsequently, long off-shore waiting days of almost one week as mentioned previously. However, apparently low productivity of discharging cereals is induced by shortage of storage capacity of the existing silo and also by low productivity of evacuation from the port by railway wagons or trucks.

The present open yard is divided into many small sections by roads and rail ways. Since the condition of pavement on open yards is desolated and uneven here and there, a forklift handling is also disturbed. Many deteriorated cargoes in various conditions are conspicuously found among the stored cargoes in

the every open yard in the port. Containers are planned to be transferred to container storage yards near Mole de Skikda and stacked in 2 or 3 tiers by forklifts.

Dwelling time of cargoes discharged from vessels depends on kinds of commodities. Some commodities such as cereals and perishable foodstuffs can be brought out from the port in exceptional simple procedure of a short time according to the customs regulation. Hence, a great part of them are immediately evacuated from the port after being loaded on trucks or wagons directly from vessels.

On the other hand, general cargoes stay for considerably long period of around 50 days. Several reasons of the long stay are listed. It seems likely that one of the major reasons is the delay of preparation of documents before submission to the customs office by consignees. Moreover, after customs clearance, some of cargoes are left in the port limits without being received by consignees for long period due to the lack of warehouses of consignees. Shortage of trucks or wagons also seems to cause the long dwelling time.

There are 49 berths used for loading and unloading commercial cargoes excluding those served for fishing boats, tugboats, etc. According to the actual record of cargo-handling operations in 1990, an average percentage of berth occupancy reached to high value of 75%. Taking account of seasonal fluctuation of vessel calling, it seems that the port is close to the saturation in capacity. In fact, in the first half of the same year, the berth occupancy ratio exceeded 80%.

It seems likely that the major reasons of apparently low cargo-handling productivity of general cargoes are shortage of the existing storage facilities and long dwelling times of cargoes within the port limits. The shortage of the storage facilities clearly disturbs smooth cargo-handling operations due to the difficulty of finding vacant space near a berth where cargo-handling is in operation. On the other hand, No.35 Quay specialized for cereal-handling is already saturated in the capacity, showing berth occupancy ratio of almost 100%.

(5) Port Management and Operations

1) Organization Structure and Function

The EPAL has a authority to operate and administrate the port such as berth allocation, pilotage, tugs, cargo handling, storage and delivery. Organization structure of the EPAL is shown in Fig. 1.5.1.

2) Employee Breakdown

Number of employees at the EPAL is shown in Table 1.5.1. The EPAL has been making effort to decrease its employees, and the total number of employees is decreased by 25% from 1985 to 1990.

3) Financial Condition

From 1987 to 1990, every year's total revenue, total expense and net income -before tax are shown in the line chart of Fig. 1.5.2. The percentages of four categories of operation revenue classified by the EPAL are shown in Fig. 1.5.4.

The revenue is composed of about 88% of cargo handling and storage charges, 5.9% of tugs and pilot services and 6.3% of other charges. The revenue from cargo handling and storage is 574 million DA and 84% of this revenue were spent as personnel expense amounting to 484 million DA.

Table 1.5.1 Employee Breakdown of EPAL

as on Dec. 1990

Dept./Category	Cadres Superieur	Cadres	Maitrise	Execution	Total
DIRECTOR GENERAL	11	3	8	2	24
HUMAN RESOURCES & GENERAL AFFAIRS	6	21	101	134	262
FINANCE & ACCOUNTING	5	15	32	3	55
PLANNING & SYSTEMS	4	15	10	7	36
HARBOR MASTER	3	65	129	211	408
CARGO HANDLING	4	17	875	1,487	2,383
COMMERCIAL	5	28	112	388	533
TECHNICAL WORKS & MAINTENANCE	4	26	192	237	459
TOTAL	42	190	1,459	2,469	4,160

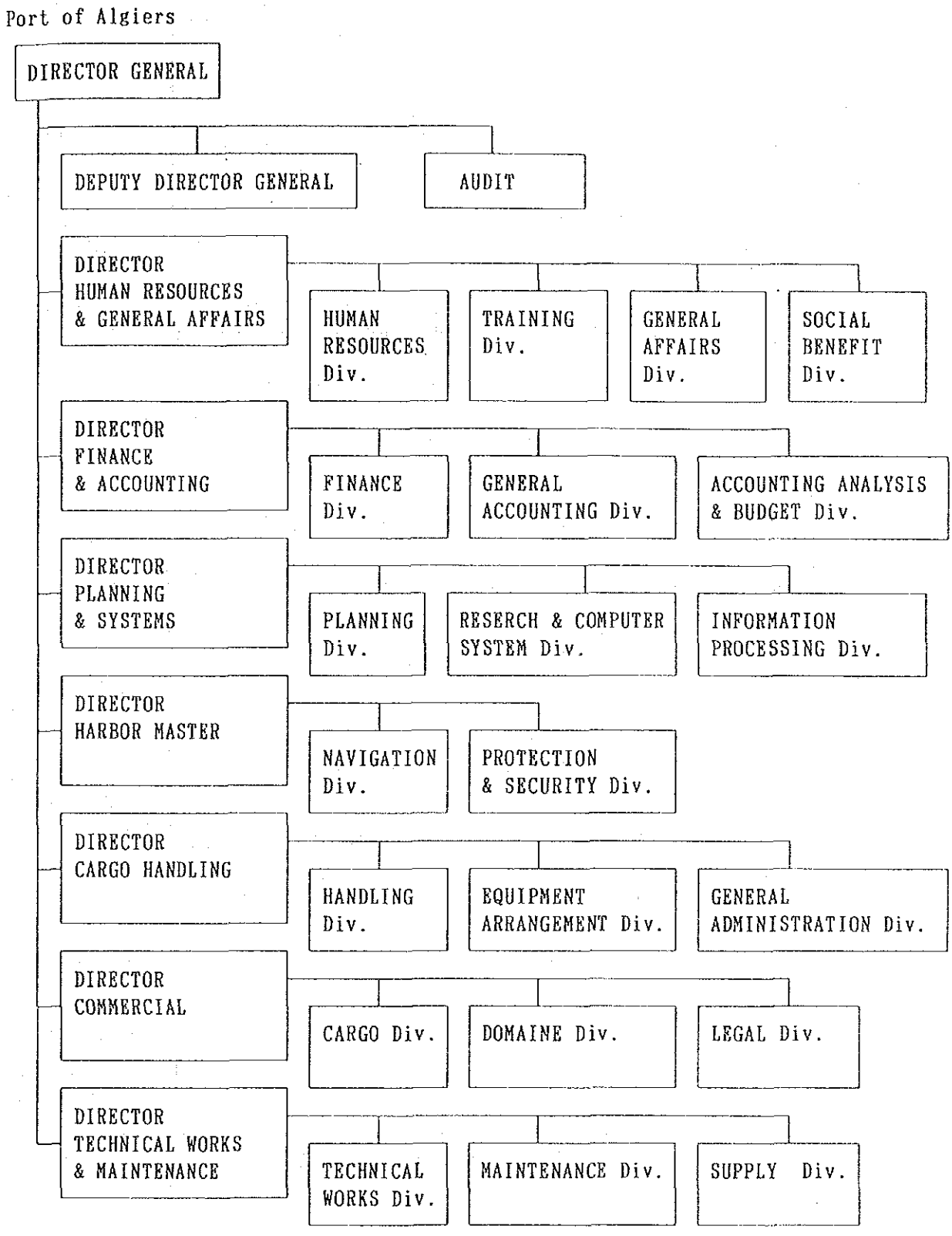


Fig. 1.5.1 Organization Chart

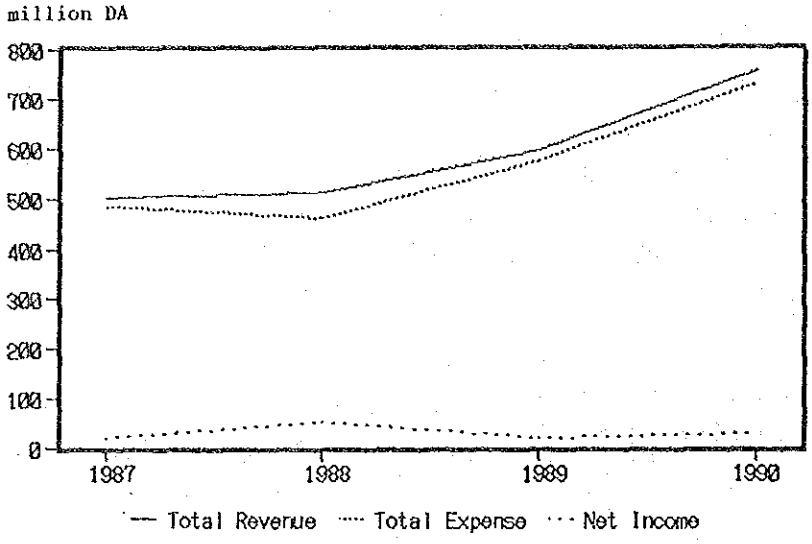


Fig. 1.5.2 Net Income (before tax)

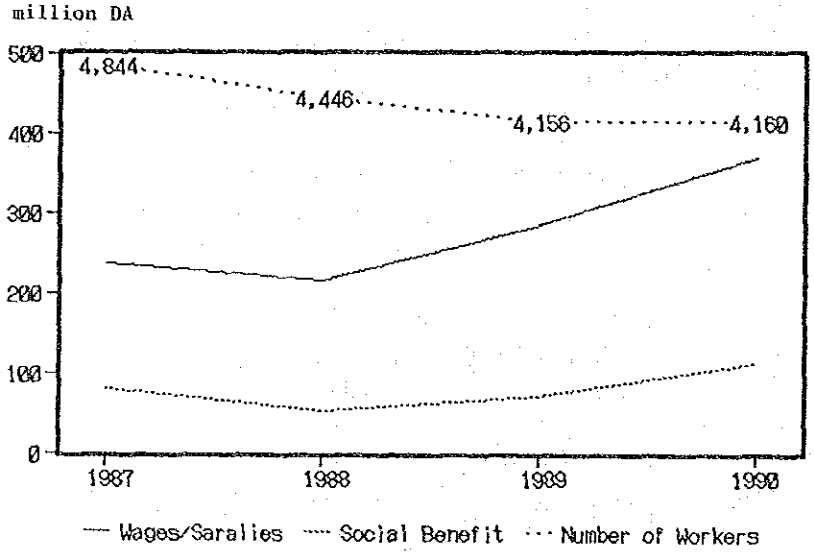


Fig. 1.5.3 Wages/Salaries

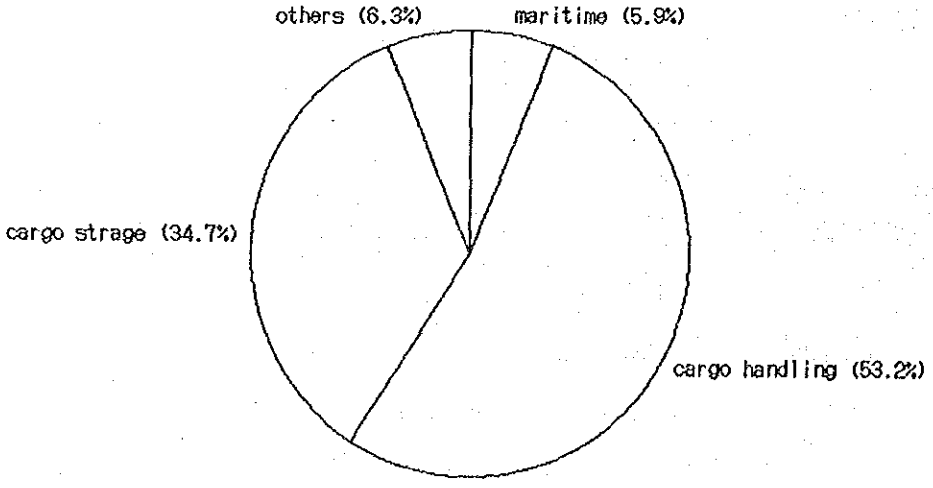


Fig. 1.5.4 Operation Revenue

(6) Review of the Existing Plan

In order to cope with the worldwide containerization, the project of the development of a container terminal, financed by the World Bank is on-going. The terminal is to be constructed by reclaiming the basin between the Quay No.27 and No. 29. The terminal is planned to be opened by 1994 as a closed container terminal with a gatehouse and enclosed with fences. The target numbers of containers to be handled at the terminal are 100,000 TEUs in 2000, 120,000 TEUs in 2005 and 198,000 TEUs in 2010, respectively. The terminal is also planned to serve fully-cellular container vessels with capacity of 1,200-1,300 TEUs.

1.6 The Port of Oran

(1) Port Facilities

The port of Oran is playing an important role as the foreign trade port for the western region of Algeria.

The port is protected by north and east breakwaters. There are seven basins totaling 120 ha; Beni-Saf (4 ha), Skikda (40 ha), Arzew (25 ha), Mostaganem (18 ha), Bejaia (18 ha), Tenes (13 ha) and Ghazaouet (5 ha). The port facilities at Oran include 33 berths with a total length of 4,369 m. There is one approach channel.

The protective facilities are comprised of a northern breakwater and an eastern breakwater; the former has length of 2,800 m and the latter has 520 m. The basins are covered by these two breakwaters and its designated water depths vary from -4.0 m to -12.0 m.

The Port has an area of 21,000 m^2 of transit sheds, 131,000 m^2 of open storage yards and two cereal silos with a total capacity of 40,000 tons (silos 30,000 and 10,000 tons) as handling and storage facilities.

Cargo handling facilities of the Oran port mainly consist 11 quay clanes, 97 fork-lifts, 3 grain unloaders, 8 mobile clanes and others.

(2) Cargo Traffic through the Port

The Port of Oran also fulfills an important role as a key sea borne cargo distribution terminal serving the western region of Algeria with the city of Oran in its center.

Port traffic in 1990 was 2.97 million tons with 2.93 million tons of cargo unloaded and 42,000 tons loaded (The share of unloaded cargo in total traffic is about 99%).

The port was an important commercial port with a general cargo traffic of 0.83 million tons accounting for 10% of total general cargo traffic of the nation. Apart from general cargo traffic, the traffic of liquid bulk and solid bulk

cargoes amounted to 0.60 million tons and 1.54 million tons respectively. Liquid bulk cargo consisted mainly of refined petroleum products (unloading), and solid bulk cargo consisted mainly of cereals (unloading).

(3) Port Activities

The number of calling ships at port of Oran was 897 in 1990 and the total net tonnage increased in 1990 by 1.02 % from 1989.

A total of 897 ships called at port of Oran in 1990. Of these, 423 were general cargo vessels, 122 were Ro-Ro vessels, 129 were car ferries, 104 were oil carriers, 79 were cereal carriers, 30 were wine carriers and 10 were container vessels.

The size of general cargo vessels calling at the port was in the range of 1,000 - 60,000 DWT, while car ferries were 10,,000 - 25,000 DWT, Ro-Ro vessels were 1,000 - 40.,000 DWT, petroleum carriers were 2,000 - 20,000 DWT, and grain carriers were 10,000 - 40,000 DWT.

In terms of the handled volume of cargo at port of Oran, the general cargo vessels accounted were 39.1% of total volume, cereals carriers were 35.8%, petroleum carriers were 18.6% and Ro-Ro vessels were 3.3%.

As for the conditions of utilization at each berth, the average number of ships moored annually at each general cargo berth is 25, the average ship size is 7,563 DWT, the average volume of cargoes handled per ship is about 2,370 tons, and the average mooring time per ship is 154 hours. The number of ships requiring less than three hours from entry into the port until berthing represent 41% of the total. While, the number of ships that took more than three hours represented 59%. It can be presumed from these figures that waiting has already started in the case of general cargo vessels.

The number of grain carriers moored annually at Quay No.12 is 38, the average ship size is about 30,500 DWT, the average volume of cargoes handled per ship is about 15,316 tons and average mooring time per ship is 224 hours. Quay no.12 installed with specialized cargo handling equipment which handles about 70% of total cereals, and remaining 30% is directly dumped to trucks. It can be said that cereals berth is already being use to the full extent of its

capacity.

The number of petroleum carriers moored annually at Quay No.17, Berth No. 21 is 95, the average ship size is about 7,930 DWT (however, 5,000-6,000 DWT class is 61% of total number of petroleum carriers), the average volume of cargoes handled per ship is about 5,313 tons, the average mooring time per ship is 64 hours and the average waiting time per ship is about 5 hours. Based on these figures, the mooring capacity of Berth No.21 has already reached its limit.

The unloading/loading of general cargoes are basically carried out in a similar manner to the Port of Algiers. At No.12 quay, the discharging of bulk cereals is done by means of 3 units of unloading machines, "rail-mounted screw type unloader", "rail-mounted pneumatic unloader" and "tire-mounted pneumatic unloader. At No.21 quay, the discharging is done by means of ship gear with grab buckets. Animal Feed in bulk is discharged by ship's gear at the berths Nos.14, 18, 21 or 22. The cement carriers are moored alongside the Cement Plan Barge which is moored at No.1 berth in No.19 quay and the cargo is handled in the same manner as the Port of Algiers. There are 5 joint mouths of pipelines for handling liquid cargo in bulk, one joint mouth for bitumen at No.16 quay, three joint mouths for petroleum products at No.17 quay and one joint mouth for vegetable oil and animal fat at No.20 quay.

General cargoes, except for directly delivery cargoes, are transferred immediately to open yards. Some cargoes to be shortly brought out from the port are temporarily placed in apron. Containers for import/export are properly arranged and stacked in blocks in the designated container storage yard. Trailers and vehicles transported by Ro-Ro vessels are also stored in a group in a open yard.

(4) Port Management and Operations

1) Organization Structure and Function

The EPO has a authority to operate and administrate the Port of Oran such as berth allocation, pilotage, tugs, cargo handling, storage and delivery in the same way as other EPs. Organization structure of the EPO is shown in Fig. 1.6.1.

2) Employee Breakdown

Number of employees at the EPO is shown in Table 1.6.1. The EPO has been making effort to decrease its employees, and the total number of employees is decreased by 27.7% from 1985 to 1990.

3) Financial Condition

Latest four year's total revenue, total expense and net income are shown in Fig. 1.6.2. The percentages of four categories of revenue, such as maritime, cargo handling, storage charge and tax parafiscale, are shown in Fig. 1.6.4.

Table 1.6.1 Employee Breakdown of EPO

as on Sep. 1991

Dep./Class	Cadres	Maitrise	Execution	Total
DIRECTOR GENERAL	6	8	2	16
RESERCH & PLANNING	7	2	1	10
HARBOR MASTER	52	153	2	207
OPERATION	28	1,078	17	1,123
TECHNICAL WORKS & MAINTENANCE	12	58	6	76
FINANCE & ACCOUNTING	27	23	3	53
HUMAN RESOURCES	20	43	20	83
TOTAL	152	1,365	51	1,568

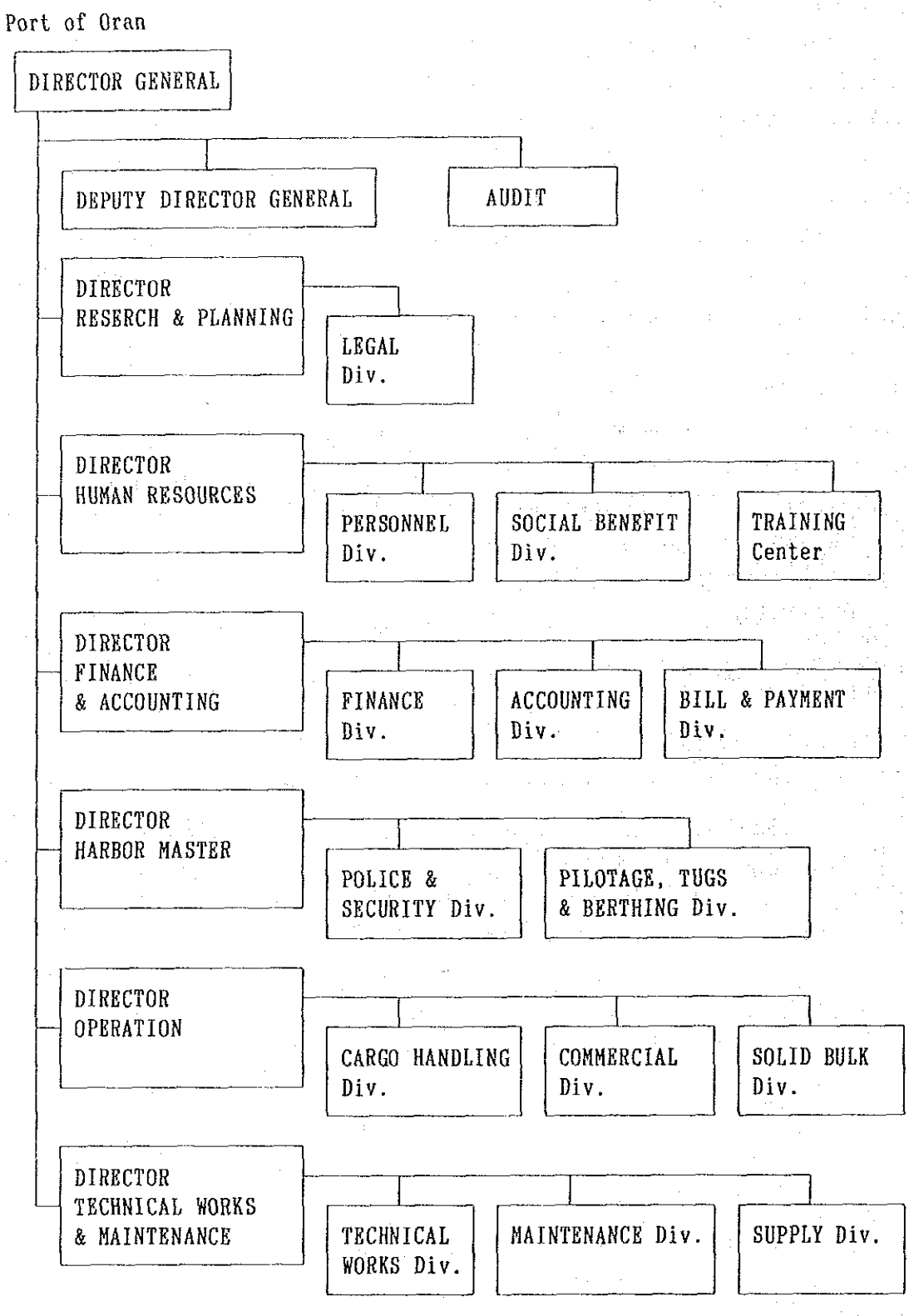


Fig. 1.6.1 Organization Chart of EPO

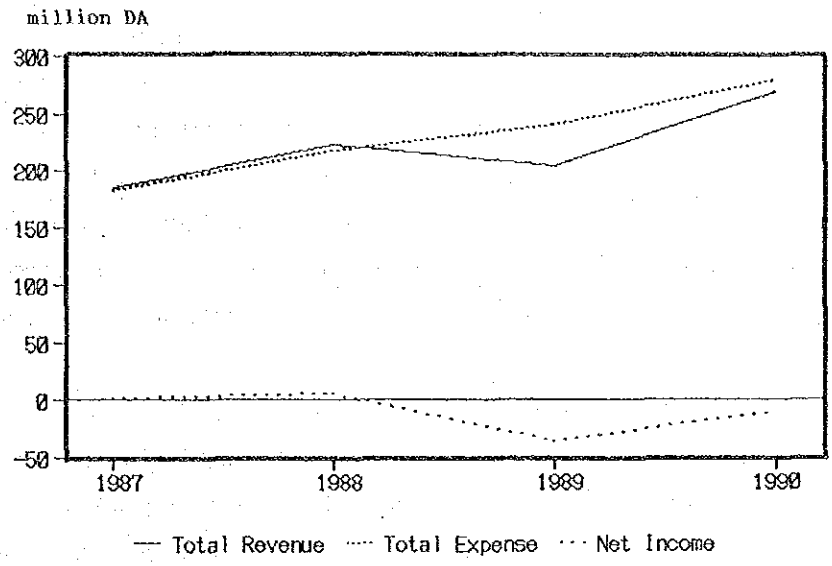


Fig. 1.6.2 Net Income (before tax) of EPO

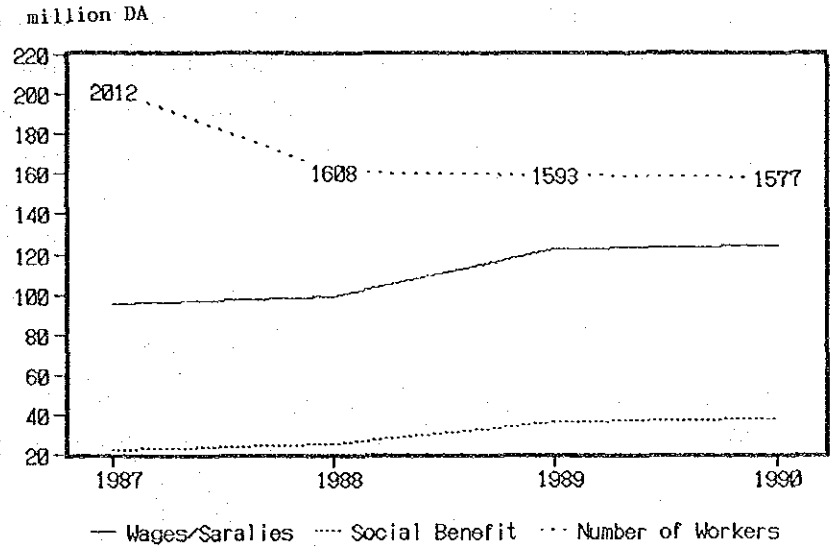


Fig. 1.6.3 Wages/Salaries of EPO

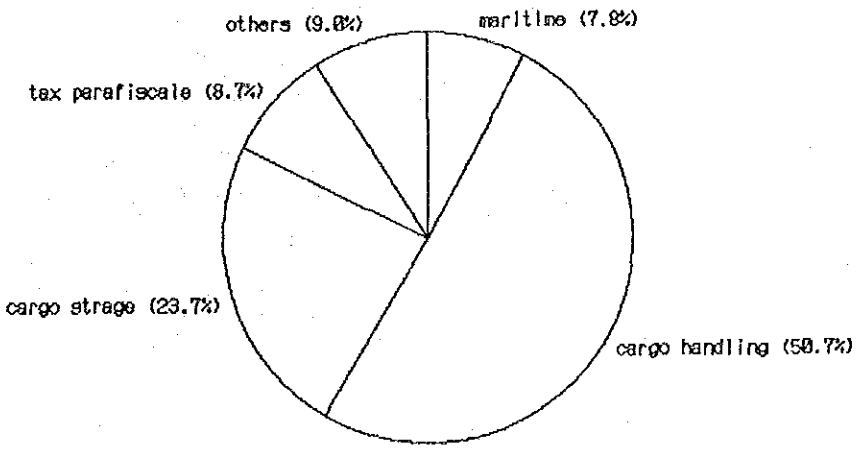


Fig. 1.6.4 Operation Revenue of EPO

(5) Review of the Existing Plans

Medium and long-term development plan has been prepared by EPO and DTP of Oran considering the expected future cargo volume up to the 2000. The principal two items were examined; The required equipments and facilities for each commodity. The required infrastructure for the port development plan such as cereals terminal, container terminal and alumina terminal.

In order to cope with increasing container transportation, a new container terminal project financed by the World Bank is planned at existing Quays Nos.21-23. This project (Container Port Development), to be implemented during the period 1989-1994, includes the development of specialized container handling facilities in the three main ports of Algiers, Annaba and Oran. The DTP of Oran has already finished tender procedures for the civil works, and the EPO has made budget planning for the period of 1991-1995 to purchase the necessary equipment. After completion of this project, the capacity of container handling facilities at port of Oran is estimated to be around 140 thousand tons per year.

1.7 The Port of Annaba

(1) Port Facilities

The port of Annaba is situated on the eastern seaboard and is the foremost foreign trade port in Algeria. Furthermore, the port functions not only as a commercial port but also as an industrial port where steel and fertilizer industries are located in and around the port.

The port area has a water area spanning 95 ha and a land area of 70 ha. The harbor basins are sheltered by two breakwaters and the water area of the port has a minimum depth of 4.0 m and a maximum depth of 12.5 m.

There are 22 berths with a total length of 3,785 m and one specialized petroleum products berth (No.26) at the northern breakwater. There is one approach channel.

The protective facilities consist of northern and southern breakwaters, the lengths of which are 980 m and 400 m respectively.

The berthing facilities in this port are divided into two categories; specialized use and common use. Specialized use represents concession berths placed at the disposal of some companies. There are nine berths which are classified as concession berths; the following is a list of the companies which use these berths and the cargoes that are handled there:

No.13	Coal	SIDER
No.14-15	Metallic Products	SIDER
No.16	Iron Ore	FERPHOS
No.17	Mineral	FERPHOS
No.18	Ammonia, Tar, Petroleum	ASMIDAL, SIDER, NAFTAL
No.19	Phosphate	FERPHOS
No.20	Sulphur, Potash	ASMIDAL
No.26	Petroleum Products	NAFTAL

The Port has 7,000 m^2 of transit sheds, 82,000 m^2 of open storage yards and a cereal silo with capacity of 16,000 tons as handling and storage facilities.

The E.P.AN has 140 cargo handling equipments, such as 16 quay cranes installed mainly in 1948, 4 mobile cranes, 3 unloaders, and 83 forklifts purchased mainly in 1980.

(2) Port-Related Industries

Major industries related to the port traffic (importation of raw materials and shipment of products) are as follows.

A. Mining Industry: ENTREPRISE NATIONALE DU FER ET DU PHOSPHATE (FERPHOS)
B. Steelmaking Industry: ENTREPRISE NATIONALE DE SIDERUR (SIDER)
C. Fertilizer Industry: ENTREPRISE NATIONALE DES ENGRAIS ET PRODUITS PHYTOSANITAIRES (ASMIDAL)

(3) Cargo Traffic through the Port

The Port of Annaba is playing an important role as a sea born cargo distribution terminal serving the eastern region of Algeria with the cities of Annaba and Constantine in its center. At the same time, the port has a character as an industrial port serving port-oriented industries in the vicinity such as a steelmaking industry and a fertilizer industry for importation of raw and intermediate materials and shipment of manufactured products.

Port traffic in 1990 was 4.33 million tons of which 3.12 million tons were unloaded and 1.21 million tons were loaded. The share of loaded cargo in total traffic is larger than at the ports of Algiers and Oran as port of Annaba has been characterized as a loading port for manufactured products.

The port was not only important commercially, witnessing general cargo traffic of 0.73 million tons which accounted for 9% of total general cargo traffic of the nation, but it was also the nation's principal industrial port with 3.04 million tons of solid bulk cargo traffic accounting for 39% of the nationwide solid bulk cargo traffic (excluding hydrocarbon related traffic).

(4) Port Activities

A total of 827 ships called at port of Annaba in 1990. Of these, 420 were general cargo vessels, 106 were mineral carriers, 108 were petroleum carriers, 70 were Ro-Ro ships, 30 were car ferries, 36 were cereals carrier, 8

were container vessels and 48 were other ships.

The size of general cargo vessels calling at the port was in the range of 1,000-40,000 DWT, while mineral carriers were 1,000-60,000 DWT, petroleum carriers were 1,000-7,000 DWT, Ro-Ro vessels were 2,000-50,000 DWT, car ferries were 4,000-12,000 DWT and cereals carriers were 10,000-30,000 DWT.

In terms of the handled volume of cargo at the port of Annaba, the general cargo vessels accounted for 28.6% of the total volume, mineral carriers were 37.6%, cereals carriers were 19.3% and petroleum carriers were 10.0%.

As for the conditions of utilization at each berth, the average number of ships moored annually at each general cargoes berth is 40, the average ship size is 5,340 DWT, the average volume of cargoes handled per ship is about 1,700 tons, and the average mooring time per ship is 122 hours. The number of ships requiring less than three hours from entry into the port until berthing represent 37% of the total, while the number of ships that took more than three hours represented 63%. It can be presumed from these figures that waiting has already started in the case of general cargo vessels.

The number of grain carriers moored annually at Berth No.12 is 23, the average ship size is about 30,200 DWT, the average volume of cargoes handled per ship is about 23,500 tons and the average mooring time per ship is 382 hours. Berth No.12, equipped with specialized cargo handling equipment, handles about 62% of the total cereals, and the remaining 38% is directly dumped to trucks. It can be said that the cereals berth is already being used to the full extent of its capacity.

The number of petroleum carriers moored annually at Berth No.26 is 75, the average ship size is about 6,000 DWT, the average volume of cargoes handled per ship is about 4,600 tons, the average mooring time per ship is 91 hours and the average waiting time per ship is about 8 hours. Based on these figures, the mooring capacity of Berth No.26 has already reached its limit.

The handling of general cargoes is done in a similar manner to the Port of Algiers. Raw Sugar is discharged by means of quay cranes with grab buckets, and directly put in storage facility through a belt conveyer system with hoppers. Bulk Cereals are discharged by 2 units of unloading machines. Most of

discharged cargoes are put into silos through a belt conveyer system. In addition, some cargoes are discharged at No.17 berth in No.5 quay by ship's gear with grab buckets. Sulfur and Potash are discharged by means of one unit of gantry crane. Coal is discharged by two units of gantry cranes at No.13 berth and transferred from quay to storage yard by belt conveyer systems. The loading of iron ore into vessels for export is hardly done in reality. Phosphate is loaded by means of two units of traveling loader. Cast Iron and Steel Goods are first stored in storage yard and then loaded by quay cranes or vessel gears. The Tanker Berth is mainly used for handling of gas oil, gasoline, fuel oil transported by domestic coastal tankers. The cargoes are handled by piping systems connecting between ship pipes and shore lines. Liquefied ammonia is discharged and loaded from/to vessels by two loading arms transferred from the berth to tanks in user's factory by pipelines, and vice versa. Bitumen is handled at No.22 berth using a pipeline system, and tar is handled at No.18 berth.

(5) Port Management and Operations

1) Organization Structure and Function

The EPAN has a authority to operate and administrate the Port of Annaba such as berth allocation, pilotage, tugs, cargo handling, storage and delivery in the same way as other EPs. Organization structure of the EPAN is shown in Fig. 1.7.1.

2) Employee Breakdown

Number of employees at the EPAN is shown in Table 1.7.1. The EPAN has been making effort to decrease its employee, and the total number of employee is decreased by 27.4 % from 1985 to1990.

3) Financial Condition

From 1987 to 1990, every year's total revenue, total expense and net income -before tax are shown in the line chart of Fig. 1.7.2. The percentages of four categories of revenue, such as maritime, cargo handling, storage charge and land rent, are shown in Fig. 1.7.4. The table shows that the percentage of cargo handling and cargo storage revenue is about 83.2% of the total revenue.

Table 1.7.1 Employee Breakdown of EPAN

as on Sep. 1991

Dep./Class	Executive	Skilled	Worker	Total
DIRECTOR GENERAL	4	1	2	7
HUMAN RESOURCES, Training & GENERAL AFFAIRS	14	31	47	92
FINANCE & ACCOUNTING	11	8	2	21
PLANNING & INFORMATION	8	3	3	14
TECHNICAL WORKS & MAINTENANCE	13	57	68	138
HARBOR MASTER	24	39	74	137
OPERATION	9	91	653	753
TOTAL	83	230	849	1,162

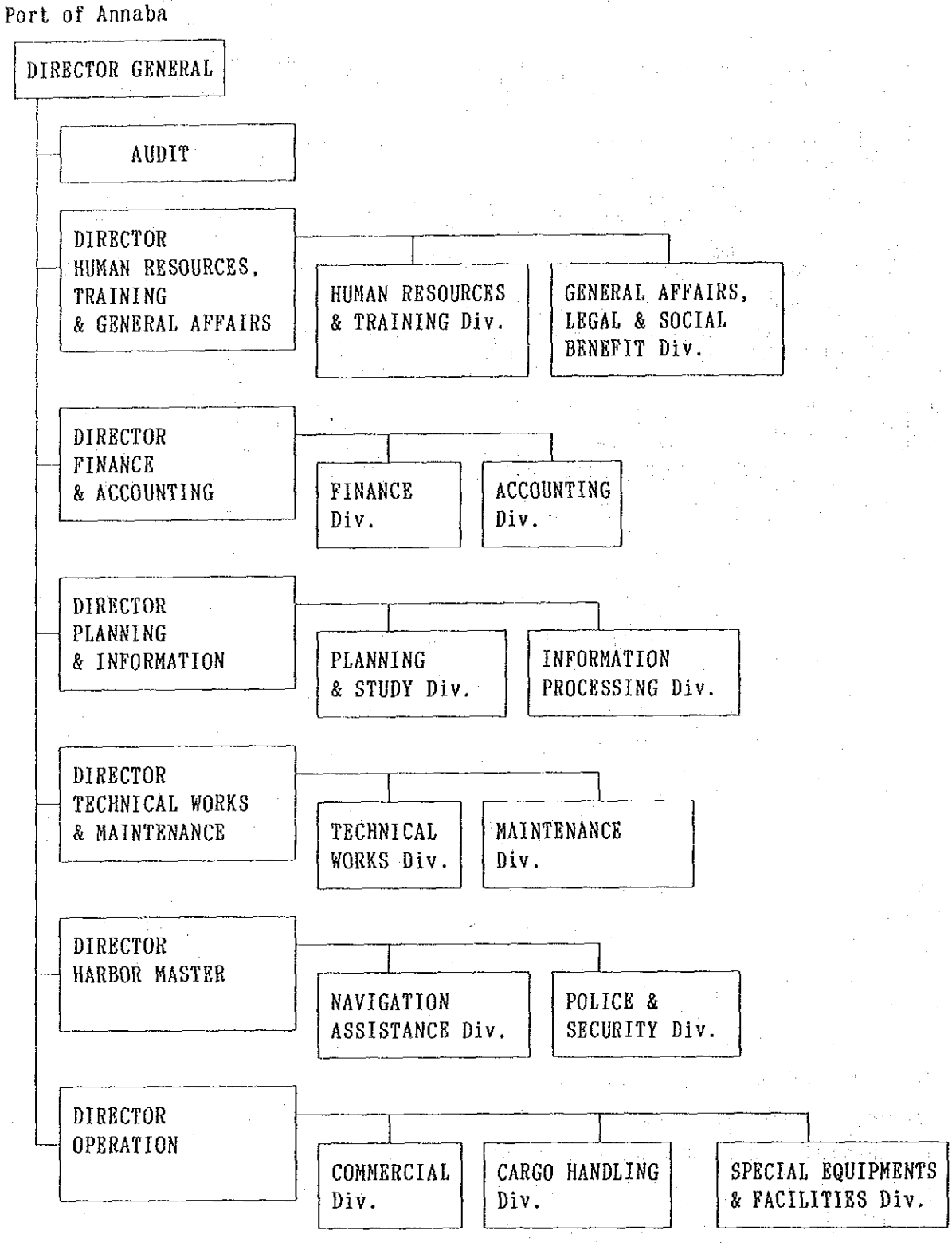


Fig. 1.7.1 Organization Chart of EPAN

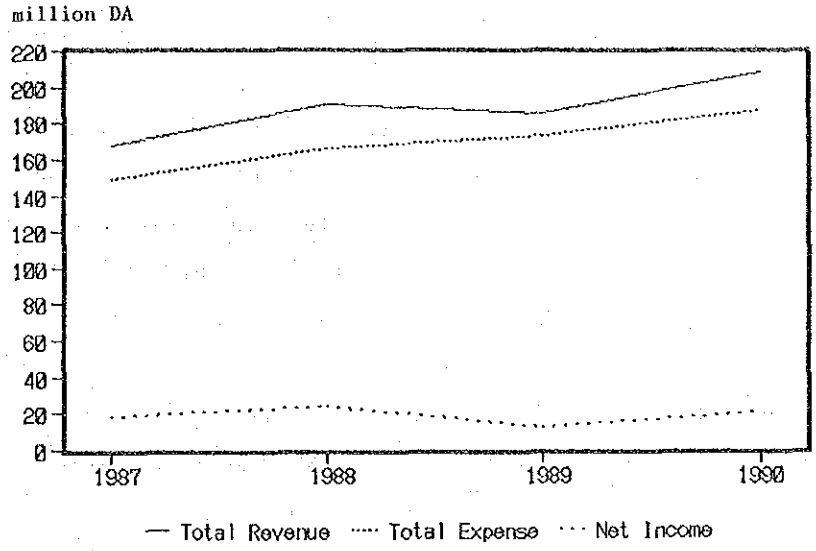


Fig. 1.7.2 Net Income (before tax) of EPAN

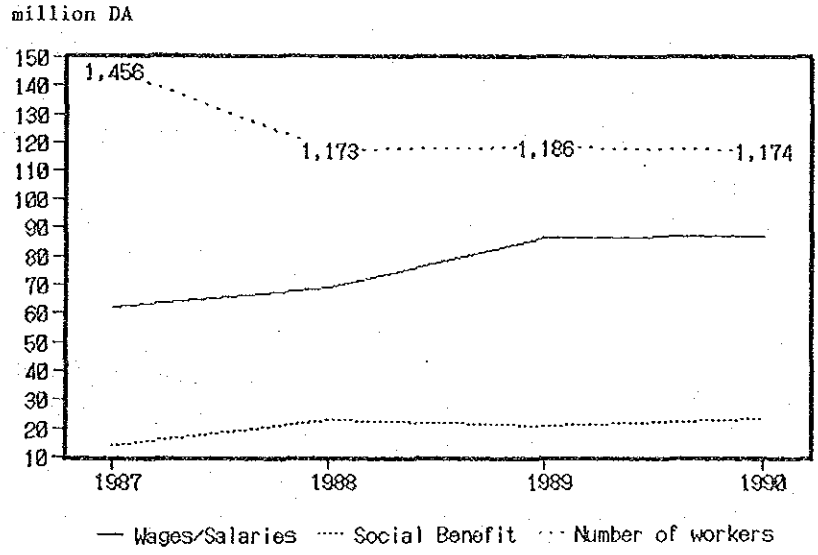


Fig. 1.7.3 Wages/Salaries of EPAN

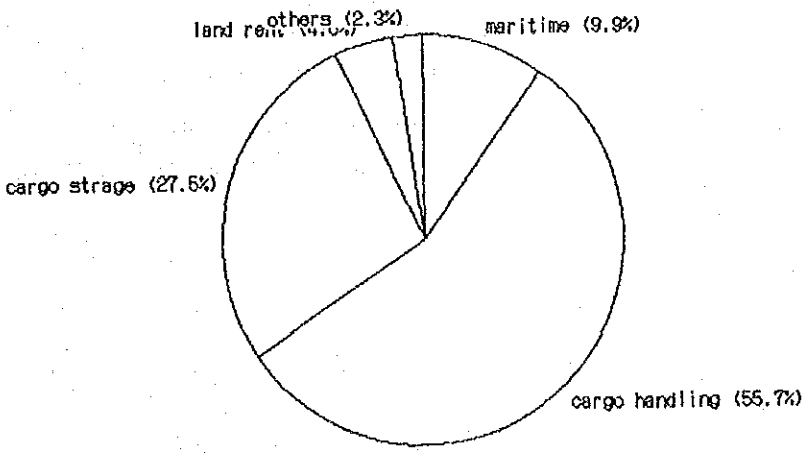


Fig. 1.7.4 Operation Revenue of EPAN

(6) Review of the Existing Plans

In order to cope with increasing container transportation, a new container terminal project financed by the World Bank is planned at berth No.1 and No.2. This project (Container Port Development), to be implemented during the period 1989-1994, includes the development of specialized container handling facilities in the three main Algerian ports (Algiers, Annaba and Oran).

After completion of this project, the capacity of container handling facilities at port of Annaba is estimated to be around 271 thousand tons per year.

1.8 Demand Forecast

To prepare the Masterplan up to the year of 2010 and the Short-term Development Plan up to the year of 1997 of the ports of Algiers, Oran and Annaba, "Demand Forecast" is carried out to determine the cargo volume handled at the ports in target years.

(1) Socioeconomic Frame for the Target Years

A. Population

The population of Algeria will reach 30.5 million in 1997 and 40.7million in 2010.

B. Economy

The forecasted values of GDP in 1997 and 2010 are shown as follows.

U: Billions of 1987 DA

	1997	2010
G. D. P.	449.88	817.34
Agricultural sector	48.74	91.91
Manufacturing sector	39.25	80.69

(2) Methodology for Demand Forecast

Two methods are used to forecast the commercial cargo volume handled at the ports of Algiers, Oran and Annaba. One is a macro forecast which estimates the cargo volume as a group including many commodities, regardless of the volume of each commodity. The other is a micro forecast, which estimates the cargo volume of each commodity individually. And the results of the cargo volume forecast by both methods were checked mutually.

(3) Results of the Forecasts

The results of the forecast are shown as followings.

Table 1.8.1 Result of Demand Forecast (Port of Algiers)

U: tons

	PACKAGE TYPE	CONTAINER SUITABLE	1990	1997	2010
(UNLOADED)					
AGRICULTURAL PRODUCTS			1,627,621	2,340,000	4,053,000
(1) CEREAL	SOLID BULK	U	1,340,156	2,000,000	3,600,000
(2) OTHER AGRICULTURAL PRODUCTS	GENERAL C.	S	71,308	73,000	97,000
(3) TIMBER	GENERAL C.	U	216,157	267,000	356,000
FOODSTUFF AND ANIMAL FEED			896,843	966,000	1,393,000
(4) SUGAR	GENERAL C.	S	210,174	219,000	299,000
FLOUR AND SEMOLINA	GENERAL C.	U	149,718	0	0
(5) VEGITABLE OIL	LIQUID BULK	U	217,882	369,000	493,000
(6) OTHER FOODSTUFF	GENERAL C.	S	185,812	227,000	303,000
(7) ANIMALFEED	SOLID BULK	U	133,257	151,000	298,000
(8) PETROLEUM PRODUCTS	LIQUID BULK	U	728,628	993,000	1,800,000
(9) METAL PRODUCTS	SOLID BULK	U	305,487	409,000	742,000
MINERALS AND CONSTRUCTION MATERIALS			736,841	942,000	986,000
(10) CEMENT	SOLID BULK	U	696,702	877,000	868,000
(11) OTHERS	SOLID BULK	U	40,139	65,000	118,000
(12)MANUFACTURED GOODS, ETC.			1,141,617	1,511,000	2,748,000
FERTILIZER	GENERAL C.	S	20,652	36,000	68,000
CHEMICAL P.,MANUFACTURED G.	GENERAL C.	S,U	1,120,965	1,475,000	2,680,000
UNLOADED TOTAL			5,437,037	7,161,000	11,722,000
(LOADED)					
(13)PETROLEUM PRODUCTS	LIQUID BULK	U	734,447	240,000	240,000
(14)METALLURGICAL SCRAP	SOLID BULK	U	8,428	40,000	73,000
(15)MANUFACTURED GOODS, ETC.	GENERAL C.		97,406	139,000	286,000
CHEMICAL P.,MANUFACTURED G.			97,406	139,000	286,000
LOADED TOTAL			840,281	419,000	599,000
TOTAL			6,277,318	7,580,000	12,321,000
			6,277,318	7,580,000	12,321,000
	SOLID BULK	U	2,524,169	3,542,000	5,699,000
	LIQUID BULK	U	1,680,957	1,602,000	2,533,000
	GENERAL C.		2,072,192	2,436,000	4,089,000
		U	517,875	419,000	599,000
		S	1,554,317	2,017,000	3,490,000

U: Unsuitable for containerization
S: Suitable for containerization

Table 1.8.2 Result of Demand Forecast (Port of Oran)

U: tons

	PACKAGE TYPE	CONTAINER SUITABLE	1990	1997	2010
(UNLOADED)					
AGRICULTURAL PRODUCTS			1,270,363	1,432,000	2,875,000
(1) CEREAL	SOLID BULK	U	1,185,659	1,300,000	2,700,000
(2) OTHER AGRICULTURAL PRODUCTS	GENERAL C.	S	24,292	38,000	50,000
(3) TIMBER	GENERAL C.	U	60,512	94,000	125,000
FOODSTUFF AND ANIMAL FEED			414,643	519,000	847,000
(4) SUGAR	GENERAL C.	S	103,000	177,000	312,000
FLOUR AND SEMOLINA	GENERAL C.	U	66,487	0	0
(5) VEGITABLE OIL	LIQUID BULK	U	80,378	113,000	150,000
(6) OTHER FOODSTUFF	GENERAL C.	S	70,874	104,000	139,000
(7) ANIMALFEED	SOLID BULK	U	93,904	125,000	246,000
(8) PETROLEUM PRODUCTS	LIQUID BULK	U	524,951	726,000	1,320,000
(9) METAL PRODUCTS	SOLID BULK	U	147,668	217,000	395,000
MINERALS AND CONSTRUCTION MATERIALS			305,823	420,000	1,147,000
(10) CEMENT	SOLID BULK	U	269,590	357,000	433,000
(11) OTHERS	SOLID BULK	U	36,233	63,000	114,000
(12) ALUMINA	SOLID BULK	U		0	600,000
(13)MANUFACTURED GOODS, ETC.	GENERAL C.		250,599	398,000	695,000
FERTILIZER		S	12,798	27,000	51,000
CHEMICAL P.,MANUFACTURED G.		S,U	237,801	335,000	608,000
FIAT PARTS		S		36,000	36,000
UNLOADED TOTAL			2,914,047	3,712,000	7,279,000
(LOADED)					
(14)WINE	GENERAL C.	S	3,696	10,000	10,000
(15)METALLURGICAL SCRAP	SOLID BULK	U	14,286	11,000	19,000
(16) ALUMINIUM		S		0	220,000
(17)MANUFACTURED GOODS, ETC.	GENERAL C.		10,470	16,000	34,000
CHEMICAL P.,MANUFACTURED G.		S,U	10,470	16,000	34,000
LOADED TOTAL			28,452	37,000	283,000
TOTAL			2,942,499	3,749,000	7,562,000
			2,942,499	3,749,000	7,562,000
	SOLID BULK	U	1,747,240	2,073,000	4,507,000
	LIQUID BULK	U	605,329	839,000	1,470,000
	GENERAL C.		589,930	837,000	1,585,000
		U	150,999	118,000	163,000
		S	438,931	719,000	1,422,000

U: Unsuitable for containerization
S: Suitable for containerization

Table 1.8.3 Result of Demand Forecast (Port of Annaba)

U: tons

	PACKAGE TYPE	CONTAINER SUITABLE	1990	1997	2010
(UNLOADED)					
AGRICULTURAL PRODUCTS			970,603	1,011,000	1,547,000
(1) CEREAL	SOLID BULK	U	866,275	900,000	1,400,000
(2) OTHER AGRICULTURAL PRODUCTS	GENERAL C.	S	31,475	28,000	37,000
(3) TIMBER	GENERAL C.	U	72,853	83,000	110,000
FOODSTUFF AND ANIMAL FEED			394,077	452,000	586,000
(4) SUGAR	GENERAL C.	S,U	161,902	203,000	283,000
FLOUR AND SEMOLINA	GENERAL C.	U	110,470	0	0
(5) VEGITABLE OIL	LIQUID BULK	U	38,681	138,000	154,000
(6) OTHER FOODSTUFF	GENERAL C.	S	83,024	111,000	149,000
(7) COAL	SOLID BULK	U	926,227	1,647,000	2,200,000
(8) PETROLEUM PRODUCTS	LIQUID BULK	U	441,362	616,000	1,120,000
(9) METAL PRODUCTS	SOLID BULK	U	102,676	159,000	288,000
MINERALS AND CONSTRUCTION MATERIALS			102,377	165,000	1,168,000
(10) SULFUR	SOLID BULK	U	75,033	130,000	335,000
(11) IRON ORE	SOLID BULK	U			770,000
(12) OTHER CONSTRUCTION MATERIALS	SOLID BULK	U	27,344	35,000	63,000
(13)FERTILIZER(POTASH)	SOLID BULK	U	65,875	83,000	160,000
(14)MANUFACTURED GOODS, ETC.	GENERAL C.		115,502	169,000	335,000
CARBONIC CHEMICAL		S	10,102	18,000	61,000
CHEMICAL P.,MANUFACTURED G.		S	105,400	151,000	274,000
UNLOADED TOTAL			3,118,698	4,302,000	7,404,000
(LOADED)					
(15)COKES, MINERAL	SOLID BULK	U	20,665	34,000	46,000
(16)TAR	LIQUID BULK	U	11,414	35,000	47,000
(17)AMMONIA	LIQUID BULK	U	68,812	98,000	140,000
(18)METAL PRODUCTS	SOLID BULK	U	303,794	509,000	246,000
(19)PHOSPHATE	SOLID BULK	U	747,157	1,164,000	2,114,000
(20)MANUFACTURED FERTILIZERS	GENERAL C.	S	43,931	135,000	307,000
(21)MANUFACTURED GOODS, ETC.	GENERAL C.		4,590	6,000	13,000
CHEMICAL P.,MANUFACTURED G.		S	4,590	6,000	13,000
LOADED TOTAL			1,200,363	1,981,000	2,913,000
TOTAL			4,319,062	6,283,000	10,317,000
			4,319,062	6,283,000	10,317,000
	SOLID BULK	U	3,135,046	4,761,000	7,722,000
	LIQUID BULK	U	560,269	887,000	1,461,000
	GENERAL C.		623,747	635,000	1,134,000
		U	183,323	83,000	110,000
		S	440,424	552,000	1,024,000

U: Unsuitable for containerization
S: Suitable for containerization

(4) Estimation of volume of container cargoes in target years

The percentage of containerization in target years is estimated by using the logistic curves. Then, the volume of container cargoes in target years can be obtained by multiplying the volume of cargo suitable for containerization by these percentages. The estimated volume of container cargoes at the study ports are shown as followings.

Table 1.8.4 Forecast Volume of Container Cargo

Port of Algiers Volume unit: tons

	1997	2010
(unloaded)		
Percentage of containerization	30.9%	77.8%
Volume of containerizable cargo	1,931,000	3,314,000
Volume of container cargo	597,000	2,578,000
(loaded)		
Percentage of containerization	61.2%	86.4%
Volume of containerizable cargo	86,000	176,000
Volume of container cargo	53,000	152,000

Port of Oran

	1997	2010
(unloaded)		
Percentage of containerization	34.9%	79.7%
Volume of containerizable cargo	701,000	1,174,000
Volume of container cargo	245,000	936,000
(loaded)		
Percentage of containerization	19.3%	67.9%
Volume of containerizable cargo	18,000	248,000
Volume of container cargo	3,000	168,000

Port of Annaba

	1997	2010
(unloaded)		
Percentage of containerization	12.7%	60.1%
Volume of containerizable cargo	411,000	704,000
Volume of container cargo	52,000	423,000
(loaded)		
Percentage of containerization	19.3%	67.9%
Volume of containerizable cargo	141,000	320,000
Volume of container cargo	27,000	217,000

1.9 Functional Allotment of Port Activities among the Three Study Ports

The three study ports of Algeria are used primarily for solid bulk and general cargoes. The total volume of such cargoes excluding liquid bulk handled at the three ports was around 11 million tons in 1990, accounting for two thirds of the total handled in Algeria. According to the origin and destination survey conducted by the Study Team, the hinterlands of the ports of Algiers, Oran and Annaba are the central, western and eastern areas of Algeria, respectively, with little overlap of their hinterlands. Thus, these three ports are playing important roles in supporting industrial activities and people's lives in their hinterlands and are expected to contribute to their regional development.

As mentioned previously, cereals are accounted for the largest share of the cargoes unloaded at the ports. Presently, berths for unloading cereals are excessively congested at the ports and consequently, cereal carriers are being forced to wait off-shore for long periods of time before berthing. In order to reduce such congestion and meet the future demand, based on forecast of the population growth in their respective hinterlands, it is necessary to increase cargo-handling productivities and storing capacities at the cereal terminals. In addition to the three study ports, other principal ports such as Skikda, Bejaia and Mostaganem are also used for discharging cereals.

Since consumption areas of cereals are spread widely in the country, and transportation cost for cereals by land is very costly compared with that by water, principal ports in each region need to be developed so as to reduce the land transportation cost, then reduce the total transportation cost from origin to the final destination for imported cereals. Other agricultural products and foodstuffs are also necessary to be transported through most of the principal ports including Djen Djen; these products should not be concentrated in the three study ports only.

Other solid bulk cargoes such as steel products, wood and cement should be transported through the above principal ports in order to save costly delivery charges of land transportation, though the share of the three study ports is high reflecting their larger hinterlands.

Liquid bulk cargoes mainly comprising petroleum products such as butane, diesel fuel, gasoline and chemical products, should be transported through the

above principal ports so as to lessen the need of costly and dangerous transportation by land.

On the other hand, as for transportation of valuable general cargoes such as machinery and medicine, not only economic but also swift, safe and convenient transportation measures are essential. For that purpose, containerization has progressed remarkably in international shipping. This worldwide tendency is expected to take hold in Algeria.

Presently, the container terminal development projects financed by the World Bank are on-going. However, in order to meet the forecast demand in the target year of 2010 of the Master Plan, additional container terminals need to be established.

Since, generally, capital costs for an efficient container terminal and daily ship costs are very expensive compared with conventional vessel operations, the number of containers to be handled at a full-scale container terminal must exceed at least around 100 thousand TEUs per annum. Judging from the forecast demand of container number to be handled at the Algerian ports in 2010, it is advisable to put an emphasis on the three study ports for the development of container terminals without distributing the limited amount of resources to other ports.

1.10 Master Plan for the Port of Algiers

(1) The Basic Concept of the Port Development

The purpose of the Master Plan (target year 2010) is to serve as a target and guideline for phase plans including the Short-Term Plan (target year 1997). The Master Plan shall be an integrated plan covering the layout plans for new facilities, modernization plans for existing facilities and effective management and operation systems. In making the Master Plan for the Port of Algiers, the following various aspects concerning the port development are recognized:

- Port congestion
- Lack of modern terminals
- Future demand for use of the port
- Economic transportation
- Effective utilization of the existing facilities
- Safe operations
- Environmental impact on areas around the port induced by the port

- Modernization of the cereal terminal:
  The volume of cereals to be unloaded at the port in 2010 is estimated as 3,600 thousand tons, 2.7 times as much as the volume in 1990. At present, Quay No.33-1, No.35-1 and No.35-3 are mainly handling cereals. Presently, the percentages of berth occupancy are already almost 100%, and therefore, there is no room to receive the above amount of cereals without modernization of the existing facilities.

- Establishment of an additional container terminal:
  The number of containers to be handled at the port in 2010 is estimated as 532 thousand TEUs. In order to cope with the progress of containerization, a new container terminal financed by the World Bank (hereinafter referred to as Terminal-1) is about to be constructed by restructuring the existing facilities. However, the cargo-handling capacity of the new terminal is insufficient to handle the above number of containers, and therefore, an additional full-scale container terminal with areas of at least 24 ha and berths of 600 meters long will be required by the year 2010. However, it is clear that there is no room to install such a spacious terminal within the existing port limits even

if restructuring of the existing facilities is conducted for that purpose. Thus, the additional container terminal is planned outside of the existing facilities.

- Preparation of open yards for steel products and wood just behind berths:
  Excluding cereals, iron and wood are the major commodities among solid bulk cargoes, accounting for 8.2% of the total in 2010, approximately twice the present volume. In order to handle bulky and heavy cargoes such as iron and wood, berths with spacious open yards behind them are necessary so as to ensure efficient cargo-handling and storage. However, existing berths have limited areas and their capacities are insufficient to handle these cargoes. Accordingly, preparation of such open yards will be required by the year of 2010.

(2) Usage Plan for the Existing Port Facilities

The usage plan for the existing port facilities by vessel type excluding container-handling is shown in Table 1.10.1. According to a result of a computer simulation for the proposed usage plan for the existing facilities in 2010, the calling vessels will be received without long off-shore waiting times.

Concerning handling cereals, an alternative case when a new cereal terminal will be constructed outside of the existing port facilities is compared with the original case when cereals will be handled at the existing wharf, namely the Wharf of Skikda. In the alternative case, there is no restriction in water depth along the new berths, various similar derivative cases within the above alternative case were compared so as to select the optimum water depth considering the major trade partners, namely the United States, Canada and France. Among the derivative cases, the case in which a new cereal terminal with a water depth of 14 m is planned to be provided out side of the existing port facilities, is considered to be the most economical plan. However, the original case is more economical than the alternative case.

Required areas of public sheds and open yards for various cargoes excluding containers are 4.4 ha and 10.3 ha, respectively. On the other hand, areas for public sheds and open yards which are expected to be available in the year 2010 were computed by reducing areas for the new container terminal and

modernized cereal terminal from the existing areas. The available areas of public sheds and open yards are 5.8 ha and 13.1 ha, respectively. Thus, the required areas will be prepared within the existing port limits except for container-stacking.

Required capacity of silos for cereals is 250 thousand tons in 2010. Subtracting the existing capacity of 30 thousand tons, silos of capacity of 220 thousand tons will be additionally required.

Table 1.10.1 The Usage Plan for the Existing Port Facilities

Berth No.	Vessel type												
	General cargo							Ro-Ro	Cereal carrier	Tanker			Car ferry
	Mixed	Cement	Foodstuffs	Wood	Iron	Sugar	Animal feed			Petroleum	Bitumen	Vegitable oil	
No.5								*					
No.6			*			*							
No.7								*					
No.8	*												
No.9-1			*			*							
No.9-2													*
No.10			*			*							
No.11-1			*			*							
No.11-2													*
No.16													
No.17	*												
No.18-1				*	*								
No.18-2				*	*								
No.19				*	*								
No.20-1				*	*								
No.20-2				*	*								
No.21	*												
No.22-1	*												
No.22-2	*												
No.22-3	*												
No.22-4	*							*					
No.22-PC	*												
No.23-1	*												
No.23-2	*												
No.23-3	*							*					
No.23-PC	*												
No.24								*					
No.25								*					
No.26-1							*						
No.26-2											*		
No.31-2	*												
No.31-3	*							*					
No.32												*	
No.33-1									*				
No.33-3				*	*								
No.34		*											
No.35-1									*				
No.35-3									*				
No.36												*	
No.37-1										*			
No.37-2										*			
No.37-3										*			
Total	14	1	4	6	6	4	1	7	3	3	1	2	2
Cargo volume (tons)	709,000	868,000	58,000	356,000	615,000	68,000	298,000	327,000	3,600,000	1,896,000	144,000	493,000	160,000
Number of vessels	355	41	28	70	131	5	20	297	157	372	63	159	366

(3) Modernization Plan of the Existing Facilities

1) Modernization of the Cereal Terminal

Modernization of the cereal terminal at the Wharf of Skikda is planned for in the target year 2010. The existing three berths are planned to be allocated for cereal-handling. Four units of rail-mounted pneumatic unloaders with nominal capacity of 400 tons per hour each will be additionally purchased. Furthermore, silos of storage capacity of 220 thousand tons as a total will also be prepared. A layout plan of the above facilities is shown in Fig. 1.10.1.

2) Preparation of Open yards for Steel products and Wood

At the Wharf of Ghara Djebilet where steel products and wood are planned to be handled, additional open yards will be prepared by demolishing the existing sheds behind the Quay No.20.

3) 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.

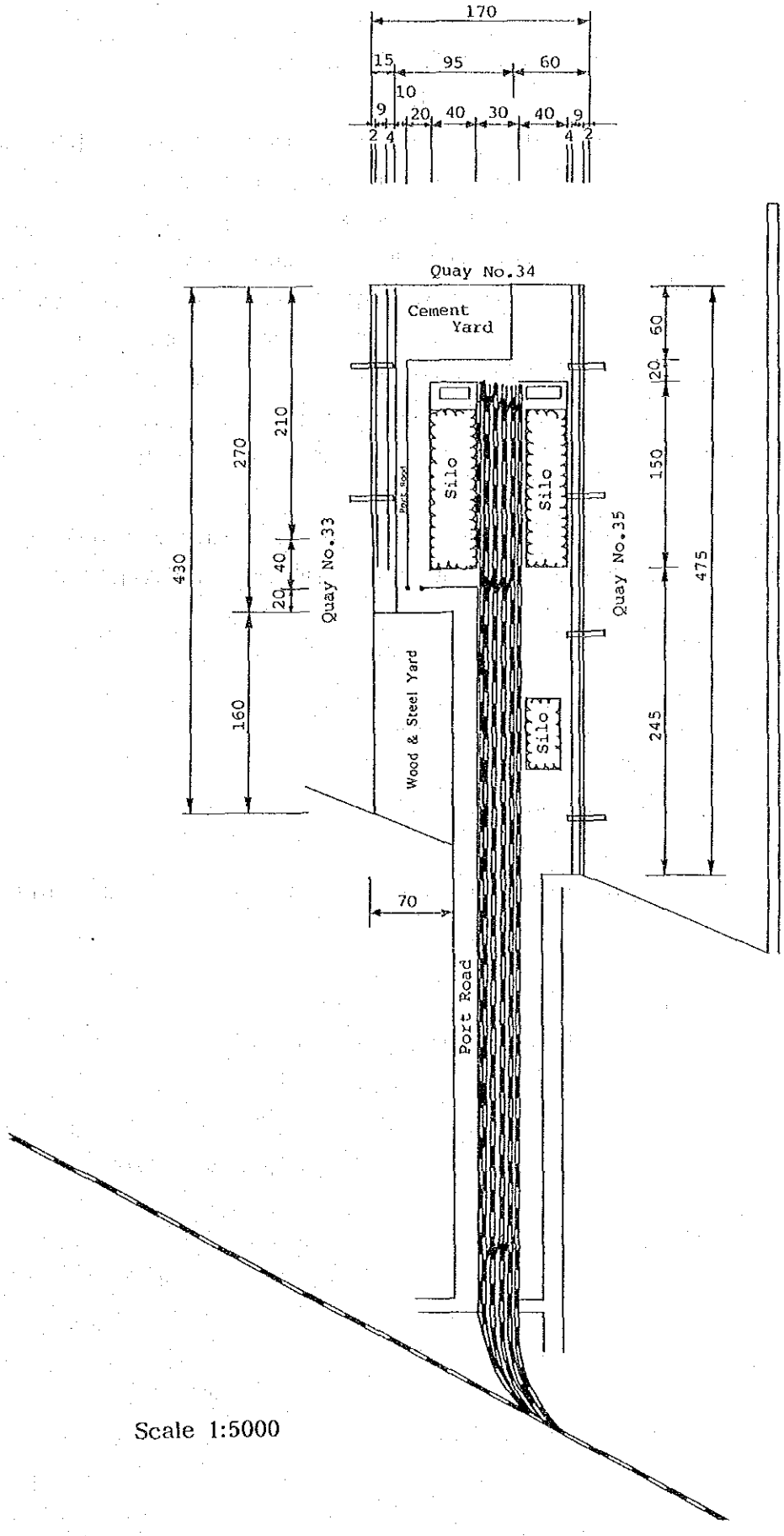


Fig. 1.10.1 Layout plan of the Main Facilities for the Cereal Terminal

(4) Establishment of an Additional Container Terminal

Required scale of berths of an additional container terminal (hereinafter referred to as Terminal-2) was determined by comparing the alternatives with different water depths and the number of berths. In the comparison, the most economical plan was selected taking account of ship transportation costs by major shipping route, ship waiting times and construction costs were considered. Ship waiting times were estimated by using computer simulation including operations at Terminal-1. According to the results of the comparison, the case when two berths of 600 m long and 13 m deep with four units of container gantry cranes will be constructed was selected as the optimum plan.

Considering the required scale of Terminal-2, alternative development plans with the target year 2010 are proposed as follows (see Fig. 1.10.2-1.10.4):

Project Site

- Case 1 East of the Brise-Lames Est
- Case 2 East of the Brise-Lames Est
- Case 3 East of the Jetée De l'Agha

The alternative plans listed above were compared with the following points:

a. Land acquisition
b. Breakwaters and sea walls to combat violent waves
c. Basins for maneuvering container vessels
d. Access to the container terminal by land
e. Potential for further expansion beyond the target year 2010
f. Construction cost

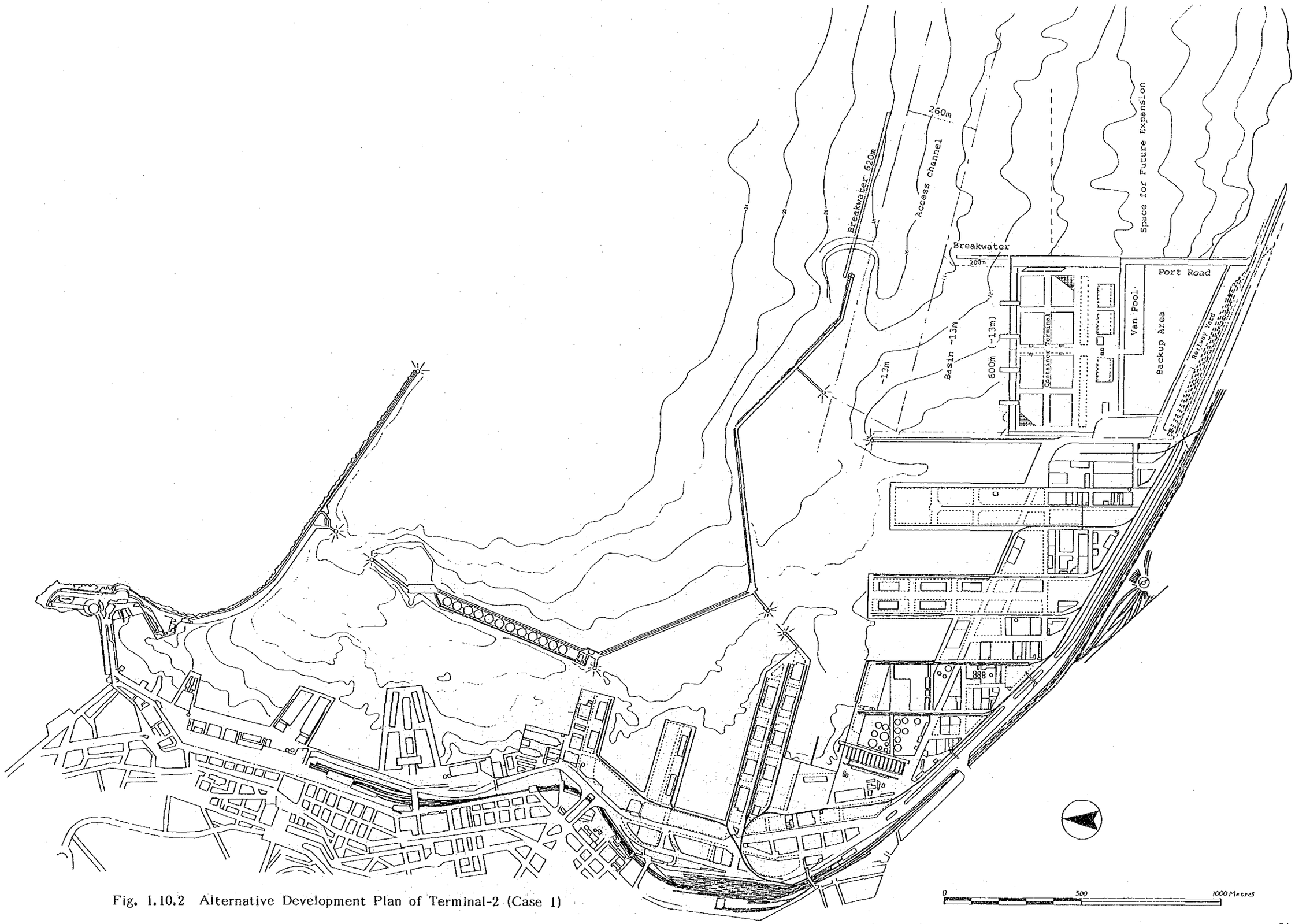


Fig. 1.10.2 Alternative Development Plan of Terminal-2 (Case 1)

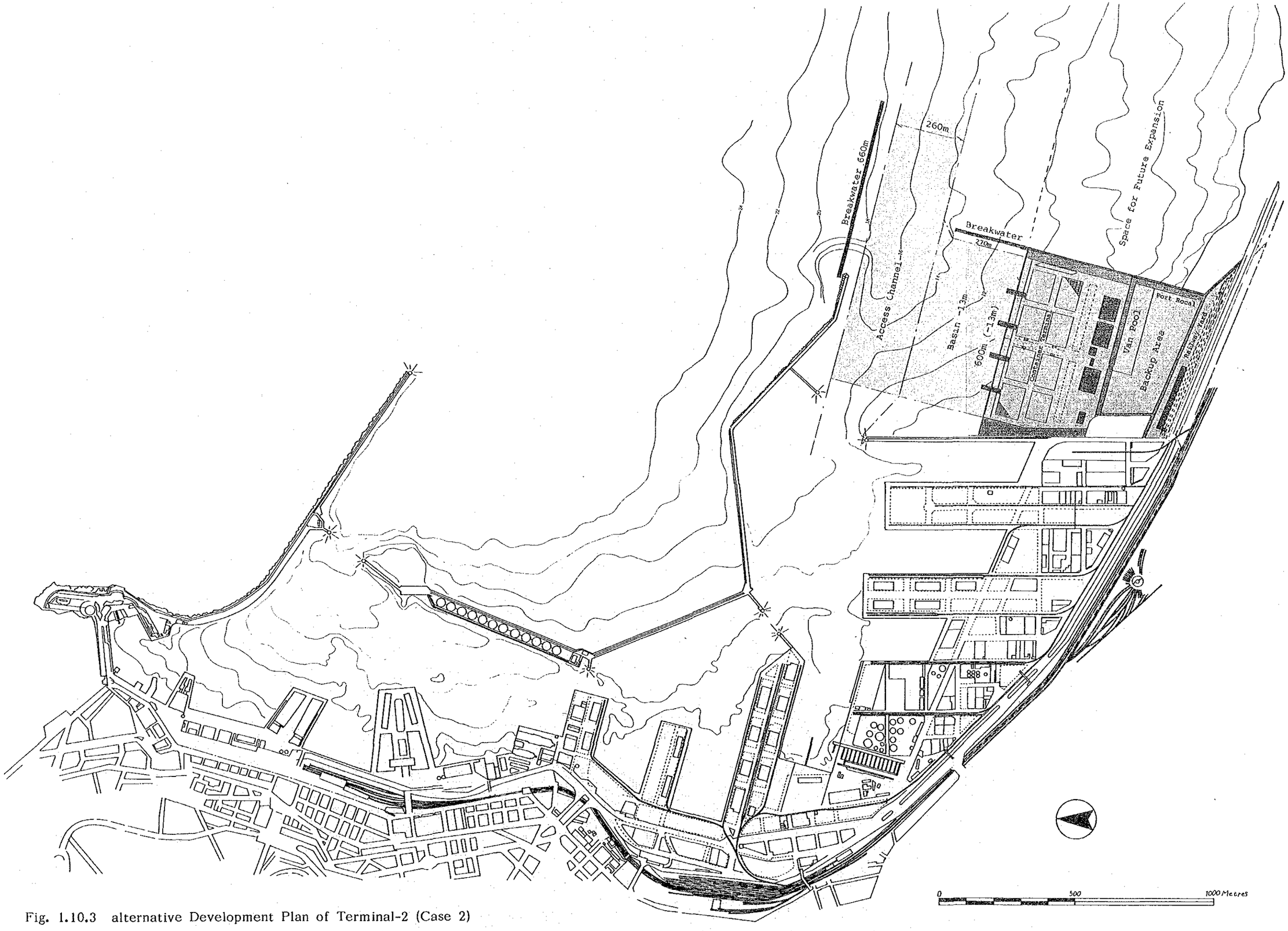


Fig. 1.10.3 alternative Development Plan of Terminal-2 (Case 2)

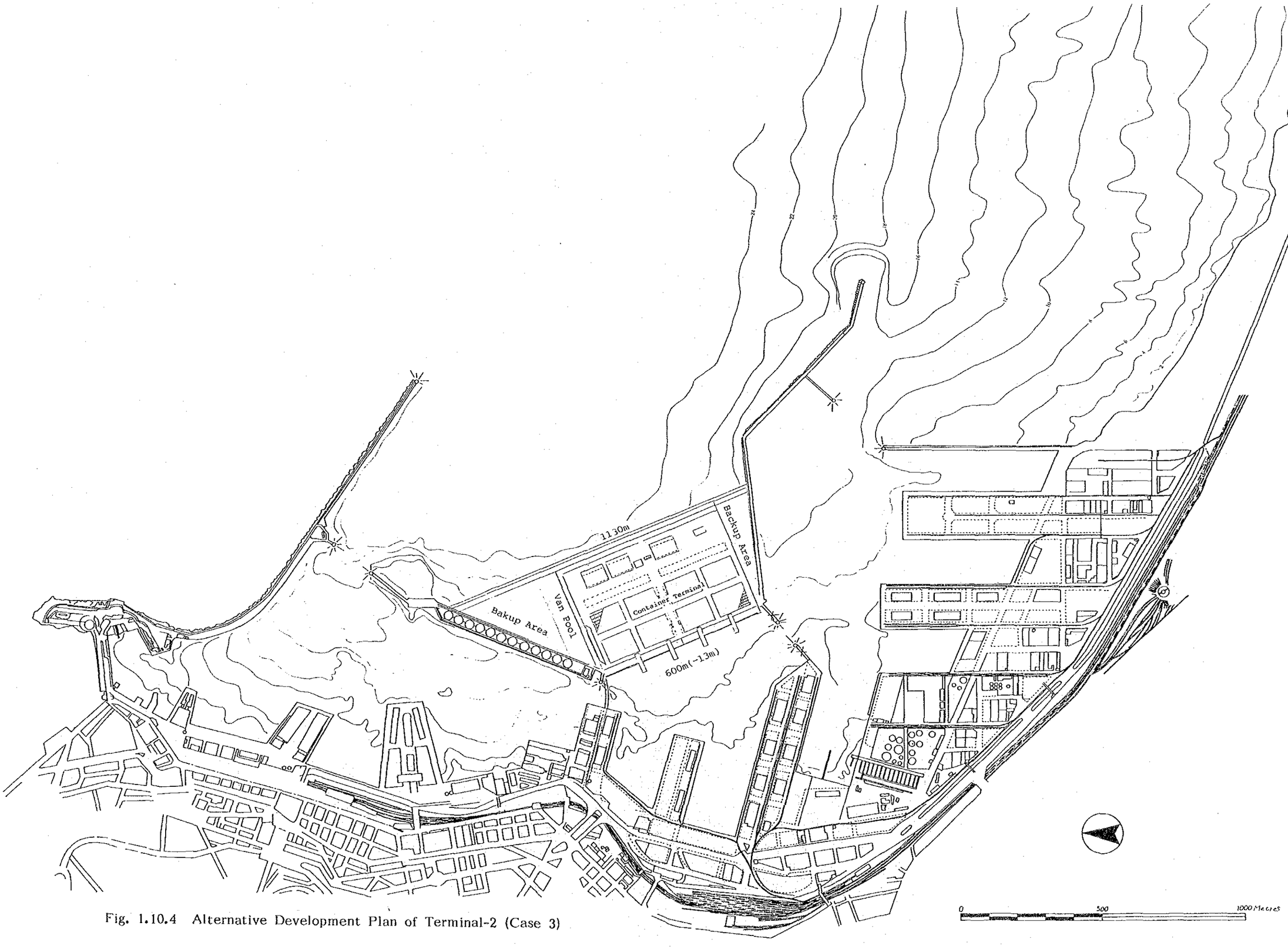


Fig. 1.10.4 Alternative Development Plan of Terminal-2 (Case 3)

Capital cost of Case 3 is much higher than Case 1 and Case 2. There is no decisive difference in operational conditions and cost between the remaining two cases, namely Case-1 and Case-2. Taking account of the future expansion beyond the Master Plan, however, Case 2 has advantages over Case 1, since additional berths will be extended in a continuous berth line in the former case. Thus, Case 2 is selected as the optimum plan.

Case 2 is further divided by four different container-handling systems. However, since it is difficult to prepare the spacious area for a chassis system economically, the chassis system should be avoided. There is no decisive difference in cost between the remaining three systems, namely straddle carrier, transfer crane and forklift systems. However, there is a risk of damaging containers in the forklift system in cargo-handling operation compared with straddle carrier and transfer crane systems. Comparing the straddle carrier and transfer crane systems, the straddle carrier system has advantages over the transfer crane system in flexible operation owing to less number of container handling times. Moreover, the straddle carrier system (Case 2-1) is more economical than the transfer crane system. Thus, the straddle carrier system seems to be suitable. A layout plan of the main facilities in Case 2-1 is shown in Fig. 1.10.5.

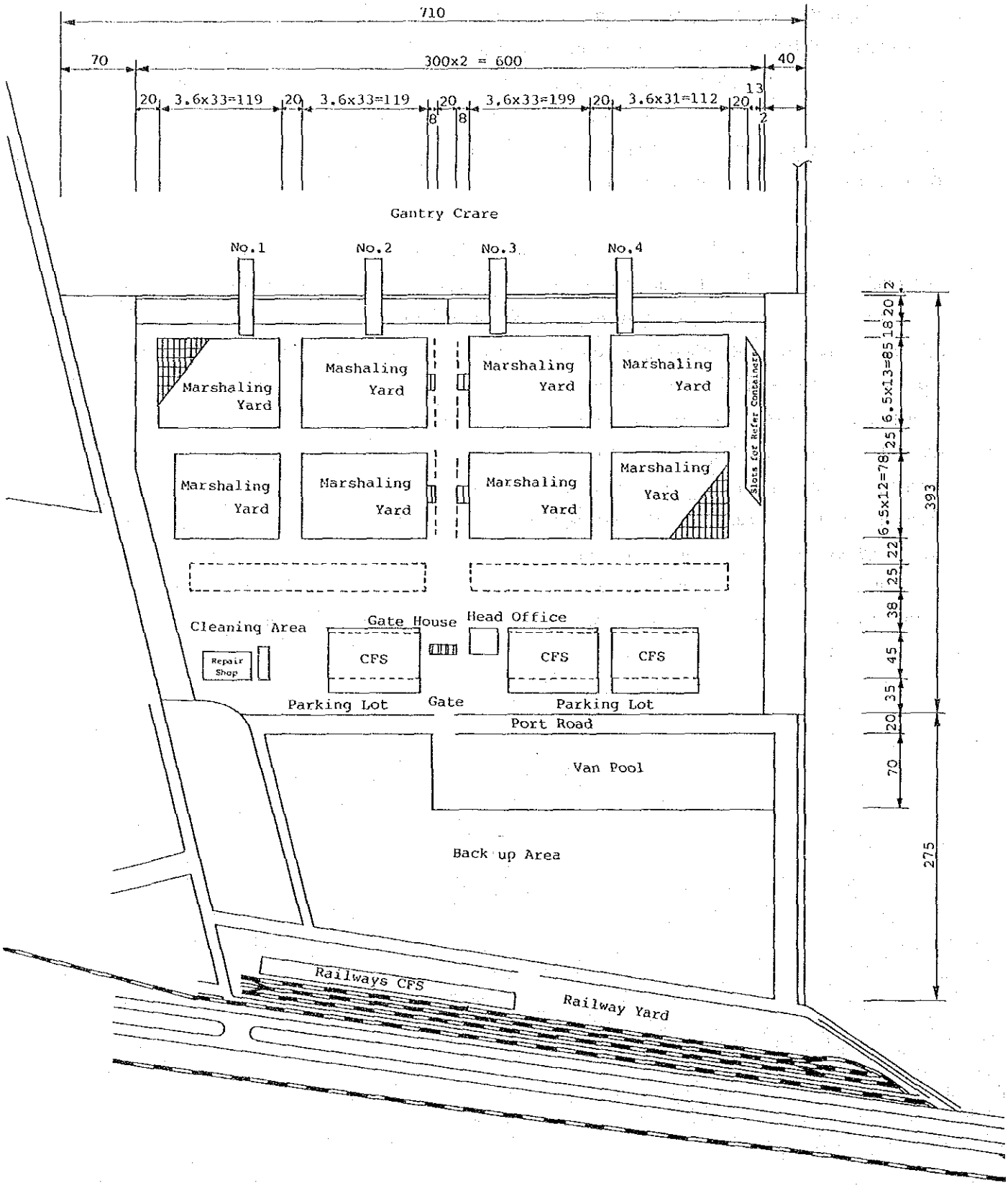


Fig. 1.10.5 Layout Plan of the Main Facilities in Case 2-1
(Straddle Carrier System)

(5) Examination of Cargo Handling System

- General Cargo Vessel

At present, the unloading and loading of cargoes from/to vessels are generally carried out using ship's crane/gear, rail-mount quay crane, mobile crane and/or floating Crane. However, according to the trend of international maritime transportation, it seems that the necessity of common quay cranes will rather decline.

The type and capacity of equipment and tools for handling on board vessels, such as forklift, sling, spreader, etc., should be properly chosen and separately used per kind, type and weight of cargoes. The handling and transfer of cargoes between apron and storage areas should be planned according to the kind of cargo and the location of the storage areas. It is necessary to examine the storage of cargoes in the transit sheds depending on the nature and kind of cargo, and also to designate the utilization of the transit sheds and the open yards per kind of cargo.

1) Cement in bulk

With respect to the forecast handling volume, the present handling system is considered to be suitable.

2) Foodstuffs or agricultural products excluding cereals

In order to ensure smooth operation at apron in future, it is necessary to examine the use of transit sheds for short periods.

3) Timber

In accordance with the nature and packing of the cargo, the handling of timber requires a wide apron and wide open yards for smooth handling and storage.

4) Steel products

In order to ensure quick handling and prevent damage at all stages of port traffic, it is necessary that the equipment and handling tools are properly chosen and used. Considering the distance between berth and storage area, the marshaling of cargoes from apron to open storage yard should be planned. Quay cranes specially designed for handling steel products should be arranged on a step-by-step basis along with increase of handling volume of cargo in the future.

5) Sugar

The present handling system of bulk sugar is considered to be proper. However, the handling system for sacked sugar needs some reformation throughout the port, eg. introduction of palletization and/or provision of temporary storage facilities within the port.

6) Animal feed in bulk

Cargo handling will be done using the existing gantry cranes and new sheds which are now being constructed just behind berth No.26.

- Ro-Ro Vessels

It is necessary to adopt the best method for loading and unloading, taking the kind of cargo, the location of the storage areas and stowage in vessel's holds into consideration.

- Cereals in Bulk

It is recommended for the handling system at the cereals terminal that the unloading is carried out by rail-mounted pneumatic unloaders and the cargoes are directly put in silos through conveyer systems.

- Tanker

Petroleum products, bitumen and vegetable oil and animal fat are handled in a similar ways to the current handling system.

- Car Ferry

The unloading from and/or loading to vessels is carried out by driving the vehicle through the vessel's ramp way.

- Container Vessel

The straddle carrier system or the transfer crane system are being considered for the container terminal that is planned for the target year 2010.

(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 to approach Terminal-2. Considering the principal dimensions of the vessels, an access channel of 260 m wide and 13-14 m deep and basins of 13 m deep are planned. The basins include a turning basin with a diameter of 520 meters.

(7) Breakwaters

It is necessary to prepare new breakwaters to protect container vessels to be maneuvered at the above basins or to moor at the berths of Terminal-2. For the purpose, the breakwaters comprising a main breakwater of 660 m long and sub-breakwater of 270 m long are planned to be newly constructed.

(8) Access Roads and Railways

The traffic volume of vehicles originating from or destined to the port in the year 2010 during peak time with a peaking factor of 2.2 is estimated to be 6,908 vehicles per day each way in total. The hourly traffic corresponding to that daily traffic is also estimated to be 1,036 vehicles each way. As hourly capacity of traffic volume per road lane is estimated as 600 vehicles, two lanes each way needs to be shared for the entire above traffic.

As for railway wagons, daily traffic is estimated to be 219 as a total. 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.

(9) Use Plan for Space East of Terminal-2

The existing port limits extend on the east coast beyond Brise-Lames Est. Water area in front of the coast is suitable for port development. In this study, a part of the space is proposed for the port development with the target year 2010. Beyond that year, the water area seems to be the only space left for

further port development, and therefore, it is essential to reserve the space for the development. The space is expected to be used for various purposes such as additional container terminals, bulk terminals with deep water depths and sites for port-related industries to be newly established or transferred from the existing port district as a result of redevelopment of the existing facilities.

(10) Environmental Consideration in the Port Activities

It is necessary to consider the possibility of pollution induced by the development of Terminal-2. Pollution is categorized into various items such as water and air pollution, soil contamination, noise and vibration.

According to the proposed development plan, capital dredging is necessary for the creation of the basins. At the time of construction, dredged materials will be dumped into an enclosed embankment which will be constructed at the site for the development. Then, the dumped materials will be covered with high quality land soil, thereby eliminating the risk of leakage of pollutant if any into the sea; though seabed materials to be dredged at the above site do not seem to be contaminated different from those inside of the existing basins which are partly contaminated. Other items of pollution such as air, water and noise can easily be prevented by proper countermeasures.

On the other hand, it is also necessary to consider environmental impacts induced by operations at the container terminal. However, container-handling is essentially pollution-free; unlike other operations in which severe countermeasures must be taken, there is no discharge of polluted water or air in container-handling. Some degree of noise may be generated from the operations. However, it seems to be negligible taking account of the land use around Terminal-2 where there is no residential areas to be affected.

As mentioned in Section 1.4, water and seabed soil within the existing basins of the port are presently polluted mainly due to sewage from the city and discharge from industries in and around the port. In order to improve the conditions, polluted water needs to be treated before being discharged into the basins regardless of the cost.

As mentioned in the same section, 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 only petroleum tankers. Therefore, it is advisable to provide full-scale facilities to receive the waste water from not only petroleum tankers but also other vessels as required. 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 its way to the reception facilities.

(11) Contents of the Master Plan

The contents of the Master Plan proposed by this study are summarized as follows:

- Terminal-2

  - Project site: East of the Brise-Lames Est

  - Dimensions: Terminal area: 25.1 hectares
    Berths: Total length: 600 meters(2 berths)
    Water depth: 13 meters
    Main breakwater: Length: 660 meters
    Sub-breakwater: Length: 270 meters
    Access channel: Breadth: 260 meters
    Basin: Area: 19.7 hectares
    Water depth: 13 meters

  - Cargo-handling facilities: 4 Units of gantry cranes of 40 ton capacity for containers
    15 Straddle carriers
    4 Toplifters of 5 ton capacity
    23 Forklifts of 3 ton capacity
    2 Tractors
    6 Trailers

  - Other main facilities: Container freight stations
    Terminal office
    Repair shop

Van pool
Railway yard
Access road: 1.8 km

- Required areas: Terminal area: 25.1 hectares
  Access road: 2.6 hectares
  Backup area: 7.7 hectares
  Others: 3.0 hectares
  Railway yard: 3.6 hectares

  Total: 42.0 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 warehouses behind Quay No.20 to prepare an open yard

- Cereal Terminal

  - Project site: Wharf of Skikda
  - Cargo-handling facilities: 4 Units of rail-mounted pneumatic unloaders: nominal capacity of 400 tons per hour each
  - Silos: Total capacity of 220,000 tons excluding the existing silo

  - 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

(12) Cost Estimation

The main conditions for the cost estimation are as follows;

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

(b) The inflation factor has been excluded from the estimation.

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

1 US$ = 21.90 DA = JY 131.25

A summary of the estimation results is presented in Table 1.10.2.

Table 1.10.2 Summary Construction Cost of the Port of Algiers

Unit; Million DA

Facilities		Case 1-1			Case 2-1			Case 3-1		
Item	Sub Item	Foreign Portion	Local Portion	Total Cost	Foreign Portion	Local Portion	Total Cost	Foreign Portion	Local Portion	Total Cost
1.Main structures	1)Main Breakwater	1,102.9	538.2	1,641.1	1,172.4	573.3	1,745.7	1,960.0	825.0	2,785.0
	2)Sub BreakWater	546.4	221.7	768.1	523.7	212.8	736.5	-	-	-
	3)Besin & Channel	14.2	78.0	92.2	22.1	121.3	143.4	-	-	-
	4)Reclamation of Land	277.1	89.4	366.5	240.1	77.3	317.4	822.9	289.2	1,112.1
	Sub Total	1,940.6	927.3	2,867.9	1,958.3	984.7	2,943.0	2,782.9	1,114.2	3,897.1
2.Container Terminal 2	1)Civil Works & Buildings	385.6	240.3	625.9	401.9	248.2	650.1	396.0	219.4	615.4
	2)Container Crane etc.	1,012.3	157.7	1,170.0	1,012.3	157.7	1,170.0	1,012.3	157.7	1,170.0
	Sub Total	1,397.9	398.0	1,795.9	1,414.2	405.9	1,820.1	1,408.3	377.1	1,785.4
3.Container Terminal 1	1)Civil works	10.2	6.9	17.1	10.2	6.9	17.1	10.2	6.9	17.1
	2)Container Crane	646.1	98.5	744.6	646.1	98.5	744.6	646.1	98.5	646.1
	Sub Total	656.3	105.4	761.7	656.3	105.4	761.7	656.3	105.4	761.7
4.Cereals Terminal	1)Silos & Buildings	1,685.0	752.3	2,437.3	1,685.0	752.3	2,437.3	1,685.0	752.3	2,437.3
	2)Civil Works	51.2	45.4	96.6	51.2	45.4	96.6	51.2	45.4	96.6
	3)Preumatic Unlooder	618.3	56.2	674.5	618.3	56.2	674.5	618.3	56.2	674.5
	Sub Total	2,354.5	853.9	3,208.4	2,354.5	853.9	3,208.4	2,354.5	853.9	3,208.4
5.Steel/Wood Terminal	1)Civil Works	0.3	0.1	0.4	0.3	0.1	0.4	0.3	0.1	0.4
	2)Handling Equipmens	516.1	80.4	596.5	516.1	80.4	596.5	516.1	80.4	596.5
	Sub Total	516.4	80.5	596.9	516.4	80.5	596.9	516.4	80.5	596.9
6.Miscellanies	1)Railway Siding	25.5	23.2	48.7	25.5	23.2	48.7	-	-	-
	2)Other Equipments	41.3	2.5	43.8	41.3	2.5	43.8	41.3	2.5	43.8
	Sub Total	66.8	25.7	92.5	66.8	25.7	92.5	41.3	2.5	43.8
7.Direct Cost		6,932.5	2,390.8	9,323.3	6,966.5	2,456.1	9,422.6	7,759.7	2,533.6	10,293.3
8.Indirect Cost	1)Physical Contingency	359.5	177.7	537.2	362.4	183.6	546.0	432.0	190.5	622.5
	2)Engineering Services	327.9	159.6	487.5	330.6	228.1	558.7	394.0	171.1	565.1
	Sub Total	687.4	337.7	1,024.7	693.0	411.7	1,104.7	826.0	361.6	1,187.6
9.Total Cost		7,619.9	2,728.1	10,348.0	7,659.5	2,867.8	10,527.3	8,585.7	2,895.2	11,480.9
10.Tax(VAT)		533.4	191.0	724.4	536.2	200.7	736.9	601.0	202.7	803.7
11.Project Cost		8,153.3	2,919.1	11,072.4	8,195.7	3,068.5	11,264.2	9,186.7	3,097.9	12,284.6

1.11 Master Plan for the Port of Oran

(1) Strategy of the Master Plan

The port planning strategy for accomplishing these goals is considered as follows:

1) Expansion of area for port development

Due to limited space is available within the existing port area of Oran, an expanded site and creation of new port space will be necessary for the increased port functions for the port of Oran. For this purpose, the water areas north-east of the port are being considered. On this side, there are steep sea and high cliff just behind. However, if the port is expanded to the north-east side, the integrated use of existing and new port facilities would be highly feasible. Therefore, future development space for port of Oran will be developed at the north-eastern sea area by the northern and eastern breakwaters.

2) Promoting the development of cereals wharf

At the port of Oran, the specialization of cargo handling by berth, streamlining of loading and unloading, and the quick dispatch of ships are generally practiced at present.

Increased cargo volume, as forecasted, will result in the construction of large ships and special carriers. At this port, this trend is expected to grow, particularly in regard to cereals from the economic point of view. Therefore, it will be necessary to develop cereal berths and cargo-handling equipment. Unloading capacity will thus be increased and the overall functions of the port will be improved.

3) Promoting the development of container terminal

Quay No.21 at the port of Oran will be improved in order to cope with the increasing container transportation traffic. However, these are merely temporary measures and there is still a limit to the handling of large container cargo volume at that berth.

If the development of container terminals at the port is allowed to lag behind container terminal construction in other countries, the port of Oran will fall from its central position as a foreign trade port.

Therefore, it is important to actively promote the container terminals at the port of Oran in order to facilitate the berthing of large container ships.

4) Reserving space for future development

The port plan must consider room for further development in the long term. As further expansion of port facilities may be necessary after the year 2010, space should be set aside for future development.

5) Optimization of investment size and time of investment

In port planning, consideration must be given not only to minimizing the total investment size, but also to the timing of each investment to maximize its effect at each stage.

(2) Present Capacity of the Port of Oran

The present capacity of Oran is estimated by analyzing the relationship between the volume of cargo handled at each berth, in term of general cargoes, cereals and petroleum products.

The annual general cargo handling capacity is estimated at 2,276 thousand tons. The volume of general cargo handled at the port of Oran in 1990 was 1,322 thousand tons. This shows that port of Oran is being operated below full capacity according to the berth data analysis.

The capacity of cargo storage facilities is estimated at 1.8 million tons. In view of the present handling volume of 834 thousand tons, the accommodating capacities of the transit sheds and open storage area seem to be sufficient.

From the time a ship arrives out side the port to its final berthing, a minimum of 0.5 hours is required. As shown in time from arrival of a general cargo ship to final berthing, 32% of all ships are forced to wait outside the port for more than 24 hours. They at least indicate that ship have to wait at port of Oran.

The volume of cereals that can be handled in a year is estimated at about 658 thousand tons. The volume of cereals handled at cereal berths in 1990 was

582 thousand tons. The mooring capacity of cereal berth has already reached its limit, however, the cargo handling equipment is not operating at full capacity.

The storage capacity of the silos at the port of Oran is 40,000 tons. The annual handling volume of cereals in 1990 was 1.186 million tons, and the volume handled at the silos was 823 thousand tons, remaining 363 thousand tons was directly dumped at the other berths and hauled out by truck. The storage capacity of silo is insufficient at present.

The volume of petroleum products that can be handled in a year is estimated at about 598 thousand tons. The volume of petroleum handled at Berth No.21 in 1990 was 504 thousand tons. The number of ships which can moor at the petroleum berth per year is estimated at about 111. The actual number of petroleum products carriers which moored at that berth in 1990 was 95. This indicates a berth occupancy ratio of 86%. The mooring capacity of the petroleum berth has already reached its limit.

(3) Master Plan and Evaluation

The alternative master plans are termed A and B as shown in Fig. 1.11.1.

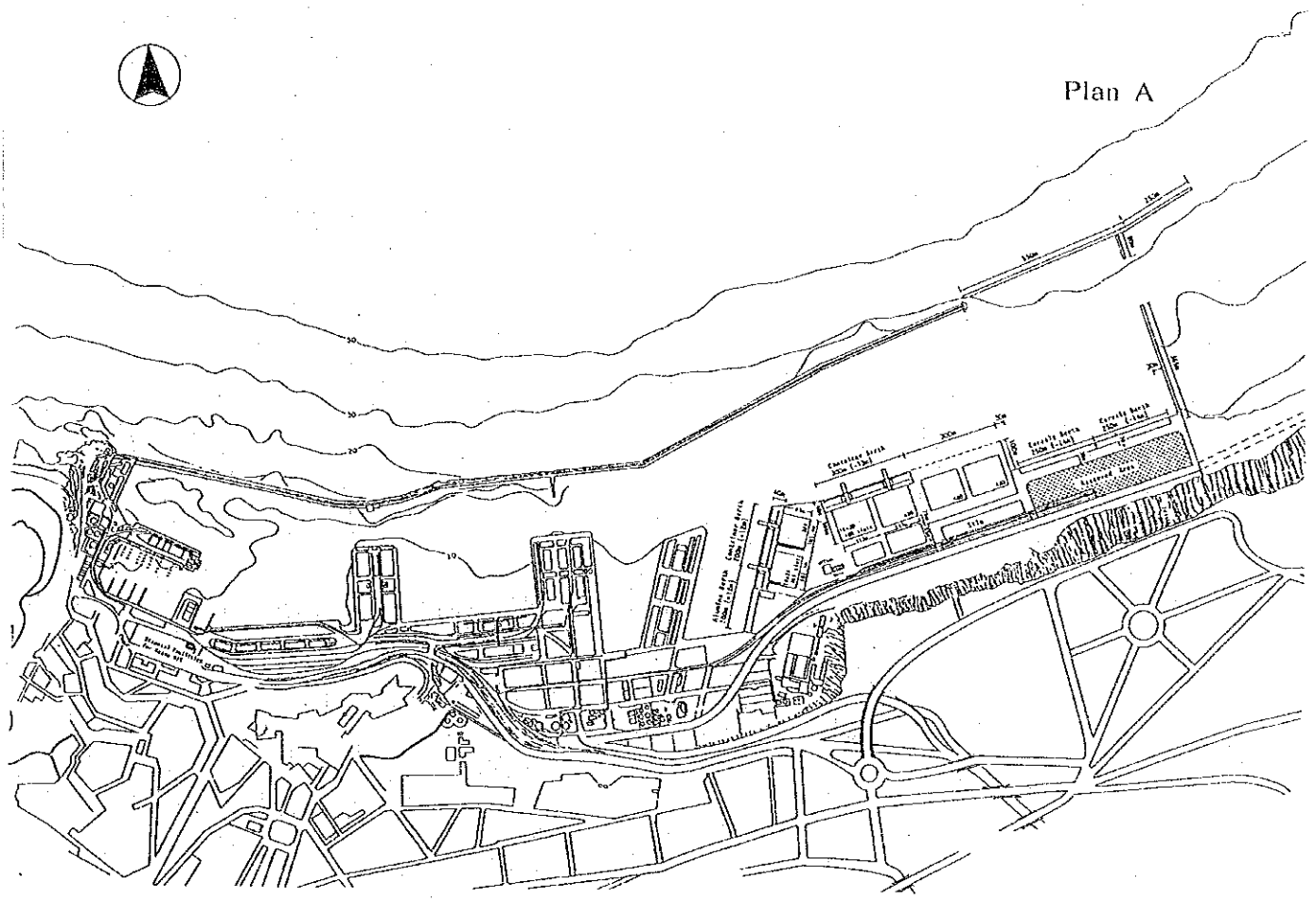
In order that the construction of cereals and container berths and the commencement of services begins as soon as possible, Plan A is arranged in a row to make for efficient use of facilities. The possibility of shaping the development area is studied in consideration that there might be further expansion of the port of Oran after the year 2010. Plan B is minimized the breakwater length, and it can be adapted to the Short Development Plan at a greatly reduced cost. However this plan is difficult to consider the further expansion of the port of Oran after the year 2010.

From the results of the evaluation (see Table 1.11.1), the construction cost of these plans do not differ much, however, Plan A will be able to flexibly cope with future cargo volumes. In consideration of these factors, Plan A is selected as the most appropriate master plan (see Fig. 1.11.2).

Table 1.11.1 Evaluation of Alternative Plan

Items of evaluation		Evaluation	
		Plan A	Plan B
Convenience	Maneuvability of ship	○	○
	Land use	◎	○
Safety	Calmness of waters within the port	◎	◎
	Emergency measures	○	○
Economy	Total construction cost	○	◎
	Investment by stage	○	◎
Flexibility	Changing conditions	◎	○
	Future development	◎	△
Environment preservation	Effects on social environment	○	○
	Effects on natural environment	○	○

Note: Ranking of evaluation ◎ Excellent
○ Ordinary
△ Some problems



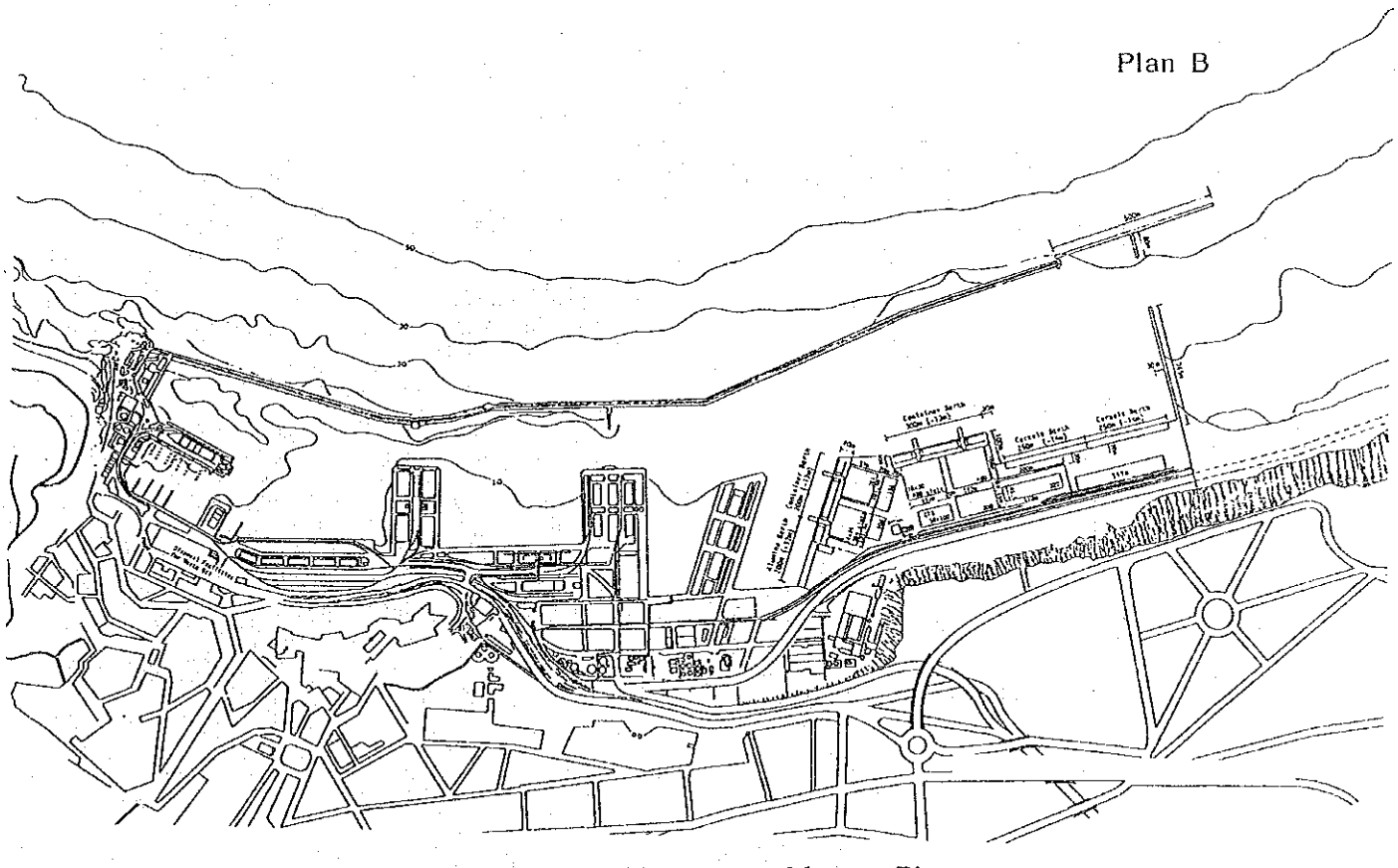


Fig. 1.11.1 Alternative Master Plan

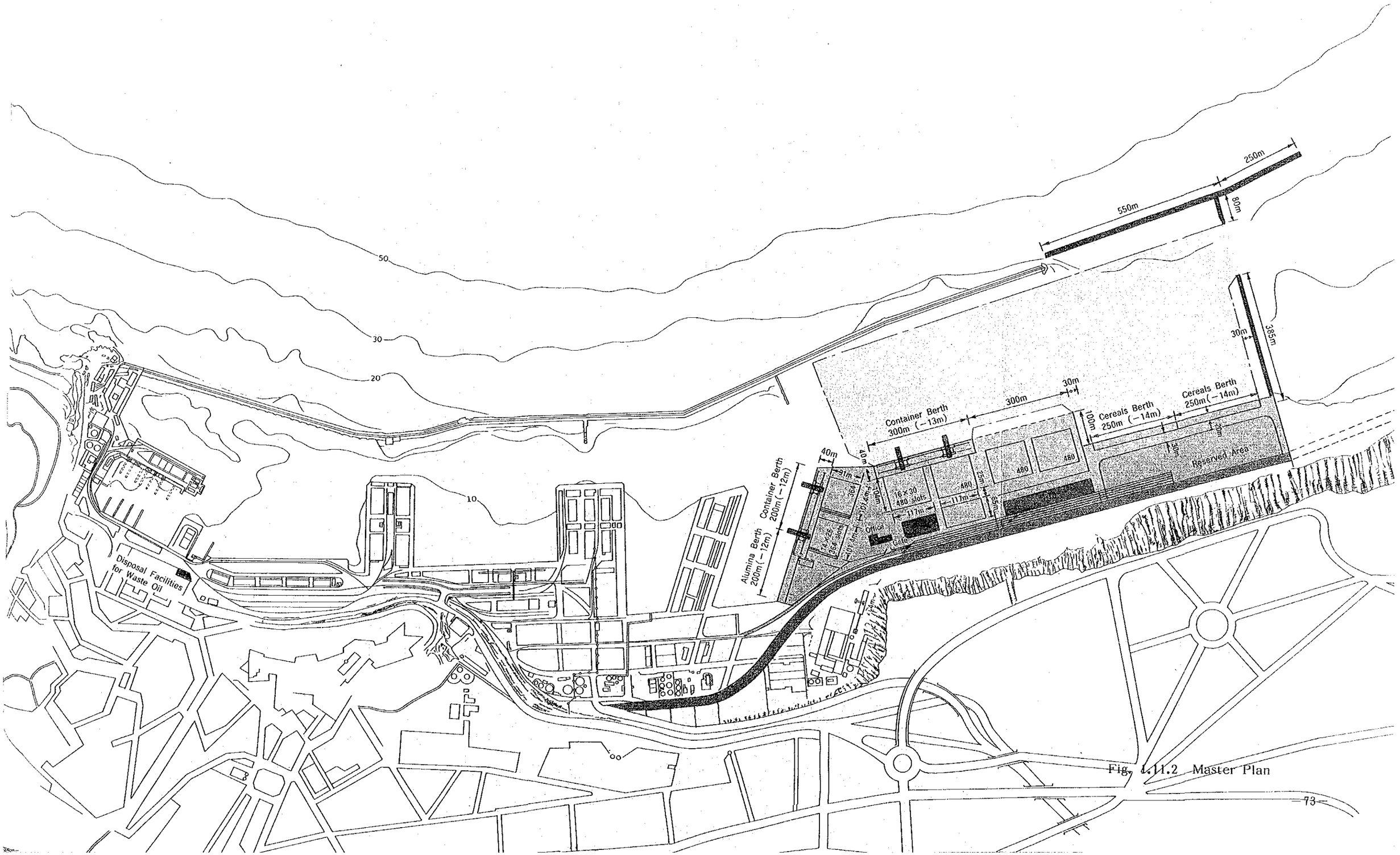


Fig. 4.11.2 Master Plan

(4) Required Scale Under the Master Plan

The port facilities necessary to handle cargoes in 2010 are summarized as follows:

1) Number of berths

The wharves necessary to handle cargoes in 2010 are shown in Table 1.11.2.

Table 1.11.2 Berths Proposed in the Master Plan

Type	Cargo Volume ('000 t)	Number of Berths	Water Depth (m)	Length (m)	Name of Berth	
					Quay	Berth No.
General Cargo Berths			9.15	130.0	No. 8	birth: 3
			9.15	130.0	No. 8	birth: 4
			9.15	130.0	No. 8	birth: 5
			8.20	120.0	No.11	birth: 9
			8.20	120.0	No.11	birth: 10
			7.50	110.0	No.13	birth: 14
			9.00	110.0	No.13	birth: 15
			10.00	200.0	No.14	birth: 16
			8.50	180.0	No.15	birth: 18
			8.00	120.0	No.16	birth: 19
			12.00	130.0	No.18	birth: 22
			10.50	120.0	No.19	birth: 24
			9.00	120.0	No.19	birth: 25
			8.50	100.0	No.20	birth: 26
Sub-total	1,009	14 (14)		1,820.0		
Cereals Berths			12.00	370.0	No.12	birth: 12
			14.00	250.0	New berth	
			14.00	250.0	New berth	
Sub-total	2,700	3 (1)		870.0		
Vegetable Oil Berth	150	1 (1)	8.50	100.0	No.20	birth: 27
Animalfeef Berth	246	1 (1)	12.00	200.0	No.15	birth: 17
Petroleum Berths			9.00	172.5	No.17	birth: 20
			10.50	172.5	No.17	birth: 21
Sub-total	1,320	2 (2)		345.0		
Cement Berth	433	1 (1)	10.50	110.0	No.19	birth: 23
Alumina Berth	600	1 (1)	12.00	200.0	No.21	birth: 28
Container Berths			12.00	200.0	No.21	birth: 29
			13.00	300.0	New berth	
Sub-total	1,104	2 (1)		500.0		
Car Ferry Berths			7.00	130.0	No. 9	birth: 6
			8.20	130.0	No. 9	birth: 7
			8.40	140.0	No.10	birth: 8
Sub-total		3 (3)		400.0		
Others			8.00	112.5	No. 2	birth: 1
			8.00	112.5	No. 2	birth: 2
Sub-total		2 (2)		225.0		
Grand Total	7,562	30 (27)		4,770		

Note: In "Number of berths" column, number of each parenthesis represents number of existing
: In numeral outside parentheses shows total number of berths

2) New Development Area

a) Main facilities

Total area: 40 hectares

Reserved area: 5.3 hectare

Turning basin: 5.3 hectares (-14 m)

Berths: total berths; 800 m (3 berths)
water depth; -13 m to -14 m

Main breakwater: 800 m

Sub-breakwater: 465 m

b) Other main facilities

Cereals silo: 105,000 ton capacity

Container freight station : 5,000 m2

Container terminal office: 900 m2

Railway yard: 3.2 hectares

Access road: 5.5 hectares

Cargo handling facilities : four (4) units of gantry cranes for containers (capacity of 400 tons each)
: four (4) units of rail-mounted pneumatic unloader for cereals (400tons/hour each)
: belt conveyors for cereals (800tons/hour)

3) Facilities for Reception of Ballast and Bilge from vessels

Location: behind Quay No.7

4) Construction Plan of the Master Plan

A construction plan with a target year of 2010 must naturally be executed in gradual stages.

Fig. 1.11.3 shows the time period required for each stage and the main work being undertaken.

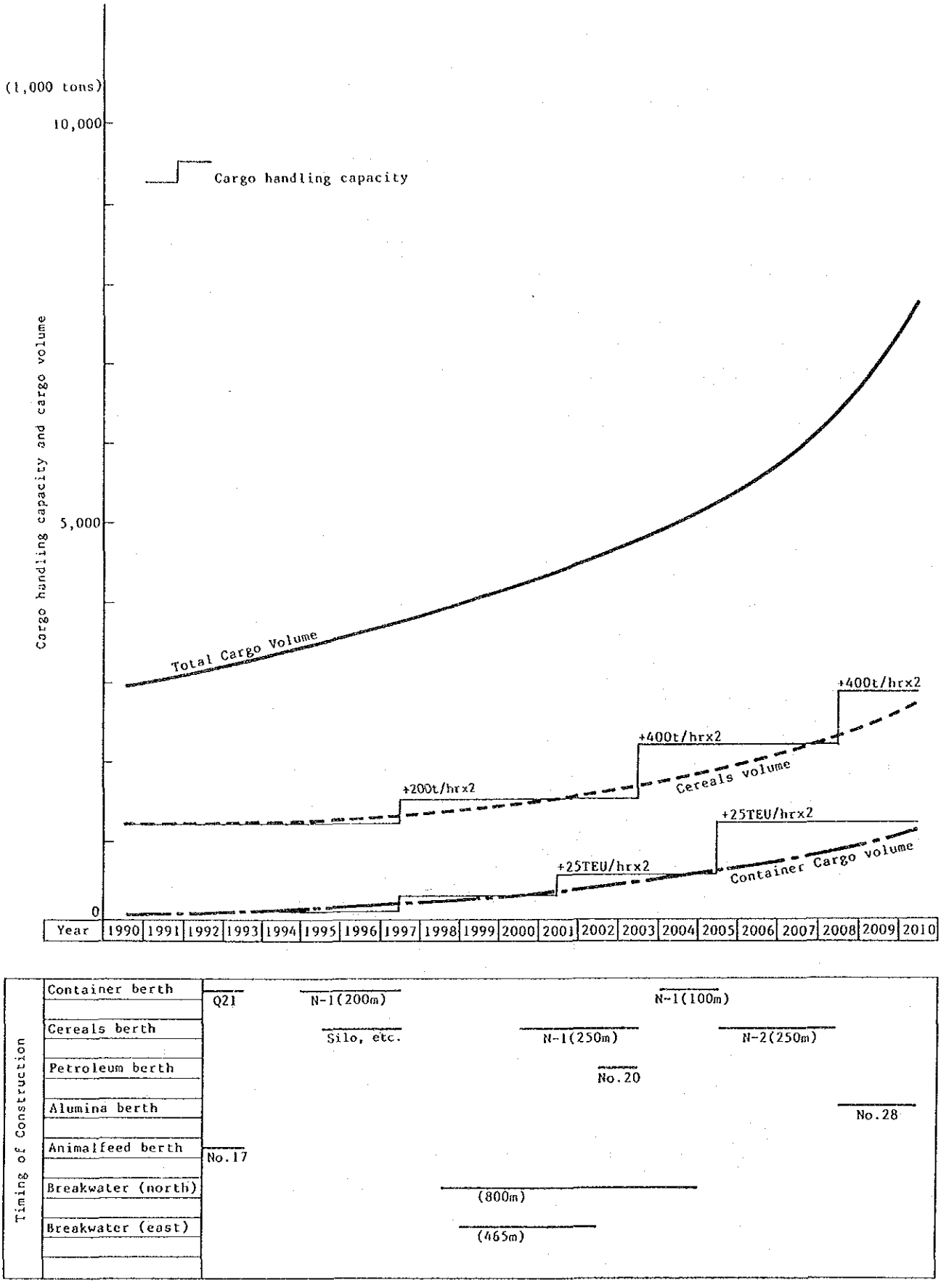


Fig. 1.11.3 Stage Plan for Construction of the Master Plan

(5) Examination of Cargo Handling System

- General Cargo Vessel

The cargo handling operation will be carried out with same idea as the port of Algiers.

- Ro-Ro Vessels

The basic idea of cargo handling within the port is the same as the port of Algiers.

- Bulk Carrier

1) Cereals in bulk

Basically, all of cargo is directly put into silos through conveyor systems and proposed handling equipment are as follows.

- New berths	Four rail-mounted pneumatic unloaders with an unloading capacity of 400 tons/hour
- Quay No.12	One existing screw type unloader and one new rail-mounted pneumatic unloader with a capacity of 400 tone/hour

2) Animal feed in bulk

Cargo handling will be done using quay cranes with lifting capacity some of 20 tons and the new sheds which are now being constructed.

3) Alumina in bulk

A pneumatic unloader and a sheltered conveyor system is recommended as handling system for alumina in bulk.

4) Cement in bulk

With respect to the forecast handling volume, this system is considered to be suitable.

- Tanker

1) Petroleum products

The petroleum products are handled by the present systems at the berths Nos.20 and 21 in quay No.17.

2) Vegetable oil

This cargo is also handled using the present pipe lines.

- Car Ferry

The unloading from and/or loading to vessels is carried out by driving the vehicle through the vessel's ramp way.

- Container Vessel

The straddle carrier system will be considered as the container handling system.

(6) Consideration of Environmental Aspects

The main components of environment to be affected by the port development are as follows: Air pollution is a factor which has a strong relationship with the usage of automobile. In the port area, exhaust fumes from ships and automobiles are the main sources of air pollution, however, the port area creates little air pollution compared with the other plants in the port.

The construction of the breakwater for protecting port facilities from waves will result in the closed water area in which it is not easy to exchange water with the outer sea. The water pollution during the capital dredging and reclamation works can be easily prevented by proper countermeasures commonly used.

At the container terminal, the operation of container handling cause some vibrations, however, it is only near the container terminal.

As for the measures in the future, in order to minimize the water pollution at the port, a standard for discharge water will have to be established

and a monitoring system arranged in advance.

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 at the behind area of Quay No.7.

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

(7) Cost Estimation

The main conditions for the cost estimation are as follows;

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

(b) The inflation factor has been excluded from the estimation.

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

1 US$ = 21.90 DA = JY 131.25

A summary of the estimation results is presented in Table 1.11.3.

Table 1.11.3 Summary Construction Cost of the Port of Oran

Unit: Million DA

Facilities		Alternative Plan A			Alternative Plan B		
Item	Sub Item	Foreign Portion	Local Portion	Total Cost	Foreign Portion	Local Portion	Total Cost
1.Main structures	1)Main BreakWater	2,407.5	900.8	3,308.3	1,591.3	595.6	2,186.9
	2)Sub BreakWater	654.7	236.9	891.6	736.9	264.6	1,001.5
	3)Besin & Channel	3.3	18.9	22.2	5.0	28.4	33.4
	4)Reclametion of Land	856.8	286.3	1,143.1	641.3	207.6	848.9
	Sub Total	3,922.3	1,442.9	5,365.2	2,974.5	1,096.2	4,070.7
2.Container Berth	1)Civil Works	152.7	90.2	242.9	150.6	88.6	239.2
	2)Container Crane etc	939.9	180.3	1,120.2	939.9	180.3	1,120.2
	Sub Total	1,092.6	270.5	1,363.1	1,090.5	268.9	1,359.4
3.Cereal Berth	1)Silos & Buildings	838.4	374.3	1,212.7	838.4	374.3	1,212.7
	2)Civil Works	169.8	108.3	278.1	194.9	123.2	318.1
	3)Pneumatic Unloader etc	916.1	79.9	996.0	916.1	79.9	996.0
	Sub Total	1,924.3	562.5	2,486.8	1,949.4	577.4	2,526.8
4.Almina Berth	1)Siros & Buildings	574.4	256.5	830.9	574.4	256.5	830.9
	2)Civil Works	6.5	5.3	11.8	6.5	5.3	11.8
	3)Unloader etc	372.3	65.7	438.0	372.3	65.7	438.0
	Sub Total	953.2	327.5	1,280.7	953.2	327.5	1,280.7
5.Animal foods Berth	1)Civil Works	6.5	5.3	11.8	6.5	5.3	11.8
	2)Backet Unloader etc	279.6	49.9	329.5	279.6	49.9	329.5
	Sub Total	286.1	55.2	341.3	286.1	55.2	341.3
6.Miscellanies	1)Other Civil Works	59.7	51.9	111.6	51.1	44.4	95.5
7.Direct Cost		8,238.2	2,710.5	10,948.7	7,304.8	2,369.6	9,674.4
8.Indirect Cost	1)Physical Contingency	502.5	208.0	710.5	420.7	177.6	598.3
	2)Engineering Services	458.4	186.8	645.2	383.8	159.5	543.3
	Sub Total	960.9	394.8	1,355.7	804.5	337.1	1,141.6
9.Total Cost		9,199.1	3,105.3	12,304.4	8,109.3	2,706.7	10,816.0
10.Tax(VAT)		643.9	217.4	861.3	567.7	189.5	757.2
11.Project Cost		9,843.0	3,322.7	13,165.7	8,677.0	2,896.2	11,573.2