Container Cargo Volume will be around 1.8 million ton with the ratio of container almost reaching its maximum level.

Volume of grain(soybean, soybean meal, sorghum and maize) through the Montevideo port will be more than 3,000,000 tons in 2010.

6-4-2 Premises of Calculation

The following premises are assumed for the rough estimation of handling capacity of general cargo berth in future taking account of the target value of improvement described in the report of the World Bank.

	Present	Future
Productivity(t/h)		
General Cargo	34.5	44.85
Dry Bulk	87.8	114.14

According to the report of UNCTAD, it is recommended that berth occupancies for conventional general cargo operations should be set so as not to exceed 70 % in the case that the number of berth is 6 to 10.

These figures are used in this examination. Namely, capacity is assumed to be reached at that period when berth occupancy reaches its maximum level.

6-4-3 Rough Capacity Calculation

(1) General Cargo Berth

Based on workabke days and working hours per day, necessary days for berthing per vessel will be 2.396 days, including non-handling time of 0.2 days at berth. Accordingly, capacity of general cargo berth, which is assumed to be composed of 9 berths excluding No.6, No.7 berth, is calculated at 772,000 tons.

(2) Dry Bulk Cargo Berth

The same as in general cargo, necessary days for berthing per vessel will be 6.176 days. Accordingly, capacity of dry bulk cargo berth(No.6, No.7 berth) is calculated at 395,000 tons.

(3) Allocation of Cargo to be Handled in 2010

Cargo volume to be handled in 2010 is 712,000 tons of general cargo and 433,000 tons of solid bulk cargo. Accordingly, there are some extra capacity for handling general cargo. Solid bulk cargo can be handled, using general cargo berths or the top of wharf B.

6-5 Brief Comment on Other Facilities Proposed by Master Plan

6-5-1 Petroleum Product Berth

The construction of the berth does not have a high priority and high urgency, though it is necessary. In the case of construction, it is necessary to put this berth close to the breakwater as much as possible so as not to hinder other vessel's passage in front of it.

6-5-2 Naval Base

The foreport zone, which is a candidate for removal of the navy base, is designated as future development zone. Accordingly, it is considered that this area is not good for the construction of the naval base. However, it is a fact that there are not any other areas suitable for the naval base that do not involve substantial construction costs.

Therefore, this area would be selected for the site of the naval base.

6-5-3 Ship Repairing Area

From the present condition of private sector that the business is in fine condition and the working rate is high, it is expected that ship repairing business will expand in future. However, more examination is necessary to confirm the demand for ship repairing facilities proposed by the Master Plan.

It is considered appropriate that the north-east side of the port be developed for such kinds of activity. For the development of this area, it is necessary to have sufficiently large basin area for working and water pollution countermeasures such as installation of water way.

II SHORT TERM DEVELOPMENT PLAN OF MAIN PORT FACILITIES

1 DEMAND FORECAST

1-1 Forecast of Socioeconomic Activities

1-1-1 Gross Domestic Product

GDP in target year (1998 and 2010) is calculated as shown in Table 1-1-1-1.

Table 1-1-1-1 GDP Projection

Unit:Million N$

Class of Economic Activity	1990	1998	2010
Agricultural & Stock	23,674	24,879	26,558
Fishery	257	276	306
Quarry & Mining	358	370	384
Manufacture	54,750	66,621	88,609
Electrical, Gas & Water	7,426	9,757	14,561
Construction	6,165	8,401	13,241
Comerce	23,961	27,378	33,133
Transport & Comunication	14,354	20,086	32,948
Others	78,802	97,789	133,955
Total	209,747	255,556	343,695

1-1-2 Population

Table 1-1-1-2 shows population projection.

Table 1-1-1-2 Population Projection

Year	1985	1998	2010
Population	2,955,200	3,181,835	3,391,638

1-2 Export

1-2-1 General

The study team forecast export cargo volume by commodity based on classification of N.A.D.E.. Study team divided cargo into seven classes, namely meat and related products, fish, agricultural products, wool, chemical products, wood and "others".

1-2-2 Forecast of each group

(1) Meat and Related Products

The share of beef in total "meat and related products" was 50 %. And other commodities included in "meat and related products" are also related to beef. Therefore, forecast of "meat and related products" is carried out based on the production of beef.

The volume of "meat and related products" will be 168,000 tons in 1998.

(2) Fish

Almost all fish landed is processed and then most of the processed fish is exported in Uruguay. Uruguay has a common sea area for fishing with Argentine. Regulates the permissible limit of fish catch volume. The volume of fish catch already almost reaches this level now. Export volume of fish is 70,000 tons, the same as at present based on fishing technology, fish catch volume and existing export volume.

(3) Agricultural Products

"Agriculatural Products" is forecasted based on projection of main grain (consisting of wheat, barley, maize, rice etc.) production by M.G.A.P.

Export volume of "agricultural products" is 363,000 tons.

(4) Wool

Export volume of "wool" is forecasted based on statistics for 36 years and suggestion of M.G.A.P. Export volume of wool is estimated at 64,000 tons in 1998.

(5) Chemical Products

"Chemical products" is calculated by elastic value of "chemical products" to manufacture sector of GDP. Export volume of "chemical products" is estimated at 21,000 tons in 1998.

(6) Wood

"Wood" is calculated by elastic value of "wood" to agricultural sector of GDP. The export volume of "wood" in 1998 will be 75,000 tons.

(7) Others

"Others" is calculated by elastic value of "others" to total GDP. Export volume of "others" is estimated at 56,000 tons in 1998.

Export volume in 1998 is shown in Table 1-2-2-2.

Table 1-2-2-2 Export Volume in 1998

	1,000tons
Meat & Related products	168
Fish	70
Agricultural Products	363
Wool	64
Chemical Products	21
Wood	75
Others	56
Total	817

1-3 Import

1-3-1 General

The study team forecast import cargo volume by commodity based on classification of N.A.D.I.. Study team divided cargo into four classes, namely, manufacturing, petroleum oil, agricultural products and "others".

Petroleum oil is handled at A.N.C.A.P berth. So, petroleum oil is not forecast this time.

1-3-2 Forecast of each group

(1) Manufacturing

"Manufacturing" is calculated by elastic value of "manufacturing" to the manufacture sector in GDP. Export volume of "manufacturing" is expected to be 412,000 tons in 1998.

(2) Agricultural Products

Import volume of "agricultural products" in 1998 is expected to be 91,000 tons, based on statistics of import.

(3) Others

Import volume of "others" in 1998 is calculated by elastic value of "others" growth rate to manufacture sector of GDP. Import volume of "others" will be 62,000 tons in 1998.

Import volume in 1998 is shown in Table 1-3-2-1.

Table 1-3-2-1 Import volume in 1998

	1,000tons
Manufacturing	412
Agricultural Products	91
Others	62
Total	565

1-4 Transit cargo

1-4-1 General

Transit cargo consists of international transit cargo and domestic transit cargo. Each transit cargo could be divided into container cargo and general (conventional) cargo.

1-4-2 International Transit Cargo

Projection of international transit cargo is calculated by growth rate of each country's GDP projection value (Argentina:2.3%, Paraguay:5.6%) in accordance with Hidrovia report.

1-4-3 Domestic Transit Cargo

Domestic transit cargo consists of container and general cargo. Almost all general transit cargo is petroleum oil that is handled at the wharf of A.N.C.A.P.. So, study team forecasts only container of domestic transit cargo. Transit cargo of container is calculated by elastic value of growth rate of container export volume to growth rate of GDP total.

1-5 Export/Import Volume by Packing Type

1-5-1 Export

Cargo can be divided in four types according to its packaging : solid bulk cargo, liquid bulk cargo, general cargo and container. We obtained container cargo volume in general cargo volume by ratio of containerization calculated based on logistic curve.

1-5-2 Import

Import cargoes are divided in the same manner as export cargoes.
Table 1-5-2-1 shows cargo handling volume by packing type in 1998.

Table 1-5-2-1 Cargo Handling Volume by Packing Type in 1998

1,000tons

	Solid Bulk	General	Container	Total
Export	210	294	313	817
Meat & Related products		69	99	168
Fish		29	41	70
Agricultural Products	189	72	102	363
Wool		26	38	64
Chemical Products	21			21
Wood		75		75
Others		23	33	56
Import	292	111	162	565
Manufacture	280	54	78	412
Agricultural Products	12	32	47	91
Others		25	37	62
Transit	0	206	456	662
International		206	422	628
Domestic			34	34
Total	502	611	931	2,044

1-6 Projection of Grain Cargo Volume to be Transhipped at Montevideo

1-6-1 Bolivia

Projection volume of grain cargo in Bolivia transported on the river are very small. Therefore, Bolivia grain is not considered this time.

1-6-2 Paraguay

It is normal to assume that the panamax size vessel which is half loaded by Paraguayan grain at Nueva Palmira would be topped off at the port of Paranagua. Therefore, Montevideo port will not use.

1-6-3 Argentina

It is assumed by the study team that cargo handling volume of grain at river port is exported as follows;

(1) Grain loaded on handy size ship (under 55,000 GRT) is exported to foreign country directly.

(2) All grain cargoes except for wheat exported from Bahia Blanca are used for topping off for panamax size ship which is half loaded at river port.

(3) Alpha zone is used for topping off for panamax size ship until handling capacity of alpha zone.

(4) The remainder of exported grain from river port is exported through Montevideo port.

Figure 1-6-3-1 shows flow of Argentine grain cargo.

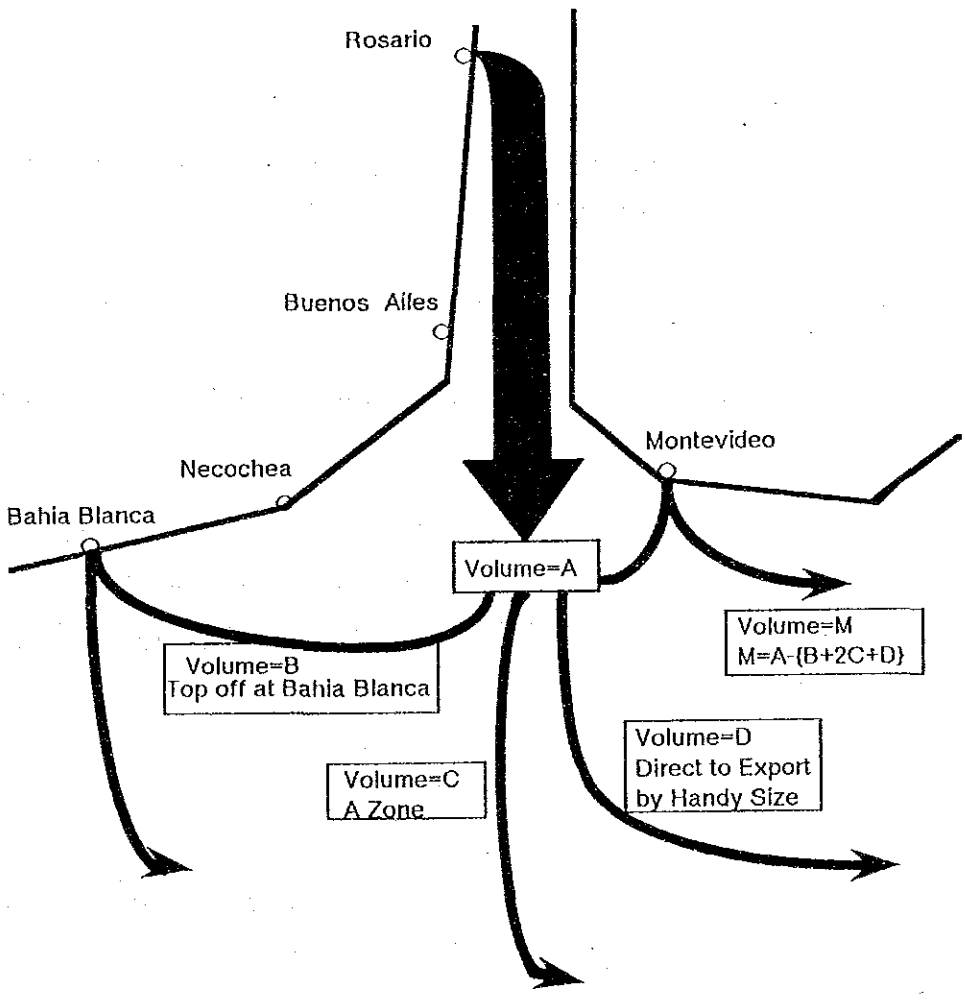


Figure 1-6-3-1 Flow of Argentine Grain Cargo

Export volume of grain from Argentine port is estimated for two cases:

a) the minimum export volume is based on present trend.
b) the maximum is based on growth rate (3.8%) of grain production by FAO.

(1) Wheat

It is assumed that growth rate is 0.3 % for minimum, 3.8% for maximum.

(2) Soybean and Soybean Meal

It is assumed that growth rate is 2.2 % for minimum, 3.8 % for maximum.

(3) Sorghum

The minimum export volume of sorghum will maintain the status quo, and the maximum growth rate is 3.8 %.

(4) Maize

Minimum export volume of maize held the status quo, and growth rate of maximum is 3.8 %.

Table 1-6-3-1 shows export volume of grain from Argentina port and grain volume through the Montevideo port. For grain volume through Montevideo port, wheat is calculated separately from the other grains because wheat has a different growing season.

Table 1-6-3-1 Volume of Grain from Argentina

Grain in 1998 Export Volume of Grain by Port
Lower Limit 1,000tons

	Export Volume	From Upriver	Buenos Aires	Bahia Blanca	Necochea
Wheat	6,007	1,682		2,643	1,682
Soybean	3,368	3,233	135		
Sorghum	1,400	1,108		294	
Maize	3,700	1,813	777	333	777
Soybean Meal	6,814	6,541	273		
Total	21,289	14,376	1,184	3,270	2,459

Grain by Ship Type 1,000tons

	From Upriver	Panamax Size Ship	Handy Size Ship
Wheat	1,682	774	908
Soybean	3,233	1,487	1,746
Sorghum	1,108	509	597
Maize	1,813	834	979
Soybean Meal	6,541	3,009	3,532
Total	14,376	6,613	7,763

Grain Planting in Autumn Which are Exported by Panamax Size Ship
1,000tons

Upriver Port	Bahia Blanca	Alpha Zone	Montevideo Port
5,839	627	3,400	1,812

Grain in 1998 Export Volume of Grain by Port
Upper Limit 1,000tons

	Export Volume	From Upriver	Buenos Aires	Bahia Blanca	Necochea
Wheat	8,462	2,369		3,723	2,369
Soybean	3,825	3,672	153		
Sorghum	1,654	1,307		347	
Maize	4,286	2,100	900	386	900
Soybean Meal	7,832	7,519	313		
Total	26,059	16,967	1,366	4,456	3,269

Grain by Ship Type 1,000tons

	From Upriver	Panamax Size Ship	Handy Size Ship
Wheat	2,369	1,090	1,279
Soybean	3,672	1,689	1,983
Sorghum	1,307	601	706
Maize	2,100	966	1,134
Soybean Meal	7,519	3,459	4,060
Total	16,967	7,805	9,162

Grain Planting in Autumn Which are Exported by Panamax Size Ship
1,000tons

Upriver Port	Bahia Blanca	Alpha Zone	Montevideo Port
6,715	733	3,400	2,582

1-7 Fishing Vessels

1-7-1 Domestic Fishing Boats at Montevideo Port

It is considered that 60 fishing boats will be working in Montevideo based on economic condition and fishing technics.

1-7-2 Foreign Fishing Vessel

Taking recent trend of calling vessels and potential of fish resources into consideration, the same number of vessels (500) as in the recent four years is assumed in 1998.

2 CONSIDERATION OF NEW GRAIN TRANSPORTATION SYSTEM

2-1 Problem Points of Present Transportation System

The biggest problem in the present transportation system is how to carry agricultural products from Argentine ports. Up-River ports in Argentina including Rosario port, which handles about 60 percent of exported grain, are physically limited in that they are not able to load fully for panamax size vessel due to shallow draught of navigation route.

At present, the top-off operation system is exclusively used at Bahia Blanca port and Paranagua port of Brazil as seaport or Alpha Zone as specific area. It is considered that top-off operation at these seaports basically consists of grain cargoes which are produced in the neighbouring area. On the other hand, the same operation at Alpha Zone has handled grain which originated in the Up-river area at a great distance from the top-off area.

Top-off operation cost at Alpha Zone is a relatively disadvantageous for grain which is produced in Up-river area.

2-2 Present Operation at Alpha Zone

Table 2-2-1-1 and 2-2-1-2 show the operations at Alpha Zone in 1984. It handled 40 vessels and the breakdown was as follows:

Panamax size vessel or above	39
Handy size vessel (35,000 DWT)	1
Total	40

Table 2-2-1-1 Operation of Private Company at Alpha Zone ('84)

Quan. /Ship	(1) Loading Volume		(2) Total Vol. (tons)	(3) Capacity (DWT)	(4) Period (Days)				
					Operation		Navi. / Delay		
	Up-River (tons)	Alpha Z. (tons)			Up-Riv.	Alpha Zone	Reca. → Up-Riv	Up-Riv → Alpha	Total
40	1,030,139	1,041,266	2,071,405	2,427,296	254	205	356	607	1,422
Ave.	25,754	26,032	51,785	60,682	6	5	9	15	35

Table 2-2-1-2 Details of (4) in Table 2-2-1-1

Period (Day)	Operation/times		Navigation/times	
	Up-River	Alpha Z.	Recalada →Up-River	Up-River →Alpha
1	0	0	11	1
2	3	1	6	1
3	2	8	0	2
4	10	12	2	3
5	8	6	1	3
6	5	4	0	2
7	1	4	0	1
8	3	1	0	1
9	1	2	0	0
10 Over.	7	2	15	26
Uncer.	0	0	5	0
Total	254	205	356	607

2-3 Premise of New Transportation System

2-3-1 Grain Bulk Vessel

The type of grain bulk vessel currently used in the world is mainly panamax type, which is able to load about 55,000 tons, the maximum sized vessel able to navigate the Panama Canal.

Therefore, in future, grain bulk carriers at basin of the La Plata river will mostly be of the panamax size.

The transportation between up-river ports and Montevideo port is assumed to be conducted by the vessel of 15,000 DWT which can sail in the La Plata river with full load.

2-3-2 Function of Montevideo Port

Grain terminal function of Montevideo port should be adopted to accommodate panamax size vessel in ballast, rather than employing the topping-off system used at Alpha Zone.

It is very difficult for a grain carrier, the operation schedule of which is affected by weather, and top-off vessel to be handled jointly without delay period at Alpha Zone. Therefore, a storage facility such as a silo is required to alleviate the problem.

2-4 Comparison of Transportation Cost

2-4-1 Cost Factor

Cost factors are as follows;

(1) Ship Cost

(2) Port & Channel Charges

(3) Fuel Expenses

2-4-2 Comparison of Transportation Route

It is necessary to examine transportation cost of the Argentine route and the Uruguayan route which will be estimated by making use of cost factor of section 2-4-1.

(1) Argentine Route

Following three cases are assumed;

Case A-1 Panamax (52,000 tons)
Recalada - Up-River (Half Load) - Alpha Zone - Recalada
Case A-2 Panamax (52,000 tons)
Recalada - Up-River (Half Load) - Bahia Blanca (Full Load) - Recalada
Case A-3 Handy (35,000 tons)
Recalada - Up-River (Half Load) - Bahia Blanca (Full Load) - Recalada

(2) Urugayan Route

Following three cases are assumed;

Case U-1 Panamax (55,000 tons) Recalada - Montevideo (Full Load) - Recaida

Case U-2 Panamax (55,000 tons) Recalada - Up-River (Half Load) - Montevideo (Full Load) - Recalada

Case U-3 Panamax (55,000 tons) Recalada - Nueva Palmira (Half Load) - Montevideo (Full Load) - Recalada

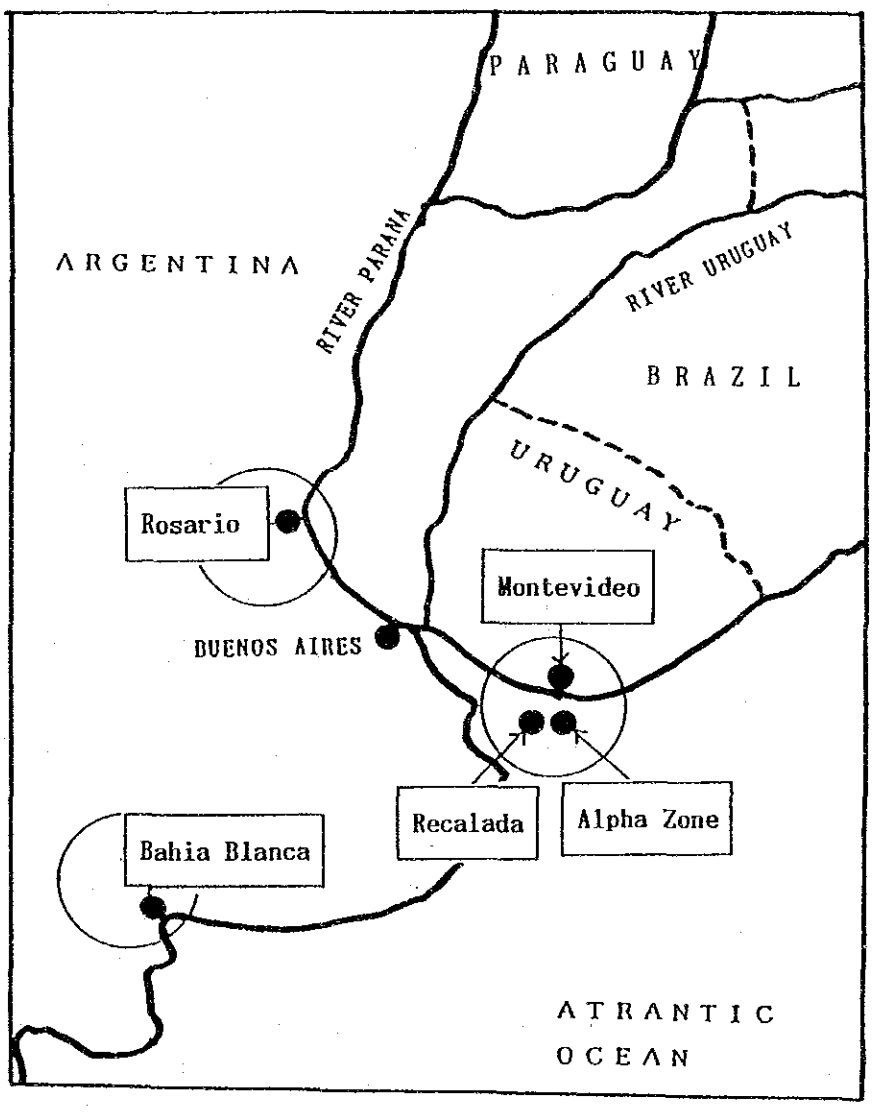


Figure 2-4-2-1 Ports Location in the Mouth of La Plata River

2-4-3 Comparison of Each Case

Table 2-4-3-1 compares the route of Argentina with that of Uruguay.

Table 2-4-3-1 Comparison of Argentine Route and Uruguayan Route

	Loading /Volume (DWT)	(1) Ship Cost /La Plata (US$/ton)	(2) Shuttle C. /La Plata (US$/ton)	Sub.Total (US$/ton)	(3) Trans.Cost / Antwerp (US$/ton)	(1)+(2)+(3) Total Cost (US$/ton)
Argentina						
Case A-1	52,000	9.05	5.00	14.05	5.80	19.85
Case A-2	52,000	6.24	No use	6.24	5.80	12.04
Case A-3	35,000	6.09	No use	6.09	7.04	13.13
Uruguay						
Case U-1	55,000	2.21	8.57	10.78	5.80	16.58
Case U-2	55,000	4.40	8.57	12.97	5.80	18.77
Case U-3	55,000	2.98	8.57	11.55	5.80	17.35

(1) Comparison between Argentina A-1 and Uruguay U-1

Comparing (1) of Case A-1 with Case U-1, ship cost of Case U-1 is lower by US 6.84 dollars per ton.

Shuttle cost (2) is calculated as the cost of top-off vessel in Case A-1 and that of shuttle vessel. Comparing (2) of Case A-1 with (2) of Case U-1, shuttle cost of Case U-1 is higher by 3.57 dollars per ton. This higher cost at Montevideo port is caused by the storage charge at the New Grain Terminal.

Regarding the transportation cost to Antwerp port (3), Montevideo port of Case U-1 is the same as Case A-1.

The difference in the total cost between A-1 and U-1 is US 3.27 dollars per ton, in favor of U-1.

(2) Comparison between panamax size vessel (55,000 DWT) of A-2 and handy size vessel (35,000 DWT) of A-3.

At basin of the La Plata river, ship cost of panamax size vessel is only US 0.15 dollars higher. But transportation cost by panamax size vessel from Montevideo port or Recalada to Antwerp port in Belgium is lower by US 1.24 dollars per ton than that of handy size vessel.

Total transportation cost (3) shows that panamax size vessel is lower by US 1.09 dollars.

(3) Comparison between Case U-3 and Case U-1.

In the case of U-3, a panamax size vessel is first loaded at Nueva Palmira port and then is fully loaded at Montevideo port. Transportation cost of Case U-1 is lower by US 0.77 dollars, compared with Case U-3.

2-4-4 Conclusion

According to this comparison of transportation cost, transportation cost of the new system is cheaper than that of topping-off system at Alpha Zone. Therefore, it is considered that there are great possibilities for this new system to be introduced to the Montevideo port.

3 MAIN FACILITIES PLAN

3-1 Grain Terminal

3-1-1 View Point of Planning of the Grain Terminal

The Port of Montevideo is located at the mouth of the La Plata River. Accordingly, all cargoes to be exported or to be imported from/to up-river ports pass the front of the Port. And yet, it is necessary for these cargoes to be transshipped because the depth of these ports is not enough for accommodating ocean-going vessels in many cases. It is easier to maintain a sufficient depth at the Port of Montevideo than at other ports in La Plata River Basin. Consequently, the Port of Montevideo has not only a locational advantage but also physical superiority in terms of depth.

Nowadays, many ports in the world play roles as transshipment bases in the world trade network. Among other things, container cargo is the most predominant one. The next will be bulk cargo.

3-1-2 Objective Vessel Size and Berth Dimension

(1) Objective Vessel Size

1) Main Vessel

Concerning grain carrier size for export from South American Countries, the category of 40,000 to 60,000 DWT accounts for the majority with 40% of the total. At the same time, the category of 60,000 to 80,000 DWT also represents a high share (38%).

According to dimension data of vessels which were topped off at the Alpha zone in 1984, the biggest vessel size was about 72,000 DWT, while the minimum vessel size was about 31,000 DWT. The category of 60,000 to 70,000 holds the majority share. The full load draft of many vessels is more than 12 m and the number of vessels whose draft is less than 12 m is only five.

From these surrounding conditions described above, the objective vessel size of main vessel is assumed as follows:

Objective Vessel Size: 65,000 DWT
Length = 230m, Full Load Draft = 13m
Ordinary Load Draft = 11.5m

2) Shuttle Vessel

Shuttle vessel size is determined from the physical limit of channel between the Montevideo port and the up-river ports. the depth of Mitre Channel is 9 m and a margin of 0.30 m has to be left below the keel for navigation.

From these conditions, following is adopted for the maximum size of the shuttle vessel:

Objective Vessel Size: 15,000 DWT
Length = 145m, Full Load Draft = 8.7m

(2) Berth Dimension

1) Main vessel

According to the Master Plan, 0.90 m is proposed as the clearance, including the tidal difference of 0.40 m.

Besides these technical matters, following conditions should be considered to determine the depth of berth:

(a) The depth of Alpha zone is about 12m.

(b) There are some ocean ports which are accommodating ocean-going grain vessels in the neighboring countries. Depth of berth in ports such as Paranagua and Bahia Branca is approximately 12 m.

(c) The depth of container terminal is planned at -11 m.

(d) The number of large vessels entering the port for grain handling is assumed to be less than 60. Therefore, it is possible to consider that vessels entering/departing the port will be carried out using tide. (The mean tidal level is about 0.9m above C.D.L in Montevideo)

On the other hand, berth length is determined by adding the breadth to the length of the objective vessel.

Accordingly, dimensions of berth, and that of basin are assumed as follows:

Depth of berth = -13m
Length of berth = 270m
Depth of basin = -12m

2) Shuttle Vessel

In accordance with the objective vessel size, dimensions of shuttle vessel berth are assumed as follows:

Depth of berth = -9.5m
Length of berth = 170m

3-1-3 *Required Number of Berth*

(a) From the view point of port interest, one high-capacity grain bulk cargo terminal is preferable to two or more terminals with moderate yearly capacity.
(b) Expansion in installing additional ship loader and higher-capacity conveyors and increasing the stockpile area at a later stage would prove more economical than the construction of a second terminal for grain.
(c) According to handling volume data of existing grain terminals in USA shown in Table 3-1-3-1, many terminals handle a fairy large amount of cargo volume using only one berth.

The grain cargo volume to be handled at the Port in 1998 will be around 2,000,000 tons. Accordingly, it is considered that one berth can handle this amount of cargo by handling equipment with sufficient capacity.

Table 3-1-3-1 Present Conditions of Grain Elevators in New Orleans, USA

Elevator	Storage Capacity (MT)	Loading Capacity	Number of Berth	Handling Volume ('000 ton)	Turnover Rate
Zennou Grain Elevator	105,000	3,000	1	11,300	108
Cargill Grain Elevator	187,000	1,750	1	1,560	8
Peavey Grain Elevator	50,000	1,500	1	3,300	66
Cargill Grain Elevator	141,000	2,000	2	10,140	72
Reserve Grain Elevator	107,000	1,750	1	3,830	36
ST Charles Grain Elevator	150,000	1,750	1	5,130	34
BUNGE Grain Elevator	175,000	2,500	1	3,110	18
ADM Growmark Grain Elevator	131,000	1,500	1	8,200	63
Continental Grain Elevator	106,000	3,000	2	9,700	92
Mississippi River Grain Elevator	150,000	2,000	1	2,190	15

3-1-4 Handling and Storage Facility

As already described in the former chapter, grain transported from up-river ports is transshipped, in principal, through unloader, silo and loader. Grain produced within Uruguay is brought into the port by truck and loaded to vessel after storing in silo.

(1) Handling Facility

1) Method of Calculation

Handling facilities to be planned are loader, unloader and relevant equipment.

a) 2,000,000 tons, is assumed as the target cargo volume.
b) Arrival distribution is assumed to be Poisson distribution.
c) Berthing time distribution is assumed to be Erlung distribution
d) Number of unit of handling equipment is, in principal, two.

Optimum handling capacity will be normally determined so as to make the total cost of transportation minimal.

2) Result of Calculation

Capacities are determined as follows considering Table 3-1-3-1.

Cargo Volume	Optimum Capacity	
	Unloader	Loader
2,000,000	700 x 2	900 x 2

(3) Storage Facilities

Based on the premise that turnover rate is 40 and utilization rate is 0.7, required storage capacity is calculated as follows:

Cargo Volume(ton)	Required Capacity(ton)
2,000,000	93,000

3-1-5 Channel and Basin

(1) Channel

One-way channel is planned as recommended in the Masterplan study. Channel width should be decided by the size of ship to be catered for and sea conditions. According to UNCTAD standard, the minimum value for the width of a one way channel is 5 times the beam width of the biggest vessel in the absence of a cross current. Based on this standard, the width of the channel is calculated at 160m (5 x 32.2m = 160 m).

In Montevideo Port, Mean Water Level is situated at 91 cm above the tidal datum and average tidal difference is 45 cm. Considering these conditions, 12m is determined as the depth of channel.

(2) Basin

Under the condition that turning of vessel is carried out with the assistance of tug boat, circle area with diameter of 2L (L = Length overall of the objective vessel) should be secured. The depth of basin in front of the grain berth for main vessel is planned at -13 m with a width of 50 m (1.5 B).

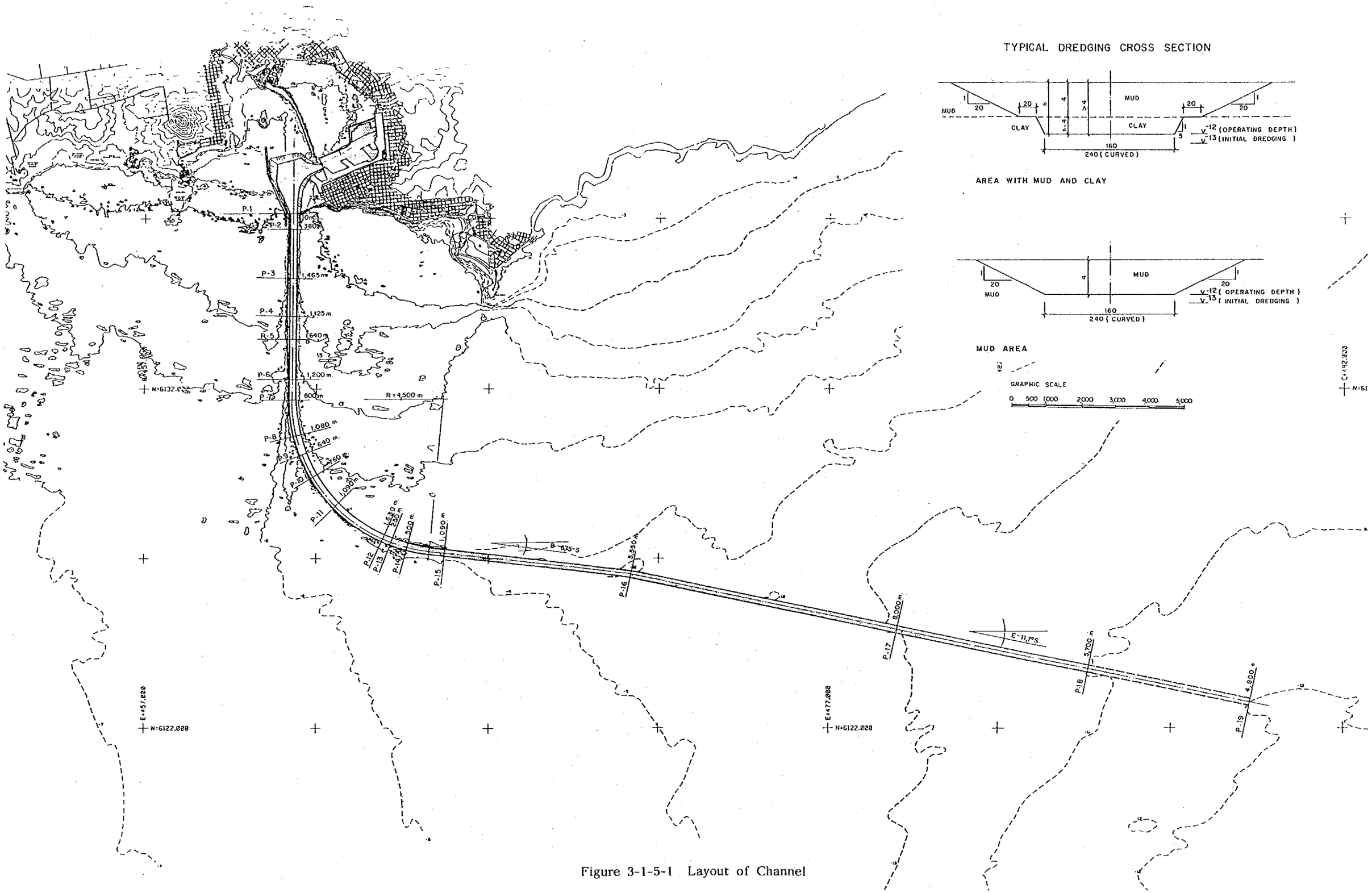


Figure 3-1-5-1 Layout of Channel

3-1-6 Selection of the site

(1) Candidate sites of grain terminal

There are four candidate sites for grain terminal as follows:

(a) Site 1--East side of Wharf A

(b) Site 2--East side of west breakwater

(c) Site 3--North side of Cintura breakwater

(d) Site 4--North side of Sarandi breakwater

(2) Rough Cost Estimation for Four Alternatives

Estimation Result for Four Alternatives are presented in Table 3-1-6-1 to 4.

Table 3-1-6-1 Construction and maintenance Dredging Cost of Site 1 to Site 4

Unit: in US$

Site	Description of Works	Total Aumunt (X 1,000)
1	Initial Construction Cost	7,044
	Maintenance Dredging Cost	437
2	Initial Construction Cost	47,103
	Maintenance Dredging Cost	372
3	Initial Construction Cost	47,804
	Maintenance Dredging Cost	643
4	Initial Construction Cost	21,224
	Maintenance Dredging Cost	399

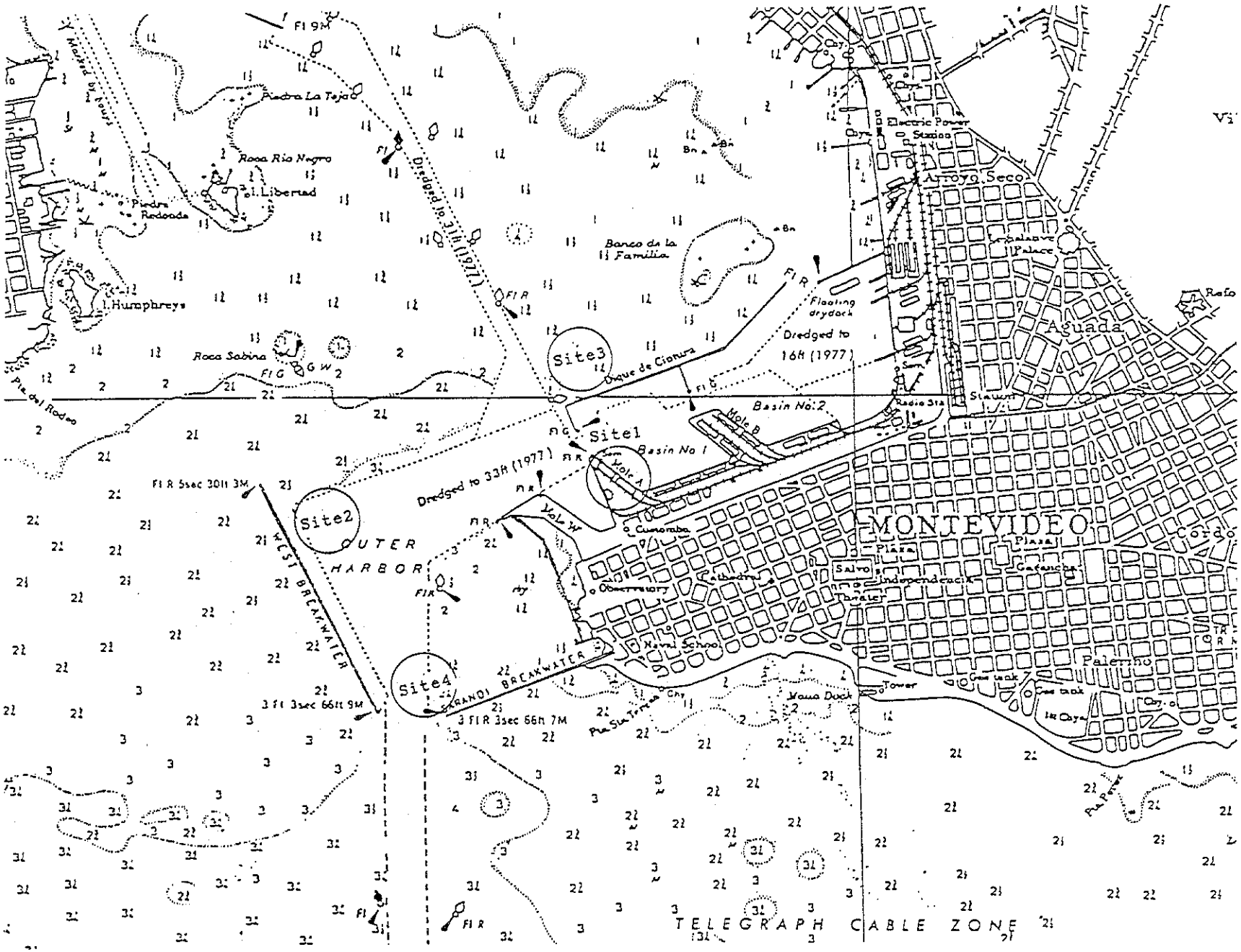


Figure 3-1-6-1 Candidate Sites of Grain Terminal

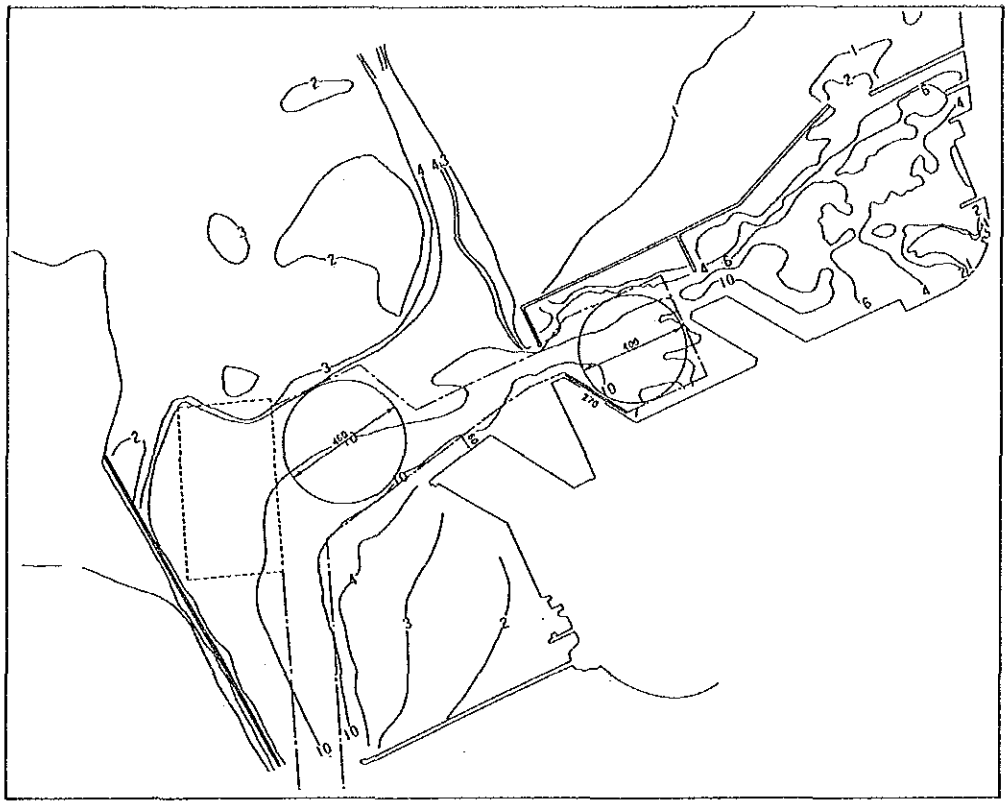


Figure 3-1-6-2 Layout Plan in Site 1

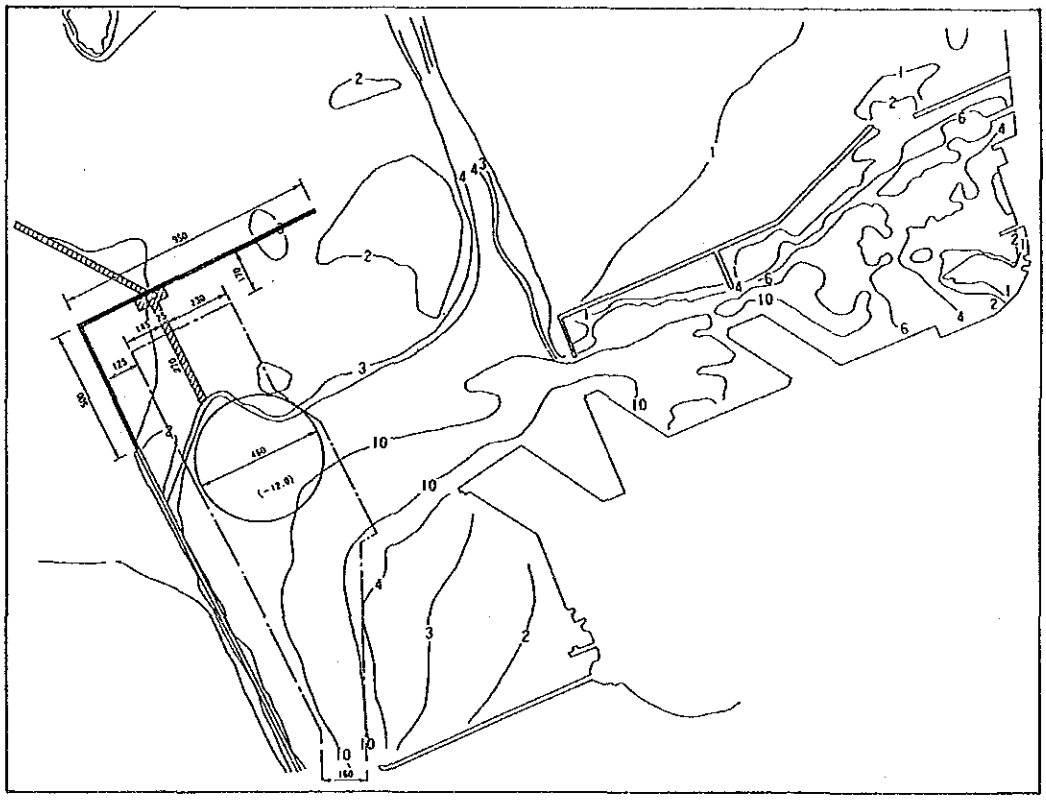


Figure 3-1-6-3 Layout Plan in Site 2

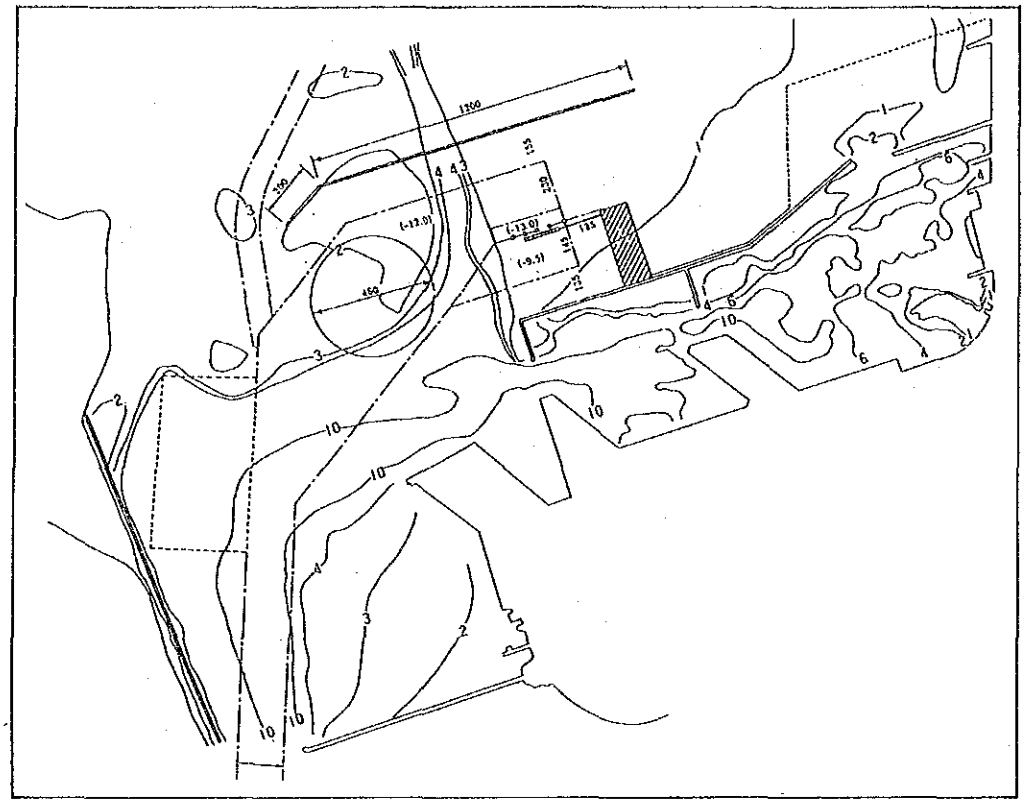


Figure 3-1-6-4 Layout Plan in Site 3

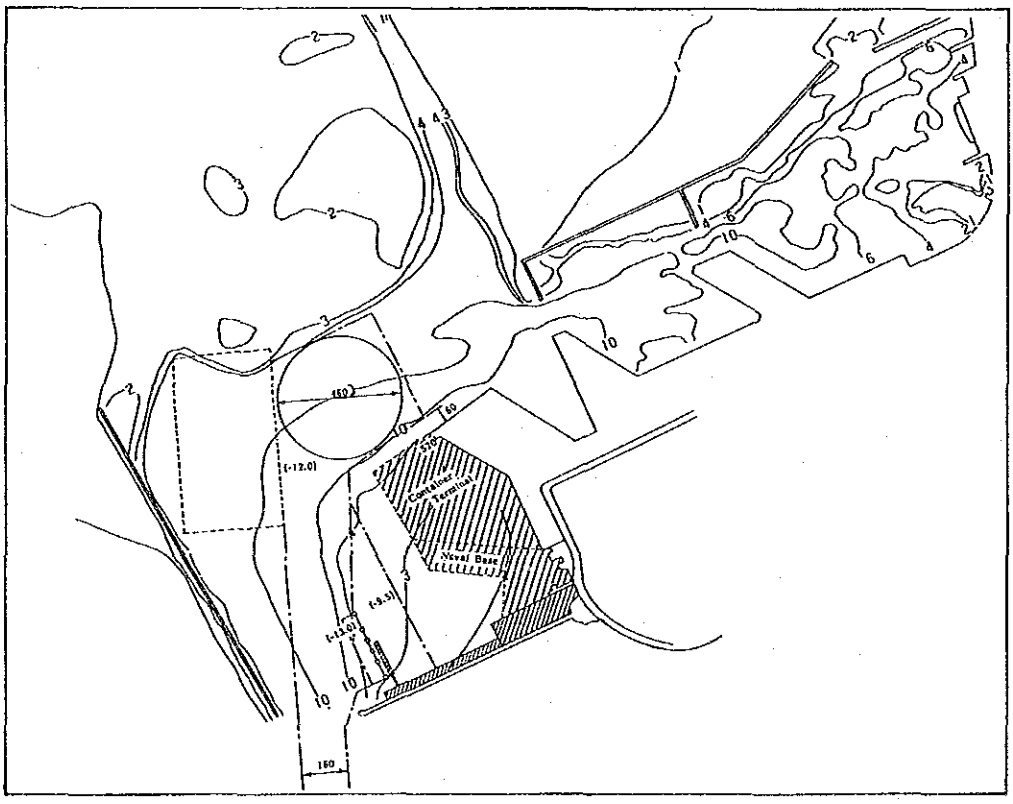


Figure 3-1-6-5 Layout Plan in Site 4

(3) Comparison of Four Alternatives

Table 3-1-6-2 Evaluation of Alternative Site

	Site 1	Site 2	Site 3	Site 4
Cost	○	×	×	○
Construction	○	×	×	○
Maintenance	△	○	○	△
Development potential	×	○	○	○
Basin	×	○	○	○
Calmness	○	○	○	○
Construction difficulty	○	○	○	○
Environmental aspect	×	○	○	○
Coordination with other plan	○	○	△	△

Note: ○ △ × show the grade of preference in this order.

1) Preliminary Selection

Following conditions are basic matters for selection of the site:

* Transshipment base should be constructed at the place directly connected to the land.

* Transshipment base should be constructed at as low a cost as possible for securing competitiveness.

From these, two candidate sites, Site 2 and 3, would be abandoned:

2) Qualitative Comparison of Two Alternatives (Site 1, Site 4)

The disadvantage of Site 1 that it has little space for future expansion is a fatal defect. Also, it is a major disadvantage that remodeling of Site 1 might cause shortage of handling capacity of general cargo.

From the view point of initial construction cost, Site 1 is the most preferable. However, maintenance cost of Site 1 is higher than Site 4. On the long term basis, it is not possible to ignore the maintenance cost difference.

3) Comprehensive Evaluation

Based on these comparisons, it is judged that site 4 is the most preferable. Layout of facilities are shown in Figure 3-1-5-6 to 3-1-5-7.

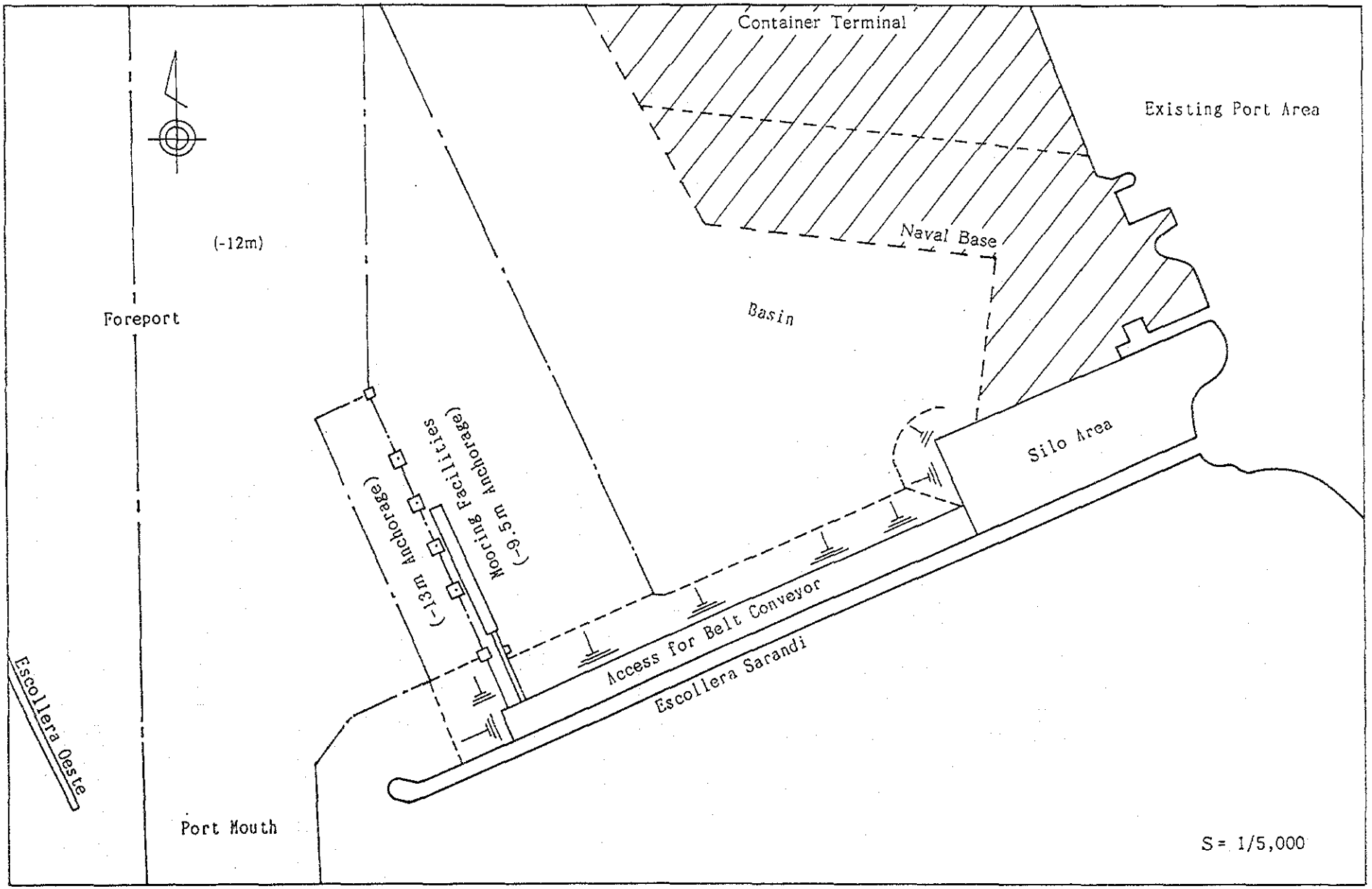
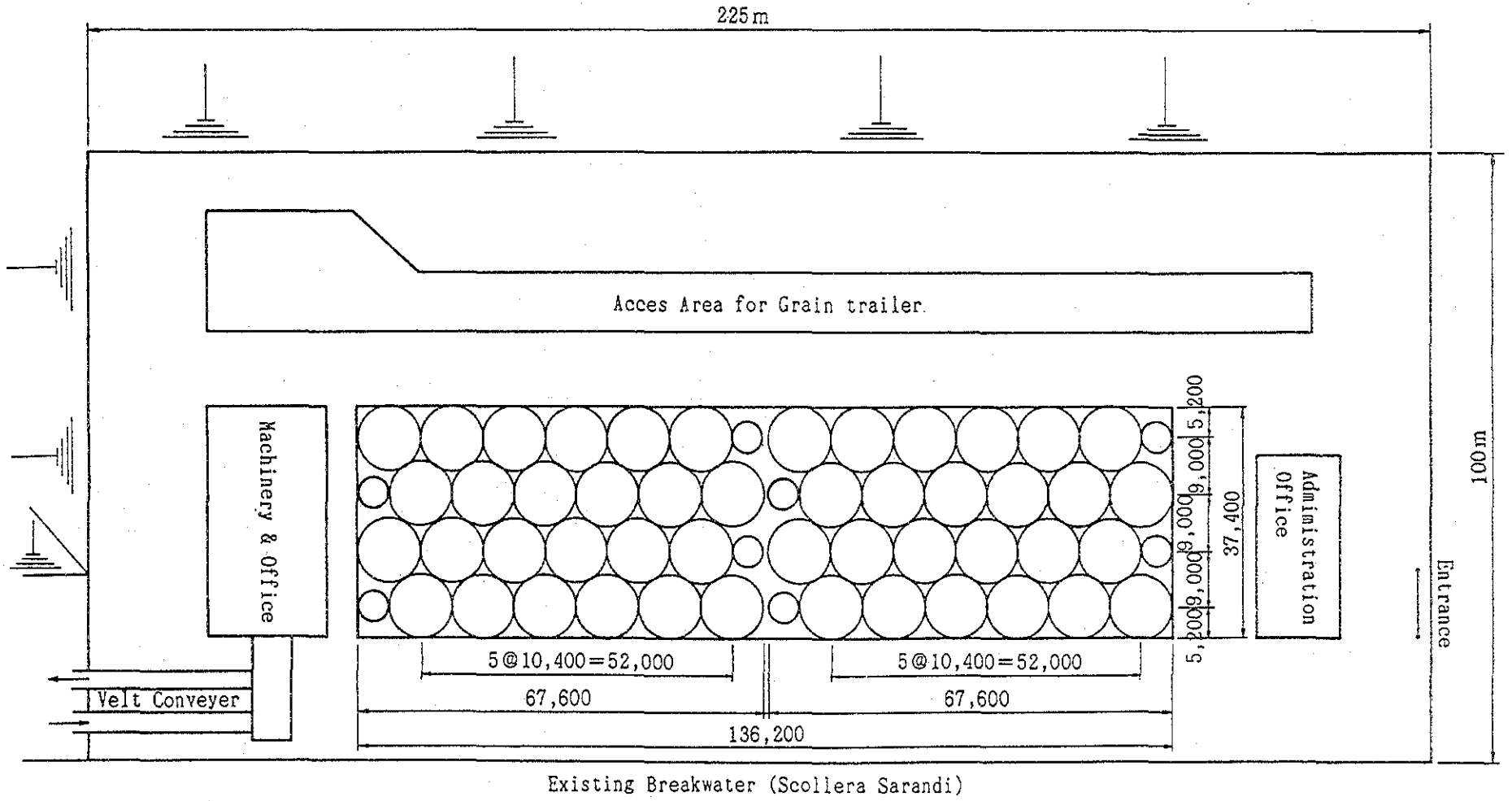


Figure 3-1-6-6 Layout of Grain Terminal



Scale: 1/1,000

Unit: mm

Figure 3-1-6-7 Layout of Grain Silo

3-1-7 Estimate of the Number of Workable Days of Ship Operation

The diffraction coefficient at the proposed constrution site is calculated using the data of waves observed off the Punta Brava. Using that diffraction coefficient, the rate of workable days of ship operation is approximately estimated as follow:

- 98.5 % for the loading side

- 94.7 % for the unloading side

Then the number of annual workable days is estimated as follows:

365 X 0.985 = 359 days for the loading side

365 X 0.947 = 345 days for the unloading side

3-2 Foreign Fishing Terminal

3-2-1 Fundamental Development Policy of Foreign Fishing Facility

(1) Necessity of Construction of Mooring Facilities for Foreign Fishing Vessels

It is understood that foreign fishing vessels are not treated well, at present. They have very low priority for berthing and many of them have to change berthing place several times per one entrance. If this situation continues, many will eventually choose another port.

At the same time, it is understood that mooring of other vessels such as container vessel and conventional vessel are obstructed somewhat by foreign fishing vessels mooring at the general berth.

In addition, many foreign vessels bring direct profit to Uruguay.

Based on the above, construction of mooring facility for foreign fishing vessels is an urgent matter.

(2) Fundamental Ideas of the Mooring Facilities

Fundamental idea in the construction of the mooring facilities are as follows:

a) From the view point of maintaining the tariff at a lower level in order not to discourage foreign fishing vessels' intention to use the port, construction cost for mooring facilities should be reduced as far as possible.

b) Therefore, it is appropriate to assume that the majority of transshipment activity, which is possible to be carried out without using mooring facilities, is carried out in water area, mainly foreport area.

c) On the other hand, mooring facilities for fishing preparation such as loading of food or water, and resting activity including crew exchange and repairing should be constructed.

d) Normal mooring method at this facility is stern mooring, i.e., perpendicular to the facility.

e) It is not usual for larger vessels (more than 1,000 GRT) to conduct stern mooring. These vessels are assumed to continue the same mooring as before.

f) Since there would be some occasions when alongside mooring is better for loading/unloading, a facility for that purpose is also planned.

3-2-2 Mooring Facility Plan

(1) Premises

For planning mooring facilities for foreign fishing vessels, following are main conditions:

a) The number of foreign fishing vessels entering the Port in 1998 is 500.

b) Monthly fluctuation of fishing vessels entering and vessel size distribution are based on the data of 1991.

c) The upper limit of vessel size for mooring facility to be planned is assumed at 1,000 GRT. (Foreign fishing vessels of less than or equal to 1,000 GRT are called "Objective vessels" and the number of it is 374.)

d) Based on the existing data in 1991 and the result of interviews with agents of fishing vessels in Montevideo, 20% of objective vessels entering the Port in June and July are assumed to stay until the beginning of the next fishing season (January).

e) Other objective vessels are assumed to stay following the staying pattern of January to March in 1991.

(2) Objective Vessel Size

The dimensions of the objective vessel are assumed by size as follows:

Table 3-2-2-1 Dimensions of of Objective Vessel and Berth

GRT (t)	Length (m)	Breadth (m)	Berth Length (m)	Berth Depth (m)	Basin Length (m)
100 ~ 300	40	8	10	5.0	85
301 ~ 400	50	8.5	11	5.5	105
401 ~ 500	55	9.5	12	6.0	120
501~1,000	70	10.5	13	7.0	150

Note:

1. Berth Length = Breadth + Allowance (3m or 0.15xBreadth)
2. Basin Length = 2.1 L

(3) Required Number of Berth

The pattern of behavior of foreign fishing vessels is divided into two types as follows:

* 1st category: Vessels in this category enter the Port in June or July, when the fishing season of squid ends, and stay until around the end of December when the next fishing season begins.
* 2nd category: Vessels in this category enter the Port at all times throughout the year and stay at the Port for short periods for transshipment of fish catching, preparation of next fishing activity, crew exchange and so on.

a) Estimation of Number of Berth for 1st Category Vessels

Based on ship size distribtuion and vessel arrival data, number of long staying vessel is calculated as 14 in June, and 14 in July, for a total of 28.

Since the staying period of these vessels is very long (from 5 to 6 months), it is necessary to prepare berths for all these vessels. Accordingly, necessary berth number is calculated as 28.

b) Estimation of Berth Number for 2nd Category Vessel

Estimation is carried out by applying queuing theory.

Arrival distribution: Poisson distribution

Staying period distribution: Erlung distribution(k=1)

Here, the ratio of ship cost to service cost is assumed to be 100:1 based on a very rough estimation.

Under these conditions described above, optimum number of berth is calculated as follows:

GRT	Number
101 ~ 300	2
301 ~ 400	5
401 ~ 500	3
501 ~ 1000	4
Total	14

c) Summary

Through the calculations described above, the following berths are planned:

Table 3-2-2-2

GRT	Long Staying Vessel Number	Short Staying Vessel Number	Total Number	Berth Length
101 ~ 300	2	2	4	40
301 ~ 400	12	5	17	187
401 ~ 500	6	3	9	108
501 ~ 1000	8	4	12	156
Total	28	14	42	491

d) Other Dimension of Berth

Width of berth is determined as 12m.

(4) Other Facilities

Water pipe and cable for lightning are installed.

(5) Construction Site

There is some space between Basin II and fishing port. Although this space is not quite sufficient, it is possible to secure additional space for accommodating foreign vessels.

(6) Layout Plan

Layout plan is shown in Figure 3-2-1. Considering turning area both of general cargo vessel in Basin II and of fishing vessel in domestic fishing port basin, the location of foreign fishing vessels' pier is determined.

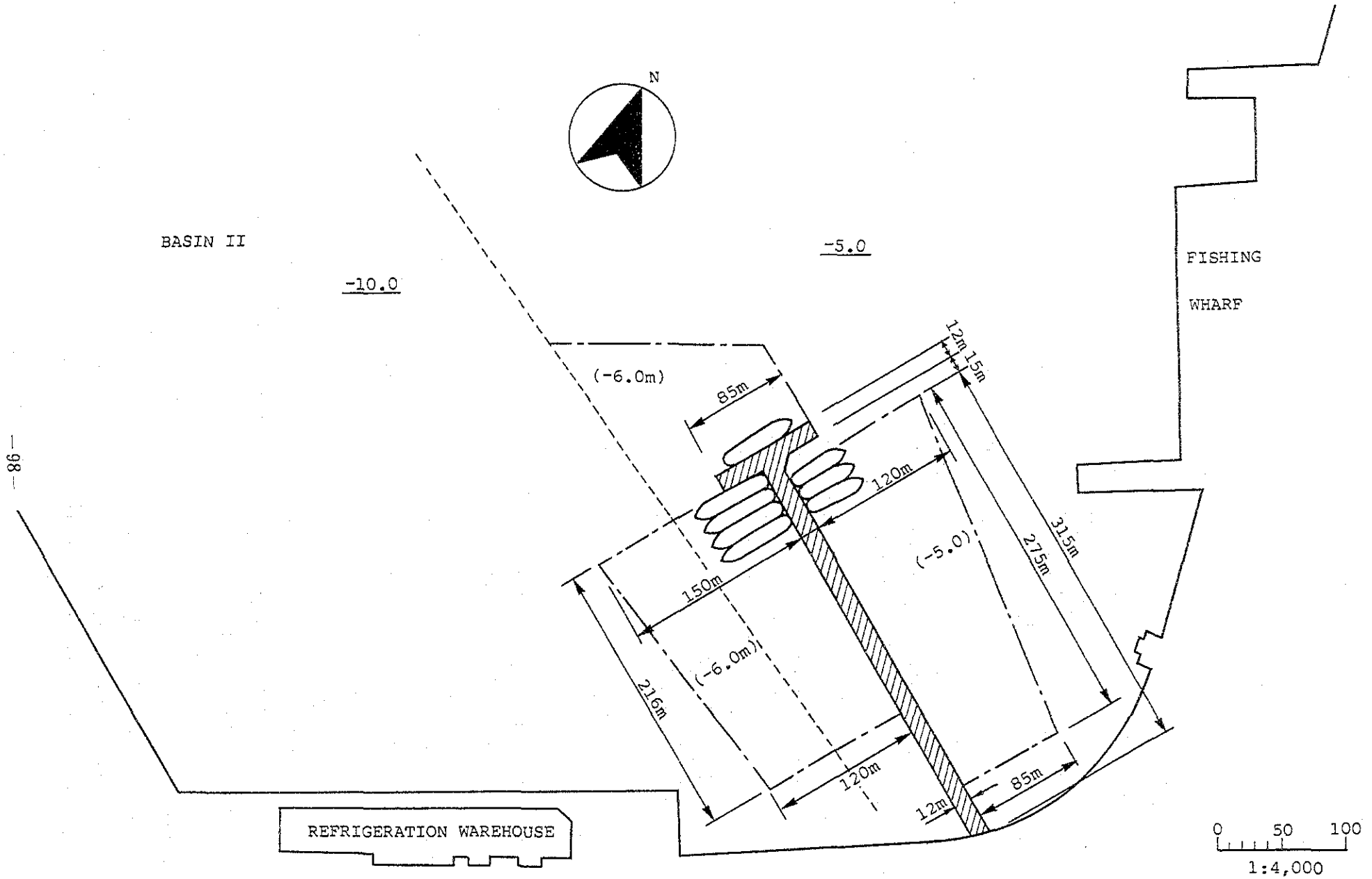


Figure 3-2-1 Foreign Fishing Terminal

3-3 Consideration of Environmental Aspect

3-3-1 Environmental Protection System in Uruguay

(1) Establishment of Ministry of Environmental Affairs

Ministry of environmental affairs (Direccion Nacional de Medio Ambital, DNMA) was established in 1991.

(2) Laws and Regulations Related to Environmental Affairs

There are no laws and regulations related to environmental affairs except water pollution at the national level.

3-3-2 General Description of Present Environmental Condition

(1) General

The survey by public sector on the condition of environmental factors such as water, air, vibration, noise, smell, animal and plant has not been carried out except for water. On the other hand, there are several data of environmental factors which have been gathered by some private sectors.

(2) Water Pollution

A survey on water quality in the bay area has been conducted only twice(1988, 1985) by the public sector since 1979 when the Decreto was made. According to the DNMA, the current condition of water pollution in the Montevideo Bay was not good. Drainage flows into the Bay without any treatment.

There are eleven mouths of drainage in the port area. Of them, polluted water flows into port area from 7 mouths.

The municipal government is now conducting a simulation study on the water pollution in the Bay. This simulation is done for formulating the master plan of water discharge system in the Bay. The study will be completed in the latter half of 1993.

3-3-3 Environmental Impact and Countermeasures against it

Generally speaking, a port facility itself does not greatly influence the

environment. In many cases, environmental impacts are caused by cultivation of industrial activities which are often vitalized by the port development project.

This project involves only the development of a grain terminal and fishing terminal. As facilities to be constructed are relatively small, onstruction of these facilities will not bring a big impact on the environmental conditions.

The following is brief comments regarding flying of small grain particles.

Generally speaking, it is very difficult to measure the volume of flying particles caused by the handling of grain at the port. At present, there is no proper method to estimate the impact of flying grain particles on the enviromental conditions.

Countermeasures against dust caused by handling of grain are assumed as follows:

* Flying of dust from conveyer is prevented by installation of cover at the conveyer section.
* The tip of ship loader should be kept as low as possible while loading, not to increase the distance between the tip of shiploader and the top of cargo heap using system of TELESCOPIC.
* The duct should be installed at the part of skirt of TELESCOPIC to collect dust.

4 PRELIMINARY DESIGN

4-1 Mooring Facilities of Grain Terminal

The mooring facilities of Grain Terminal is designed for the candidate site 4 selected in the preceding chapter.

4-1-1 Design Conditions

The structures are designed under the following conditions:

(1) Basic Conditions

1) Berth depth

Berth depth is -13 meters at the loading side and -9.5 meters at the unloading side.

2) Maximum design vessel

For the mooring facilities for loading: 65,000 DWT

(Length 230 m, Breadth 32.5 m , Ordinary draft 11.5 m, Full load draft 13 m)

For the mooring facilities for unloading: 15,000 DWT

(Length 145 m, Breadth 21 m and Full load draft 8.7 m)

3) Crest height

+ 4.0 meters for the mooring facilities for loading

+ 3.5 meters for the mooring facilities for unloading

4) Berth length

270 meters for the mooring facilities for loading

170 meters for the mooring facilities for unloading

5) Seismic forces: Nil

6) Surcharge

For a ship loader for each breasting dolphin: 200 tons

For an unloader for the unloading pier: 800 tons

7) Approaching velocity of vessels: 0.10 m/sec

(2) Natural Conditions

1) Tide levels: The same as that shown in section 2-3-1 of Part I

2) Soil conditions

The soil profile B3 shown in Figure 2-4-2 of Part I is applied to

the entire area. The hard rock layer underlying deeper than -17.7 meters shown in the figure is efficient as a bearing stratum.

4-1-2 Design

The plan view of mooring facilities is shown in Figure 4-1-2-1.

All structures are of reinforced concrete pile type, except the mooring dolphin for 65,000 DWT of vessels which is of reinforced concrete caisson type. The typical structures are shown in Figure 4-1-2-2 to 4-1-2-4.

4-2 Mooring Facilities at Fishery Terminal

4-2-1 Design Conditions

The structures are designed under the following conditions:

(1) Basic Conditions

1) Berth depth: - 6.0 meters
2) Maximum design vessel:
   1,000 GT (Length 70 m, Breadth 10.5 m and Draft in half-load 5.0 m)
3) Crest height: + 4.0 meters
4) Seismic forces: Nil
5) Surcharge: 1.0 ton/m^2
6) Approaching velocity of vessels: 0.15 m/sec

(2) Natural Conditions

1) Tide levels: The same as Grain Terminal of Section 4-1
2) Soil conditions

   The soil profile B1 shown in Figure 2-4-2 of Part I is applied to all the length of mooring pier. As shown in the figure, any rock layer is not found up to - 34.2 meters, but there is fine silty sand or fine clayey sand underlying deeper than - 11 meters, which is of 10 to 38 in N-value and is efficient as a bearing or a friction stratum.

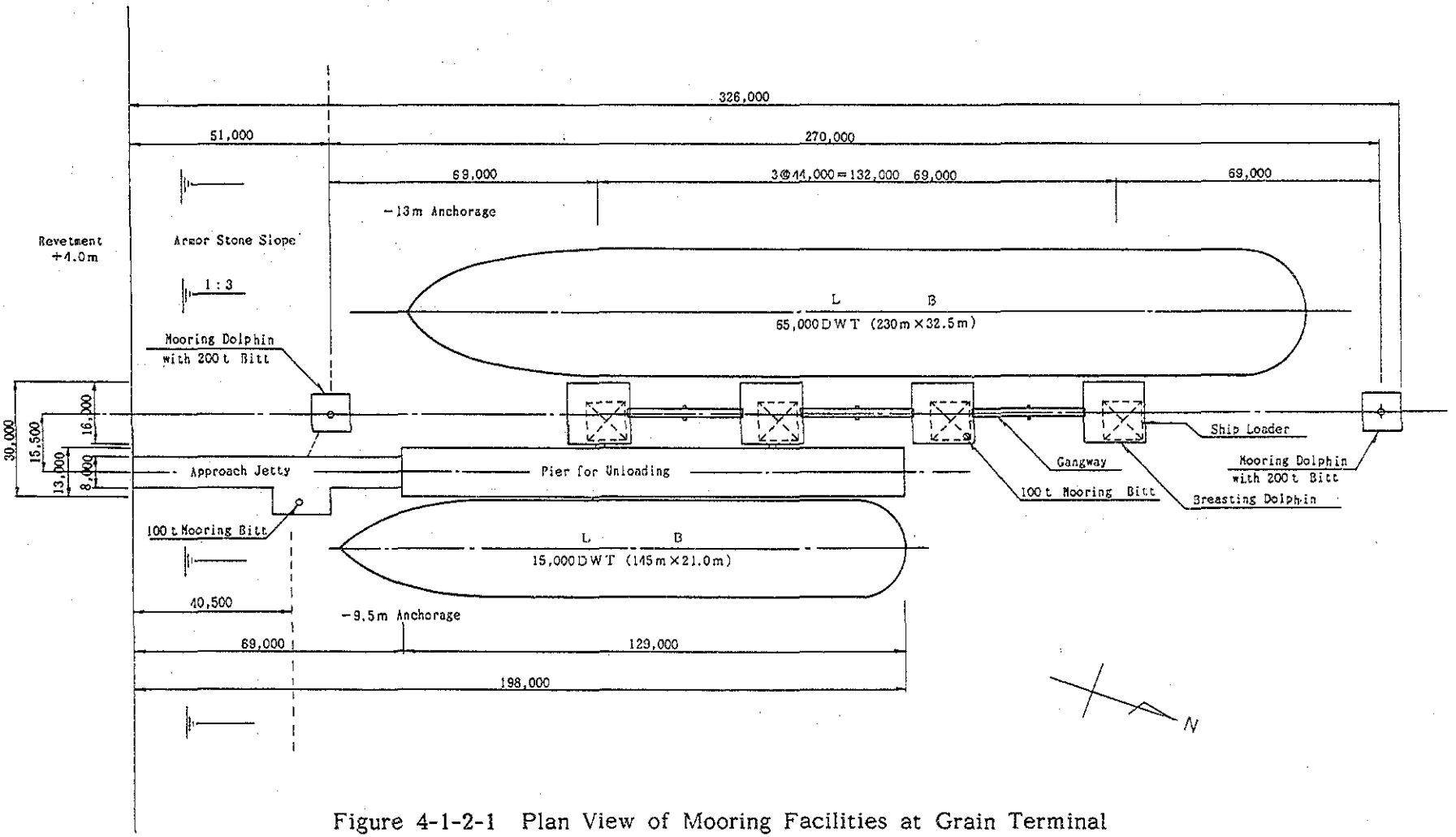
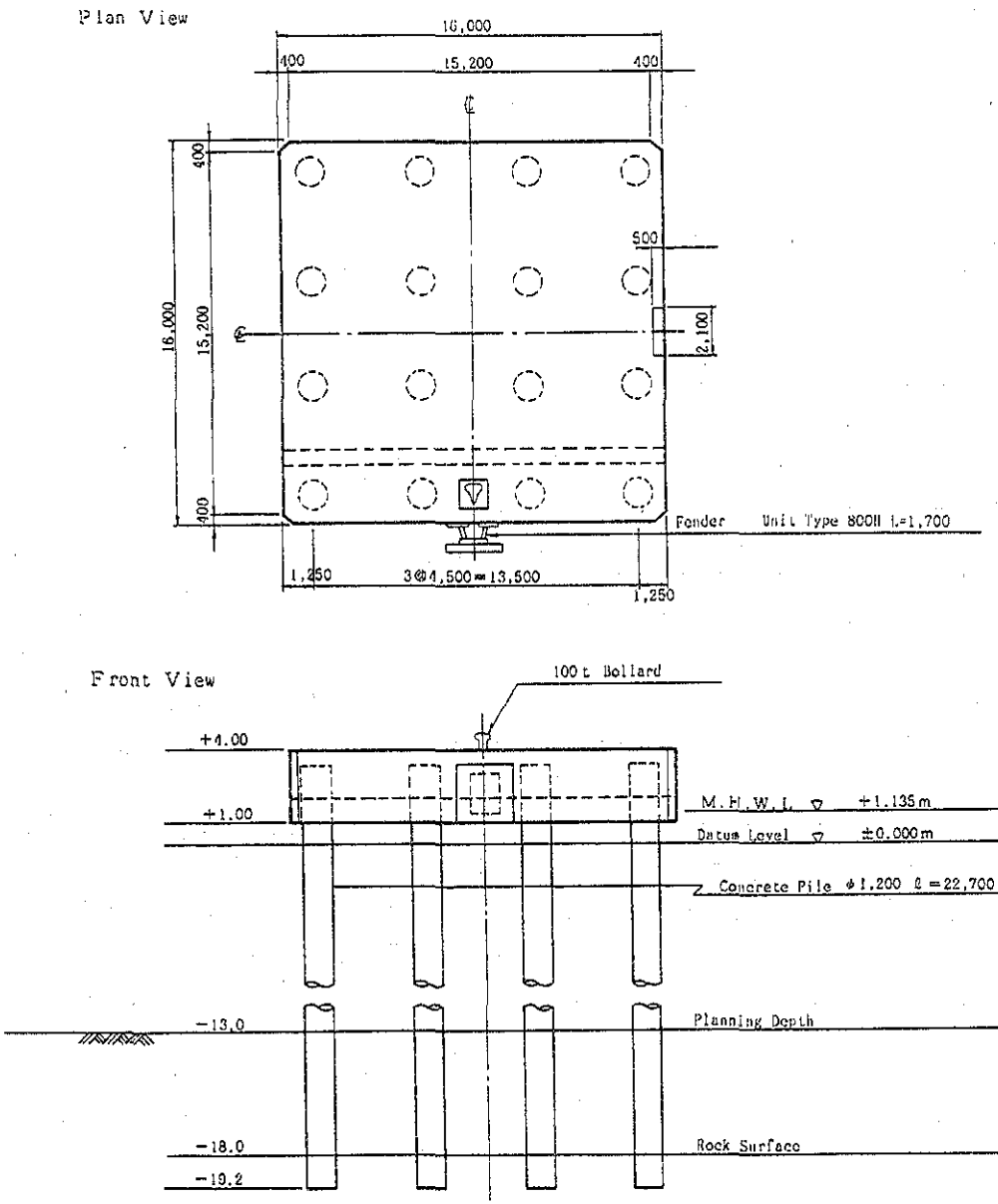


Figure 4-1-2-1 Plan View of Mooring Facilities at Grain Terminal

Unit: mm



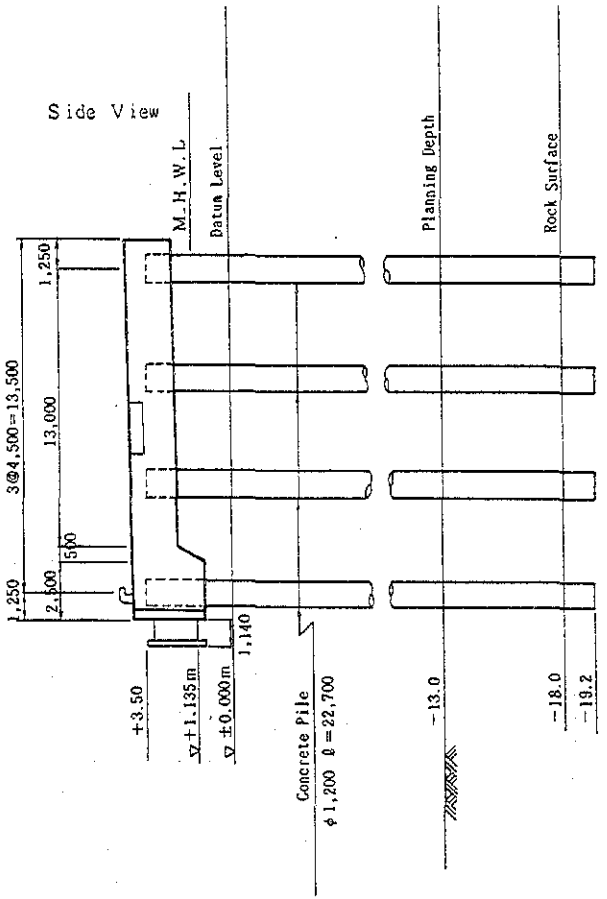


Figure 4-1-2-2 Breasting Dolphin

Unit: mm

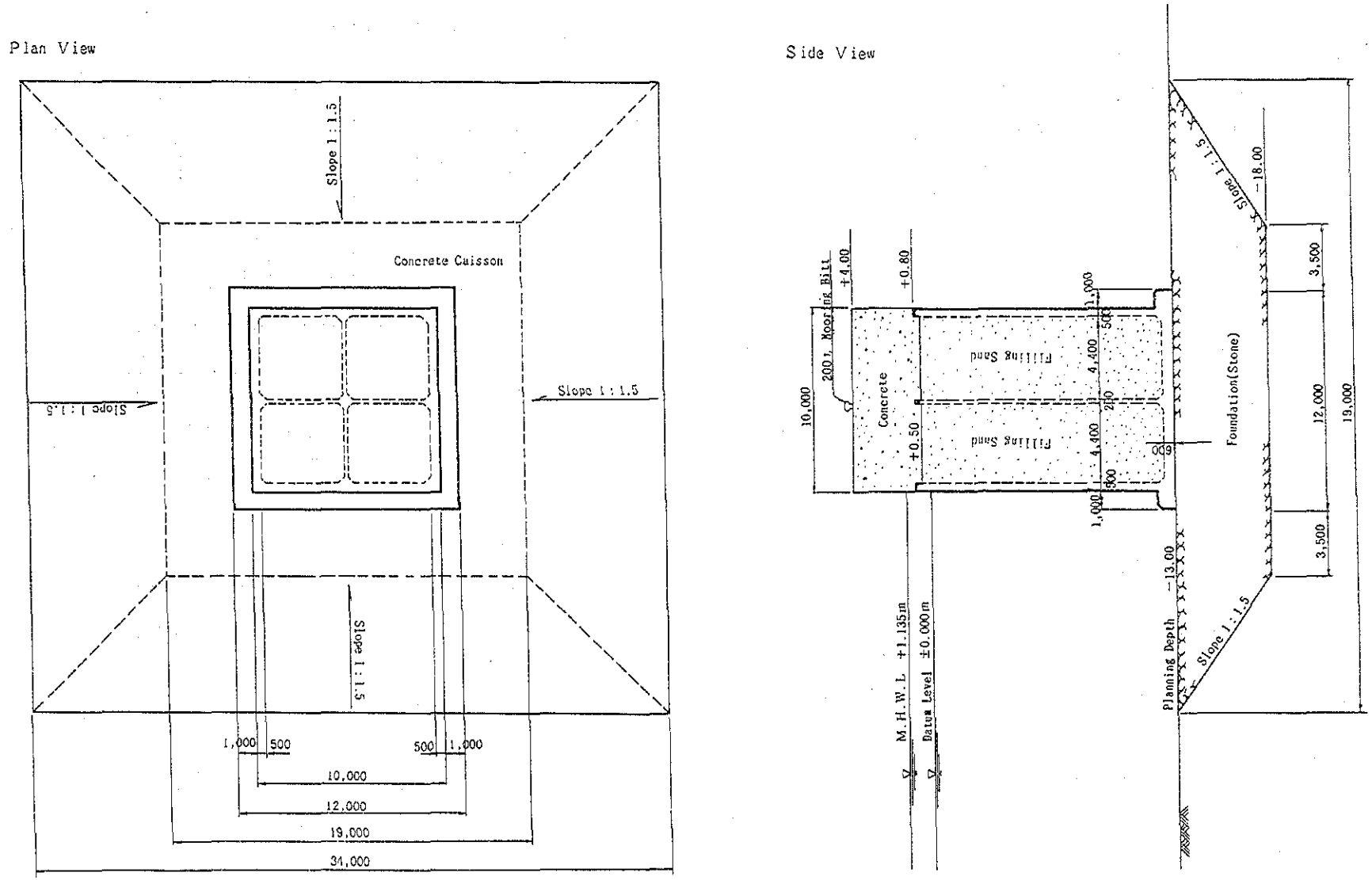


Figure 4-1-2-3 Mooring Dolphin

Unit: mm

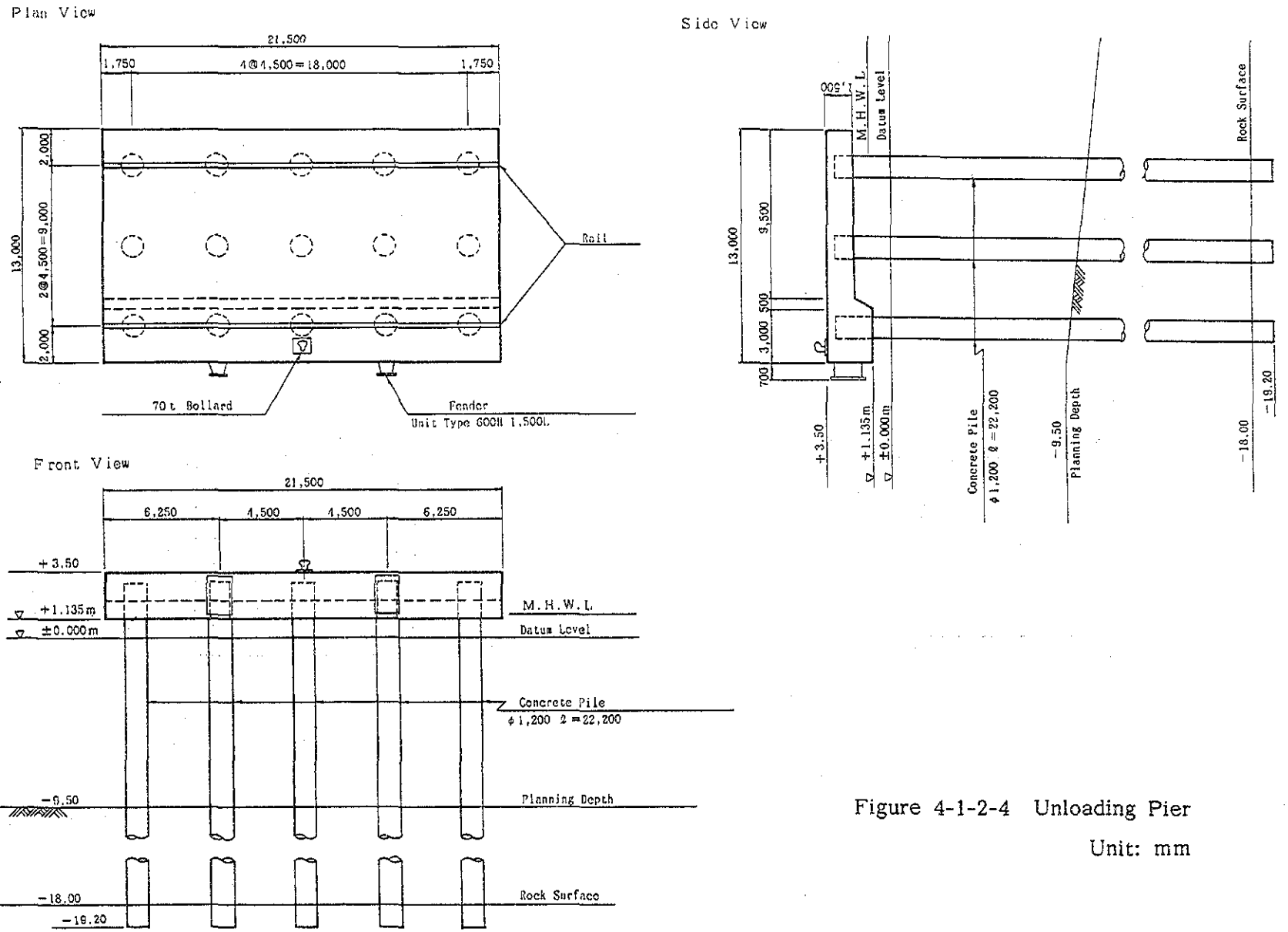


Figure 4-1-2-4 Unloading Pier

Unit: mm

4-2-2 Design

The typical structure is shown in Figure 4-2-2-1. The structure is of reinforced concrete pile type.

4-3 Handling and Storage Facilities

4-3-1 Design Conditions

(1) Basic Conditions of Grain and Grain Facilities

1) Annual grain handling volume is 2,000,000 tons in the target year of 1998.
2) Grains to be handled are wheat, soybeans, maize, pellets, etc.
3) Capacities of facilities determined by the optimum capacity are as follows:
   - Storage capacity of silo: 93,000 tons
   - Unloader: 700 ton/hr X 2 sets
   - Shiploader: 900 ton/hr X 4 sets
4) Type of grain handling
   - Intake from shuttle vessels (15,000 DWT) and trucks in a style of bulk cargo are considered.
   - Carrying to large sized vessels (65,000 DWT) and trucks in a style of bulk cargo are considered

(2) Other Conditions

1) Work conditions
   - Annual available days for operations:
     - Unloader: 250 days/year
     - Shiploader: 250 days/year
   - Daily available hours for operations:
     - Unloader: 20 hours/day
     - Shiploader: 20 hours/day
2) Electricity
   - Receiving voltage: 30,000 V, 50 Hz
   - Power source voltage:
     - High tension: 6,000 V, 3-phase 3-line, 50 Hz
     - Low tension: 380 V, 3-phase 3-line, 50 Hz

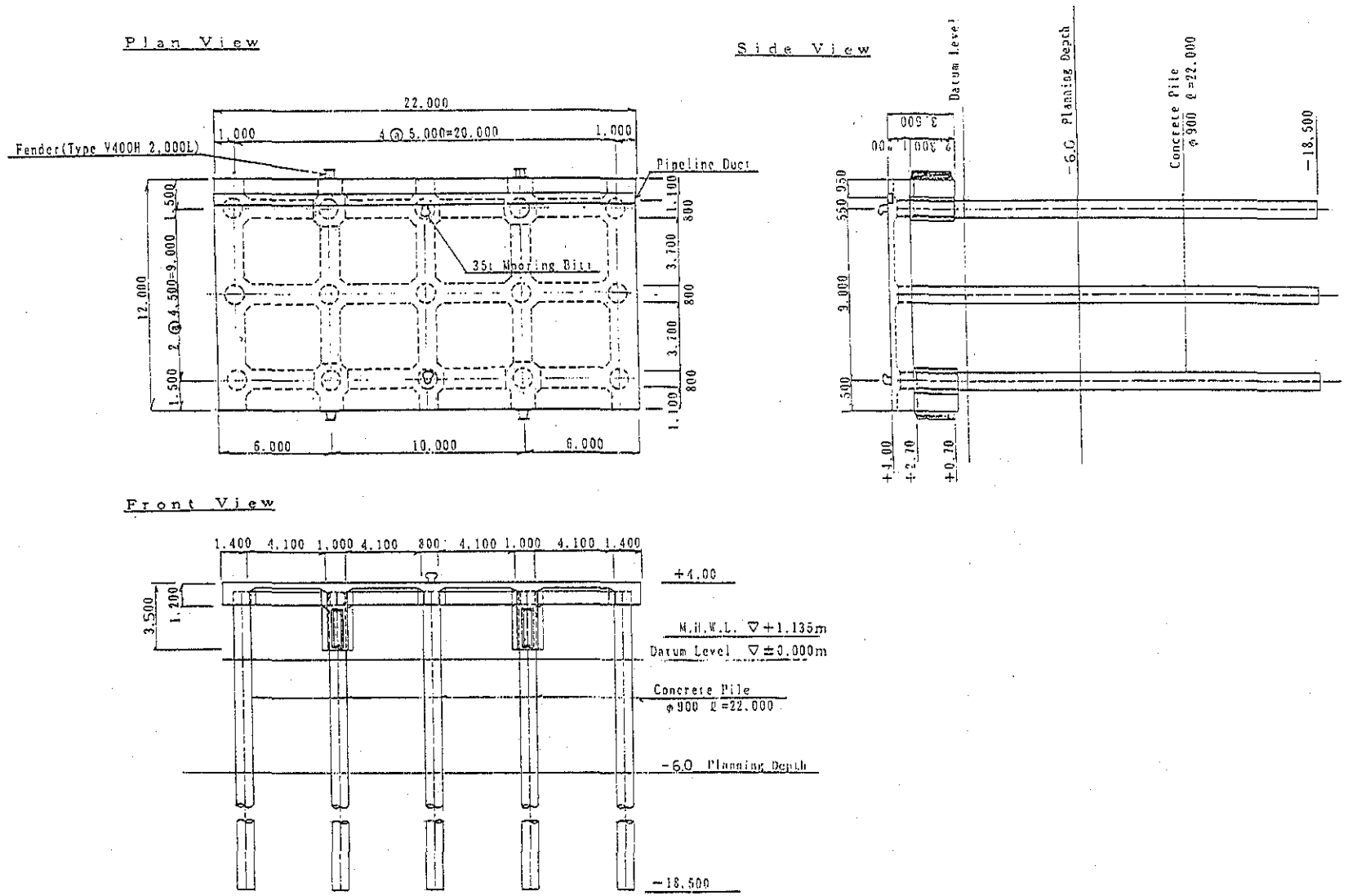


Figure 4-2-2-1 Mooring Facilities at Fishery Terminal

Unit: mm

- for control: 220 V, single-phase 2-line, 50 Hz
- for lights: 220 V, single-phase 2-line, 50 Hz

4-3-2 Composition of Facilities

Each facility comprises following components as listed in Table 4-3-2-1.

Table 4-3-2-1 List of Facilities

Facility	Component	General Description
Unloading Facilities	Unloader	700 ton/hr X 2 sets, Mechanical Type
Loading Facilities	Shiploader	900 ton/hr X 4 sets, Non-slewing boom type, with Dust Collector
Silo Facilities	Silo	Main Bin: 1860 ton X 4 X 12 = 89,280 ton Auxiliary Bin: 465 ton X 8 = 3,720 ton Total Volume: 93,000 ton
	Machinery	Conveyor, Bucket Elevator, Screening Machine, Weighing Scale, Sampler, Fumigator, Temperature Controller, Dust Collector
	Building	Machinery Office: 2,600 m^2 Administration Office: 900 m^2
	Electrical Facilities	Power Receiving/Distributing Facilities, Power Controller, Inventory Controller
	Silo Foundation	Concrete Slab and Wooden Pile
	Others	Receiving and Carrying Facilities from /to Truck
Conveyor Facilities	Wharf Conveyor for Unloading	700 ton/hr X 200 m X 2 lines
	Receiving Conveyor	700 ton/hr X 400 m X 2 lines
	Carrying Conveyor	900 ton/hr X 400 m X 2 lines
	Wharf Conveyor for Loading	900 ton/hr X 100 m X 1 line 900 ton/hr X 180 m X 1 line

4-3-3 Design of Facilities

(1) Unloader

A continuous mechanical type has been recently coming into wide use and is adopted in this design. The outline is as shown in Figure 4-3-3-1.

(2) Conveyor

Conveyors to be installed in the terminal are designed as follows:

1) Wharf conveyor for unloading

Capacity	: 700 ton/hr X 2 lines
Length	: Approx. 200 meters
Width of Belt	: 1200 mm
Speed of Belt	: 150 m/min

2) Receiving conveyor

Capacity	: 700 ton/hr X 2 lines
Length	: Approx. 400 meters
Width of Belt	: 1200 mm
Speed of Belt	: 150 m/min

3) Carrying conveyor

Capacity	: 900 ton/hr X 2 lines
Length	: Approx. 400 meters
Width of Belt	: 1400 mm
Speed of Belt	: 150 m/min

4) Wharf conveyor for loading

Capacity	: 900 ton/hr X 2 lines
Length	: Approx. 100/180 meters
Width of Belt	: 1400 mm
Speed of Belt	: 150 m/min

(3) Shiploader

A non-travel-slewing shuttle type of shiploader, which meets the general layout plan of terminal and the condition of location, is adopted in this design. The outline is as shown in Figure 4-3-3-1.

(4) Silo

There are two types of silo structure such as vertical and horizontal type, and the former type is adopted in this design, considering the layout plan and conditions of location. Steel plate, corrugate steel and reinforced concrete are usually used as a main material of vertical type of silo. Since the steel plate structure is advantageous because construction costs including foundation are economical due to its light weight and it has other merits, it is adopted in this design.

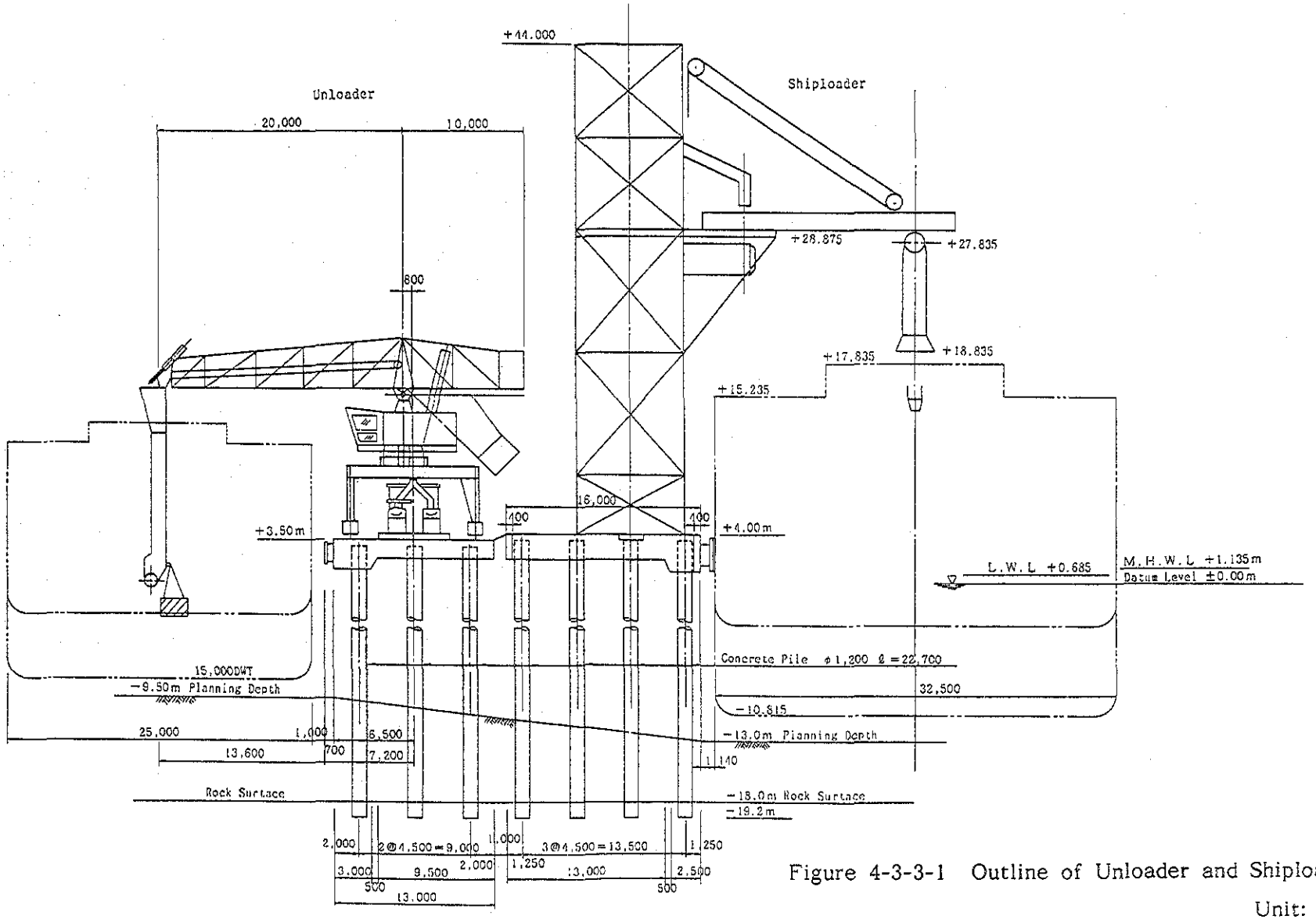


Figure 4-3-3-1 Outline of Unloader and Shiploader

Unit: mm

5 CONSTRUCTION AND COST ESTIMATION

5-1 Construction

Dredging by means of a large sized dredger, and such construction works as piers and other port facilities have been already executed at Montevideo Port. The newly proposed facilities described above will be able to be constructed using the same methods as before except for the grain handling facilities such as load/unloading equipment, belt conveyer and silo. This kind of grain handling facilities have been constructed twice before at the vicinity of Montevideo Port, Fray Bentos and Nueva Palmira by foreign construction companies, and this time also these facilities will be constructed by introduction of a foreign engineering. Equipment and labor for the construction works will be locally procurable except for large sized construction crafts such as sand carrier with grab bucket, floating crane for cast-in-place.

(1) Facilities

The construction quantities of facilities of the grain terminal and fishery terminal are presented in Table 5-1-1-(1) and (2), respectively.

Table 5-1-1-(1) Grain Terminal Facilities and Construction Quantities

Facility		Unit	Quantity	Remarks
1. Dredging	(1) Transfer Station	m^3	935,980	-13m/-9.5m Depth
	(2) Foreport	m^3	567,000	-12m Depth
	(3) Approach Channel	m^3	11,833,000	-12m Depth, 160m Width
2. Reclamation	(1) Silo Area	m^3	318,600	22,500 m^2
	(2) Access Road	m^3	288,000	14,400 m^2
3. Slope Protection	(1) Access Road	m	510	Armor Stone Slope
4. Mooring Facilities	(1) Breasting Dolphin	unit	4	Concrete Pile
	(2) Mooring Dolphin A	unit	2	Concrete Caisson
	(3) Unloading Pier	m	129	Concrete Pile
	(4) Approach Jetty	m	53	Concrete Pile
	(5) Mooring Dolphin B	unit	1	Concrete Pile
5. Pavement	(1) Silo Area	m^2	3,738	Asphalt Pavement
	(2) Access Road	m^2	2,760	Asphalt Pavement
6. Grain Handling Facilities	(1) Unloader	unit	2	700 ton/hr
	(2) Ship Loader	unit	4	900 ton/hr
7. Grain Storage Facilities	(1) Silo	unit	1	93,000 ton
	(2) Wharf Conveyor for Unloading	line	2	700 ton/hr X 200m
	(3) Receiving Conveyor	line	2	700 ton/hr X 400m
	(4) Delivery Conveyor	line	2	900 ton/hr X 400m
	(5) Wharf Conveyor for Loading	line	2	900 ton/hr X 100m

Table 5-1-1-(2) Fishery Terminal Facilities and Construction Quantities

Facility		Unit	Quantity	Remarks
1. Mooring Facilities	(1) Pier	m	415	Concrete Pile

(2) Materials

The main materials needed for the construction are listed in Table 5-1-2-(1) and (2).

Table 5-1-2-(1) Main Construction Materials (Grain Terminal)

Facility	Main Materials					
	Steel (t)	Concrete (m^3)	Stone (m^3)	Filling (m^3)	Asphalt (m^3)	Others
1. Dredging	---	---	---	---	---	
2. Reclamation	---	---	---	606,600	---	Fence (620 m)
3. Slope Protection	---	---	39,960	---	---	
4. Mooring Facilities	820	11,870	7,200	1,990	---	Rubber Fenderr (16 sets) Bitt & Bollard (12 sets) Beacon (2sets), Rail (220m)
5. Pavement	---	---	3,250	--- 650		
6. Grain Handling Facilities	1,060	---	---	---	---	
7. Grain Storage Facilities	9,185	---	---	---	---	
Total	11,065	11,870	50,410	608,590	650	

Table 5-1-2-(2) Main Construction Materials (Fishery Terminal)

Facility	Main Materials					
	Steel (t)	Concrete (m^3)	Stone (m^3)	Filling (m^3)	Asphalt (m^3)	Others
1. Mooring Facilities	660	7,854	---	---	---	Rubber Fender (75 sets) Bollard (75 sets) Light Beacom (1 set) Water Pipeline (415 m)
Total	660	7,854	0	0	0	

5-2 Cost Estimation

5-2-1 Estimate Conditions

Some conditions for the estimation are as follows:

1) As for the grain terminal, the costs of Site 4 are estimated.
2) Dredging costs up to -11 meters in depth of water in the area of Fore port and Approach Channel are not included.
3) Taxes locally imposed on materials and labors except customs duties on import goods are also included.
4) Land rents, compensations and insurance costs are excluded from the estimation.

5-2-2 Estimation Result

The summary of the estimated construction cost of the grain terminal and the fishery terminal is presented in Table 5-2-2-1-(1) and (2), respectively.
Table 5-2-2-2-(1) and (2) show the annual maintenance dredging costs.

Table 5-2-2-1-(1) Construction Cost of Grain Terminal

Facility		Unit	Quantity	Construction Cost ('000 US$)		
				Total	Foreign Portion	Local Portion
1. Dredging	(1) Transfer Station	m^3	935,980	1,738	0	1,738
	(2) Foreport	m^3	567,000	1,053	0	1,053
	(3) Approach Channel	m^3	11,833,000	16,068	0	16,086
	Sub-Total	LS	1	18,859	0	18,859
2. Reclamation	(1) Silo Area	m^3	318,600	2,238	1,690	548
	(2) Access Road		288,000	2,006	1,515	491
	Sub-Total	LS	1	4,244	3,205	1,039
3. Slope Protection	(1) Access Road	m	510	1,741	0	1,741
4. Mooring Facilities	(1) Breasting Dolphin	unit	4	3,328	1,645	1,682
	(2) Mooring Dolphin A	unit	2	924	67	858
	(3) Unloading Pier	m	129	4,730	3,354	1,376
	(4) Approach Jetty	m	53	323	111	212
	(5) Mooring Dolphin B	unit	1	832	411	421
	Sub-Total	LS	1	10,137	5,588	4,549
5. Pavement	(1) Silo Area	m^2	3,738	186	0	186
	(2) Access Road	m^2	2,760	138	0	138
	Sub-Total	LS	1	324	0	324
6. Grain Handling Facilities		unit	1	20,194	17,453	2,741
7. Grain Storage Facilities		unit	1	25,584	10,434	15,149
Total		LS	1	81,083	36,681	44,402
8. Engineering Services		LS	1	3,974	2,649	1,325
9. Physical Contingency		LS	1	2,272	719	1,553
10. Tax		LS	1	7,489	0	7,489
Grand Total		LS	1	94,818	40,049	54,769

Table 5-2-2-1-(2) Construction Cost of the Fishery Terminal

Facility	Unit	Quantity	Construction Cost ('000 US$)		
			Total	Foreign Portion	Local Portion
1. Mooring Facilities	m	415	5,589	2,141	3,447
2. Engineering Services	LS	1	279	107	172
3. Physical Contingency	LS	1	559	214	345
4. Tax	LS	1	1,137	425	712
Grand Total	LS	1	7,564	2,888	4,676

Table 5-2-2-2-(1) Annual maintenance Dredging Cost (Grain Terminal)

Dredging Area	Area (m^2)	Shoaling Height (m/year)	Dredging Volume (m^3)	Cost ('000 US$)	Remarks
Approach Channel	---	----	2,214,000	2,457	-11 to -12m
Port Mouth	132,800	0.99 x 0.3	39,441	63	-11 to -12m
Central Area	245,200	1.41 x 0.3	103,719	165	-11 to -12m
Transfer Station	153,900	0.7	107,730	171	-12/-13m
Total				2,856	

Table 5-2-2-2-(2) Annual maintenance Dredging Cost (Fishery Terminal)

Dredging Area	Area (m^2)	Shoaling Height (m/year)	Dredging Volume (m^3)	Cost (US$)	Remarks
- 5m Baisn	35,490	0.65	23,068	36,678	
- 6m Basin	46,205	0.83	38,350	60,976	
Total				97,654	

6 PORT MANAGEMENT AND OPERATIONS

6-1 Recommendations on the Present Management and Operation

6-1-1 Unification and Privatization of Cargo Handling

The biggest reason for the present low productivity of cargo handling is that cargo handling is divided into stevedoring (ANSE) and on-shore cargo handling (ANP) and there is a lack of coordination between them. Regarding this point, a new port law was established in April 1992; a new direction pointing towards the unification and privatization of cargo handling under control of the ANSE has been determined.

6-1-2 Efficient Use of Warehouse

Since there is a lot of cargo handled through direct delivery without storage in warehouses in Montevideo Port and potential demand for use of warehouses seems high, effective measures should be taken against warehouses with low utilization rates, taking users' opinions into consideration.

To put it concretely, it is recommended that the ANP rent warehouses (including renting some spaces of them based on square) to private companies, instead of operating them directly. This can make users of warehouses store cargo under their own plan and management. Furthermore, the ANP can not only simplify its organization (because direct management becomes unnecessary) but also utilize warehouses effectively. However, superannuated warehouses difficult to use should be demolished thereby creating space for other purposes.

In particular, the introduction of this renting method to the refrigerating warehouses should be aggressively examined.

6-1-3 Efficient Use of Cargo Handling Equipment

(1) Superannuate cranes or forklifts with low utilization rates should be demolished. Quay cranes should be moved to other wharves as necessary. Since to equip quay cranes on every berth is not always necessary, utilization of mobile cranes is also useful.

(2) Reinforcement of Maintenance

It is necessary not only to inspect handling equipment regularly but also to stock those spare parts which are used often. By doing this, troubles while cargo handling and a long period maintenance should be avoided.

6-1-4 Simplification of Business of the ANP

Though privatization of port services is now going on in the field of cargo handling based on a new law, it is desirable to examine privatization of port service or entrusting business to private sector more in other fields in order to operate and manage the port efficiently. Specifically, following items should be examined;

(1) Privatization of Tugboat and Line Handling Service

(2) Simplification of Maintenance Division

It is expected to simplify the maintenance division by improving the maintenance way; in stead of present direct management of repair, small repair or daily maintenance should be done by themselves but big repair should be entrusted to external organization.

(3) Entrusting dredging of channels and ports to private sector in stead of direct management

6-1-5 Reinforcement of Marketing Function of the ANP

To promote use of port it is essential to establish a more useful and attractive port in terms of both facilities and management and operation for users such as shipping lines, shipping agents, forwarders, shippers, consignees, etc.. For that purpose, it is necessary to have a real time, broad, systematic grasp of the users' needs and to reflect their needs in the practical development and management of the port.

The port should be marketed aggressively, providing users with pertinent information. These functions will become more important after implementation of

expansion of the container terminal and construction of a grain terminal and a foreign fishing terminal.

The existing commercial division of the ANP should be reinforced as a marketing division that promotes these works.

6-1-6 Securing of Storage Space of Empty Containers

Storage space of empty containers must be secured to avoid transporting a lot of empty containers into the conventional wharves in view point of efficient cargo handling and traffic safety in the conventional wharves.

6-1-7 Restructuring the Tariff System

(1) Restructuring wharfage charge

Present tariff system of wharfage charge of Montevideo Port is based on length of vessel rather than size of vessel, therefore, large vessels enjoy relatively low wharfage fees. Since increasing berth depth to accommodate large vessels requires a lot of money, the tariff system of wharfage charge should be based on size of vessel such as GRT or NRT. In Montevideo Port large vessels such as container or bulk cargo vessels are increasing, therefore, the ANP should restructure the tariff system based on size of vessel.

(2) Restructuring charge levied on cargo

Charge levied on cargo should be changed from a system based on classification of NADE/NADI Code to a system based on type of cargo. Furthermore, as for import cargo, it also should be designed based on freight volume of cargo rather than value (CIF value).

(3) Simplification of container charge

It would be desirable to introduce a unified and simplified tariff for container based on a box (TEU), combining present charges levied on cargo and handling of container charge.

6-2 Management and Operational Plan for the New Grain Terminal

6-2-1 Implementation Body

Several factors are considered in selecting a construction and management/operation body for the new grain terminal. The body should be able to satisfy the following conditions:

1) Be an organization that can provide services based on aggressive sales, efficient operation and reasonable charges, since the grain terminal handles foreign transit grain cargo and attracting users is a condition for success.

2) Possess adequate finances to construct the terminal

3) Possess terminal operation know-how

There are three alternatives for the creation of a construction and management/operation body:

Case I: Integrated construction and management/operation by the ANP

Case II: Integrated construction and management/operation by the private sector

Case III: The ANP constructs a mooring facility as a basic port facility, the private sector constructs and manages/operates handling equipment and silos.

These cases are evaluated as shown in Table 6-2-1-1.

Table 6-2-1-1 Evaluation of Implementation Bodies

	Case I	Case II	Case III
Public interest	○	△	○
Knowhow	△	○	○
Efficient operaton	△	○	○
Aggressive sales	△	○	○
Raising funds	○	○	○
Integrated use	○	○	△

Judging from the above analysis, Case II or Case III, in which the private sector is the main implementation body, is suitable.

However, the ANP should take following means to secure public interest.

1) The ANP reclaims the site and lends it (land) to the private sector (The ANP holds the ownership of the site).

In this scenario the ANP could participate in the project by investing the land itself.

2) The ANP controls planning and management of the terminal.

6-2-2 Organization

The organization of the grain terminal is shown in Figure 6-2-2-1, which has the following two divisions:

Administration: 1) General affairs about terminal operation, personnel affairs, accounting, receipt of charge, etc.
2) Obtainment of customers, contact/coordination with customers

Operation: Berth assignment, loading/unloading of grain, storage in silo

The Grain Superintendent directs which vessels are to be unloaded/loaded and is also responsible for grain stocks. He is assisted by two Shift Superintendents. They oversee the hour to hour operations including the loading and unloading systems, operational personnel, maintenance personnel.

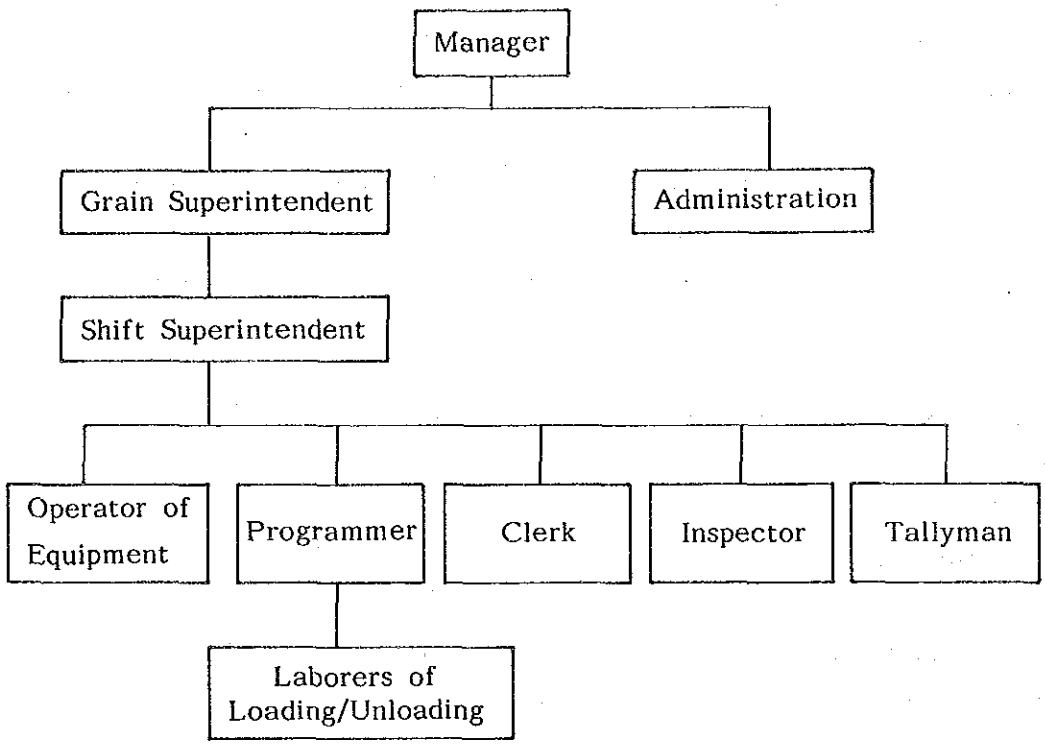


Figure 6-2-2-1 Organization Chart of the Grain Terminal

6-2-3 Operational Hours

Since cargo handling of grain in transshipment should be able to compete with other neighboring ports, the terminal should be operated 24 hours per day, seven days per week except holidays.

One shift should consist of 12 hours (2 shifts per day).

6-2-4 Personnel Distribution

Required personnel for the grain terminal is shown in Table 6-2-4-1.

Table 6-2-4-1 Required Personnel for the Grain Terminal

Division	Number	Remark
Manager	1	
Administration Division	5	5 x 1shift
Operating Division		
Grain Superintendent	1	
Shift Superintendent	2	1 x 2shift
Operator of Equipment	12	6 x 2shift
Programmer	2	1 x 2shift
Clerk	2	1 x 2shift
Inspector	2	1 x 2shift
Tallyman	4	2 x 2shift
Laborers of Loading/Unloading	32	Loading: 6 x 2shift Unloading: 10 x 2shift
Total	63	

6-3 Management and Operation Plans for the Foreign Fishing Terminal

(1) Implementation body of the terminal

Since this terminal was planned to alleviate the problem of berth shortage and inconvenience to foreign fishing vessels as mentioned above, basically same management and operation of existing berths should be followed. Therefore, the ANP should build and manage the terminal.

(2) Organization and personnel distribution

Though a new terminal is built, duties of the terminal are same as existing berths and foreign fishing vessels will not increase rapidly. Therefore, this terminal can be managed and operated by utilizing existing organization and personnel. New organization or personnel are not required.

7 PROJECT FEASIBILITY

7-1 Economic Analysis

The purpose is to appraise the economic feasibility of the Short-term Development Plan from the viewpoint of the national economy.

7-1-1 Methodology of Economic Analysis

(1) Purpose: To appraise the economic feasibility of the Short-term Plan from the view point of the national economy.

(2) Methodology: Evaluation of the economic internal rate of return (EIRR) based upon the "Discount Cash Flow Method" employing the "With and Without" Method.

(3) Conversion into economic price: Market prices are converted into border prices.

7-1-2 Prerequisites of the Economic Analysis

1) The "Base Year" in 1994.

2) The period of calculation ("Project Life") in the economic analysis is assumed to be thirty years.

3) The exchange rate adopted for this analysis is US$1.00=N$2,667.00.

7-1-3 "Without" Case

- Grain terminal is not constructed at the Montevideo port;

- A part of grain cargoes from Argentina is handled at the Alpha Zone and some facilities are increased for Alpha Zone;

- Foreign fishing vessels terminal is not constructed at the Montevideo port;
- Foreign fishing vessels visit Montevideo port the same as at present;

7-1-4 Cargo Volume Handled and Foreign Fishing Vessels Calling at the Montevideo Port

(1) "With" Case

	1998	After 1999
Grain cargo:	2,000,000tons	2,000,000tons
Foreign fishing vessels:	500 vessels	500 vessels

(2) "Without" Case

1) Grain Cargo

Forecast Grain Cargo Volume in both the "With" and "Without" Case at the Port of Montevideo

	With	Without
Grain Cargo ('000)	After 1998	
Local	201	Handled in Montevide
Transshipment	1,779	Handled in Alpha Zone

2) Foreign Fishing Vessels

Number of Foreign Fishing Vessels calling in both the "With" and "Without" Case at the Port of Montevideo

	"With"	"Without"
Foreign Fishing Vessel	500	Same as Present (384)

7-1-5 Economic Prices

1) Methodology

The market prices are changed to "Border Prices" by various conversion factors such as "Standard Conversion Factor", "Conversion Factor for Consumption" and so forth.

2) Exclusion of Transfer Items

Transfer items should be excluded in the calculation of the costs and benefits of the project for the economic analysis.

3) Method of Applying Conversion Factors

In this study, ANP provided the following conversion factors to the study team. ANP obtained these data from M.T.O.P.

(1) Standard Conversion Factor (SCF) is 0.703.

(2) Conversion Factor for Skilled Labour is 0.703.

(3) Conversion Factor for Unskilled Labour is 0.484.

7-1-6 Benefits

1) Benefit Items

Grain Terminal

a) Savings in river transportation cost including handling cost and additional construction cost of topoff vessels fleet at the Alpha Zone;
b) Savings in the staying cost (by shortening of cargo handling time) of vessels for Uruguayan grain cargoes;

Fishing Terminal

c) Savings in the changing cost of foreign fishing vessels at the Port of Montevideo;
d) Savings in the staying cost of foreign fishing vessels at the Port of Montevideo;
e) Increase in the output of port service industries (such as supplying gas oil, water and repairing vessels);

Common

f) Promotion of national development in Uruguay;
g) Increase in employment opportunities/incomes;

7-1-7 Costs

(1) Construction Cost

(2) Personnel Costs

(3) Maintenance and Repair Costs

(4) Operation Costs

(5) Replacement Investment Costs

(6) Residual Values

7-1-8 Evaluation

1) Calculation of EIRR

The EIRR of the Short-term Development Plan of the Port of Montevideo is calculated as follows;

Grain Terminal	11.3%;
Foreign Fishing Vessels Terminal	15.9%;

2) Conclusion

It is generally considered that an EIRR of more than 10% is economically feasible for infrastructure or social service projects.

(1) Grain Terminal

The calculated EIRR of 11.3% of this project is considered barely feasible.

(2) Foreign Fishing Vessels Terminal

This project with the calculated EIRR of 15.9% is considered feasible.

3) Sensitivity analysis

Case A:The costs increase by 10%.

Case B:The benefits Decrease by 10%.

Case C:The costs increase by 10% and the benefits decrease by 10%

Sensitivity Analysis for EIRR

Case	Grain Terminal EIRR (%)	Foreign Fishing Terminal EIRR (%)
Base Case	11.3	15.9
Case A	9.2	14.3
Case B	9.0	14.2
Case C	7.0	12.7

7-2 Financial Analysis

7-2-1 Purpose and Methodology of Financial Analysis

(1) Purpose: to appraise the financial feasibility of the grain terminal and the foreign fishing terminal proposed in the short-term plan

(2) Methodology: evaluation of the financial internal rate of return (FIRR) based upon the Discount Cash Flow Method

7-2-2 Prerequisites of the Financial Analysis

(1) Project life: 30 years

(2) Base year: 1992

(3) Cargo handling volume of the grain terminal: 2,000,000t/year

(4) Number of vessels which use the foreign fishing terminal: 374/year

(5) Fund rasing plan (interest rate): 8%

7-2-3 Revenues

(1) Grain terminal

-Use of port charge

-Wharfage charge

-Cargo handling/Storage charge

(2) Foreign fishing terminal

-Use of port charge

-Wharfage charge

-Transshipment charge

-Water supply charge

7-2-4 Costs

(1) Initial investments

(2) Administration costs: personnel costs, maintenance, repair costs, etc.

(3) Renewal investment costs

7-2-5 Appraisal of the Project

(1) Grain terminal

1) Scenarios

To examine the impact on the FIRR, the following conditions are established;

Case A: The grain terminal shares the total maintenance dredging cost.
Case B: The grain terminal shares two-thirds of it.
Case C: The grain terminal shares half of it.

2) *Results*

The results are shown in Table 7-2-5-1.

Table 7-2-5-1 FIRR of the Grain Terminal

	FIRR
Case A	8.5%
Case B	9.5%
Case C	9.9%

3) Sensitive analysis

Sensitive analysis is conducted for the following three cases;

Case I: The project cost increases by 10%.
Case II: The revenue decreases by 10%.
Case III: The project cost increases by 10% and the revenue decreases by 10%.

Table 7-2-5-2 shows the calculation results of each case.

Table 7-2-5-2 FIRR Sensitivity Analysis

	Base Case	Case I	Case II	Case III
Case A (Sharing the total dredging cost)	8.5%	6.9%	7.1%	5.5%
Case B (Sharing two third of the dredging cost)	9.5%	7.9%	8.1%	6.6%
Case C (Sharing half of the dredging cost)	9.9%	8.4%	8.6%	7.1%
Interest Rate of Fund	8.0%			

(2) Foreign fishing terminal

1) Scenarios

To examine the impact on the FIRR, the following conditions are established;
Tariff increase of 400% from 1998 (when the fishing terminal opens)
Tariff increase of 300% from 1998
Tariff increase of 200% from 1998
Tariff increase 0%

2) Results

The results are shown in Table 7-2-5-3.

Table 7-2-5-3 FIRR of the Grain Terminal

	FIRR
Tariff Increase of 400%	10.4%
Tariff Increase of 300%	8.0%
Tariff Increase of 200%	5.5%
Tariff Increase 0%	-

3) Sensitive analysis

Sensitive analysis is conducted for the following three cases to examine the impact of unexpected future changes in case of tariff increase of 300% and 400%:

Case I: The project cost increases by 10%.
Case II: The revenue decreases by 10%.
Case III: The project cost increases by 10% and the revenue decreases by 10%.

Table 7-2-5-4 shows the calculation results of each case.

Table 7-2-5-4 FIRR Sensitivity Analysis

	Base Case	Case I	Case II	Case III
Tariff Increase 300%	8.0%	6.8%	6.9%	5.8%
Tariff Increase 400%	10.4%	9.0%	9.1%	7.9%
Interest Rate of Fund	8.0%			

7-2-6 Conclusion

(1) Grain terminal

Judging from the above analysis, this project can be regarded as barely financially feasible provided that the total dredging cost is shared.

However, since the grain terminal is a new project and handles transit cargo, it is difficult to forecast how much cargo volume can be handled and unexpected future changes might occur. On the other hand, the private sector is desirable as the implementation body of the project because this project requires aggressive sales, efficient operation and know-how.

Therefore, it is recommended that the Government or the ANP should make efforts to reduce the share of the maintenance dredging cost of the implementation body, which will promote the participation of the private sector.

(2) Foreign fishing terminal

This project can be regarded as financially feasible if the present tariff of the wharfage charge is raised by 300% to 400%. Since after implementation of this project the foreign fishing vessels get benefits from this project equal to the increase revenue from raising the tariff of the wharfage charge, this raising of the tariff can be considered possible.

However, raising of the tariff from 300% to 400% is rather steep. On the other hand, present tariff structure of the wharfage based on length of vessel is remarkably profitable for large vessels. This should be reconsidered taking the trend towards larger vessels into account. If the tariff structure of the wharfage charge is improved from the present one based on length of vessel to new one based on size of vessel such as GRT or NRT, we can expect significantly increased revenue from wharfage charges.

Therefore, this project can be regarded as financially feasible on condition that the ANP improves the tariff structure of wharfage charge based on size of vessel rather than raising tariff rate of wharfage charge of foreign fishing vessels.